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THE PRACTICE  
OF  
DENTAL MEDICINE.

BY

GEORGE F. EAMES, M.D., D.D.S.,

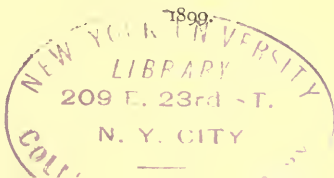
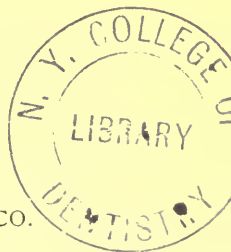
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TO

GEORGE W. STODDARD, D.D.S.,

THIS WORK IS

DEDICATED,

IN ADMIRATION OF HIS MECHANICAL SKILL AND TEACHING  
ABILITY, AND IN GRATEFUL REMEMBRANCE OF HIS  
KINDLY ENCOURAGEMENT AND WISE COUN-  
SEL DURING A PUPILAGE FOLLOWED  
BY A FRIENDSHIP OF OVER  
TWENTY YEARS,

BY HIS FRIEND,

*THE AUTHOR.*





## PREFACE.

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THE object of the following work is to supply a need which has existed for some time. No text-book has covered the subjects herein proposed, and such technical literature as may be found in books and journals is largely unclassified as to etiology, pathology, diagnosis, treatment, etc., and is thus unavailable for handy reference or systematic study.

A still greater need, more and more in evidence as the demand for a higher education for dentists grows stronger and the necessity for a more general knowledge of medicine on their part becomes apparent, is for an explanation of the significance of dental and oral relations to certain general pathological conditions. This need is not supplied by medical colleges, for in these the teaching is not adapted to dental practice and the dental relations to the various subjects taught are not elucidated. It would seem that the time has come when the dentist should possess formulated rules and methods of practice in the medical treatment of dental cases.

The effects of certain constitutional disorders upon the teeth and other oral structures are being better understood as time goes on, and the influence of local pathological conditions in the mouth upon other organs and tissues are in like manner being better comprehended; therefore the advanced teaching of to-day should give these subjects the consideration which their importance demands.

This book is an endeavor to accomplish the task thus indicated; and if, in certain instances, the writer has failed to reach the standard which may be demanded by those qualified to criticise, he asks indulgence, hoping to profit by intelligent criticism.

Grateful acknowledgment is made to Dr. G. V. Black and to Lea Brothers & Co. for permission to use cuts and various portions of the text from the "American System of Dentistry."

The writer is deeply indebted to Prof. Edward C. Kirk for his able criticism and invaluable suggestions, which have greatly enhanced the value of the work.

To Prof. John A. Follett are due the warmest thanks for the many evening hours of kindly counsel and criticism which he so generously gave for the writer's benefit.

G. F. E.

BOSTON, March 1, 1899.



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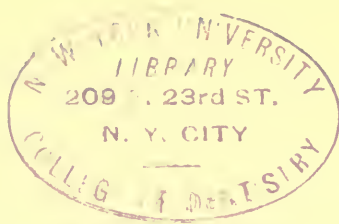
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# THE PRACTICE OF DENTAL MEDICINE.

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## INTRODUCTORY.

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### CHAPTER I.

#### GENERAL CONSIDERATIONS IN PATHOLOGY.

ALL branches of medical science have been formulated, their sphere of usefulness being found in the only too frequent tendency of the body, either by traumatism or disease, to depart from the normal or healthy condition. This departure from a state of health inaugurates what is known as a pathological condition, or state of disease.

Pathological conditions may assume a great variety of forms, each presenting certain characteristics peculiar to itself, consequently each pathological condition thus marked off is given a name by which it is designated, but the name of the disease is only ascertained by a study of its characteristic expressions, or symptoms.

**Symptomatology.**—There are many different diseases, each with its own set of symptoms, yet the individual symptoms of one may not differ from those of any other disease. Several symptoms of one disease therefore may be found in another, but if we study these symptoms attentively we shall notice the fact that they are often found in groups,—a number of satellites to some more important symptom which either is not found at all in other diseases, or has a different group of associate symptoms. These manifestations, symptoms, or expressions of disease may be known to us in the following ways: By physical manipulation, seeing, hearing; and by those sensations of which only the patient can tell us.

We may also in this way learn the history of the disease, which may give significance to the symptoms\* and assist in the diagnosis; indeed, it is by means of the symptoms and clinical history that a diagnosis is formed.

**Differential Diagnosis.**—If some diseases have many symptoms in common, how shall a discrimination be made? Under such circumstances it is customary to eliminate the symptoms which are common to the group, when it will be usually found that some one or more prominent symptoms, or a particular combination of symptoms, connected with the case under consideration, mark it off from the others; these constitute the distinguishing features upon which a diagnosis is made.

**Influence of Pathological Processes.**—Diseases in general usually follow a somewhat typical course, nearly always beginning with some local affection or producing one after a short time. At the seat of the disease, abnormal products are, after a time, usually formed; these soon find their way through various channels to surrounding parts, thence by the lymph- and bloodvessels into the general circulation, thus reaching every part of the body and producing new symptoms.

The nerves, not being exempt from this morbid influence, cause additional symptomatic sensations, thus exhibiting the wonderful sympathetic relation of all parts of the human body.

**A Knowledge of Minute Physiological and Pathological Processes as a Basis of Treatment.**—To cope successfully with disease, one must not only possess a knowledge of the functions in health, but the broadest possible conception of life as exhibited in numberless animal forms from the ameba to man; thus, having an understanding of the characteristics of the simple forms under both normal and abnormal conditions, it becomes a comparatively easy task to gain a knowledge of like conditions in larger and more complex forms, which are only multiplications of the simpler forms.

The physician when called to a patient first considers the body as a whole, its position, movement, etc. Then follows an inspection of its parts, as the tongue, pulse, and skin; special organs receive attention, such as the heart, lungs, and kidneys; the secretions are analyzed, placed under the microscope; and finally, perhaps, the blood-cell itself is subjected to a similar analysis.

These blood-cells may be studied in the blood of a frog under

\* The term "symptom" is intended to include "physical signs."



the microscope. Under normal conditions, the white blood-cell may be seen to move, throw out pseudopodia, ingest particles of food, and assimilate them. If now a putrescent fluid be injected into the circulation and after a time a portion of blood drawn off, an interesting and wonderful sight presents itself, viz. many of the white cells will be seen to contain bacteria, whose presence results in various degrees of injury. Some cells are found unchanged, others are partially destroyed, and some are dead. If the cell can withstand the noxious influence of the bacteria, it recovers; if not, it dies. It is simply a question of warfare between the white blood-cells and the bacteria. The victory of the white blood-cells means defeat of the disease germs, and a return to health of the entire organism. Such a study of these simple forms gives one a better understanding of the diseases in which they play so strong a part.

**Idiosyncrasy.**—Idiosyncrasy is a condition of the body in which food, medicine, or some other agent produces an unusual effect. This condition is well illustrated by the following cases:

A man of intelligence, and in good health, could not take a teaspoonful of honey without great swelling of the face and neck, distress, and much difficulty in breathing. This was tried in different parts of the country, and at intervals of years, with invariably the same effect.

A man, aged thirty-eight, cannot be near dogs without having an attack of asthma.

In another case, opium causes catharsis instead of constipation; in another, the mere presence of fish is sufficient to induce urticaria. Very minute quantities of mercury will, in some persons, cause profuse ptyalism, while to others large doses may be given for a long time without the slightest effect.

Another case of marked idiosyncrasy was shown in a man who wished to have a tooth removed. He was a fine specimen of physical manhood, the last person in whom one might suspect any physical peculiarity. The administration of nitrous oxid was begun, but after two or three inhalations he showed signs of strangulation, with discoloration of the face, and it seemed impossible for him to inhale more. Upon repeated attempts the same result occurred each time, though nothing was amiss with the inhaler or with the anesthetic agent. Ether was substituted immediately afterward with a most satisfactory result, the breathing being easy and natural.

These cases should teach watchfulness and preparation for possible emergencies that may arise. The precaution should be taken not to administer the full dose of a powerful drug to a patient seen for the first time, but to divide the dose and watch its action.

---

## CHAPTER II.

### THE INFLAMMATORY PROCESS IN GENERAL.

THE essential nature of inflammation is not understood at the present time, therefore the following definitions simply include the most prominent phenomena which are manifested in this pathological process.

**Definition.**—Inflammation may be defined as a pathological process in which the action of the capillary vessels is perverted, and the circulation deranged; these symptoms being accompanied by discoloration, heat, pain, swelling, and disordered function. Bland Sutton defines inflammation as “the method by which an organism attempts to render inert noxious elements introduced from without, or arising within it.” In Dennis’ Surgery inflammation is defined as “the sum of the phenomena which take place in the tissues as the effect of an injury.”

**Etiology.**—Causes are: 1. *Predisposing* (*a*, natural; *b*, acquired). 2. *Exciting*. A *predisposing* cause is one which places the human system in a condition favorable to the production of inflammation, without actually producing it. An *exciting* cause is one which, either alone or in conjunction with the predisposing cause, produces inflammation or disease immediately.

**NATURAL PREDISPOSING CAUSES.**—These are inherent in the human system, while those causes may be called “acquired” which depend upon accidental circumstances. The first group have reference to physical peculiarities, inborn or engrafted into the system, which prepare the way for an active disease having a direct cause. Among these physical peculiarities may be classed the taint of syphilis, general debility, plethora, and nervous susceptibility. For instance, persons who have naturally a large amount of blood, or, in other words, are plethoric, are especially prone to

inflammation, while those of a feeble or lax constitution are more liable to local congestions. It is true that such congestion is likely to end in inflammation, but the process is not so rapid as in a plethoric constitution.

*Age and Sex.*—Age and sex may also be included in natural predisposing causes. At different stages of life certain organs are especially liable to inflammation. For example, in infancy we have teething and diarrhea; in childhood the skin, parotid gland, and tonsils are peculiarly susceptible. Manhood experiences inflammation of the lungs, heart, and genito-urinary organs, and later in life, throughout old age, one is prone to gout, rheumatism, asthma, hepatitis, pleuritis, etc.

The chief tendencies to inflammation which are determined by sex are included in occupation, dress, exercise, etc.

ACQUIRED PREDISPOSING CAUSES.—Food, dress, occupation, climate, and season may act as agents by which one may acquire a predisposition to inflammation.

*Food.*—It is well known that the character of food has an influence in predisposing one to inflammation. Either the habitual use of stimulating articles of diet, and especially alcoholic drink, on the one hand, or an impoverished diet on the other, always stands as an important factor to be taken into account in the prognosis of possible future inflammation.

*Dress.*—The majority of persons have yet to learn how to dress, and it is not an easy lesson. The body is often kept too warm or too cold. The circulation may be impeded by tight clothing or footwear, causing anemia of the compressed part and congestion of the unrestricted parts, as well as an endless train of consequent evils. These local congestions are acquired predisposing causes of inflammation.

*Occupation.*—If one's occupation is such that any organ or set of organs is used constantly, with the liability of being overworked, it may become the seat of chronic inflammation, with acute attacks from time to time. Singers and speakers are afflicted with inflammation of the larynx, while dentists and watchmakers are liable to a similar condition of the eyes.

*Climate.*—A change of climate must always be taken into consideration as rendering a patient more liable to inflammation, whether the change be from north to south, or south to north.

It is a matter of common experience that it takes time to

become acclimated to a certain locality, and to overcome a proneness to disease during this period.

*Season* has its influence. In summer there is more liability to inflammation of the stomach and bowels, while in winter the Schneiderian membrane, the pericementum, and the membrane of the throat and lungs are more frequently affected.

**EXCITING CAUSES.**—The great variety of exciting causes of inflammation may be divided into two classes, local and constitutional. As examples of local causes, the following are some of the most common: Heat in any form whatsoever; caustic substances, as acids and alkalies; acrid vapors and secretions. All these agents may act upon the part so as either to impair its structure and function or to destroy the tissue outright. These local irritants act rapidly and may cause severe local and constitutional symptoms. Other local causes acting mechanically are incisions, punctures, contusions, fractures, and dislocations; distensions, as by gas; compressions, as by ligatures or bandages; the presence of foreign bodies, as a calculus forming a ranula; an unerupted tooth, etc.

Constitutional causes are more obscure as to their action. A severe shock is a cause often followed by serious consequences, as in case of a railroad injury or a gunshot wound, the victim often surviving the first effects only to succumb to the later reaction due to shock. Insufficient food, by lowering the standard of vital resistance, is a prolific constitutional cause of inflammation. Experimentation upon animals shows this, for as the starvation process continues it is followed by ulceration of the intestinal tract. Scurvy, as is well known, is caused by a deficiency of alkaline salts in the blood, for which reason lemon-juice is liberally and effectually used in such cases.

**Varieties.**—Generally speaking, inflammation may be *acute* or *chronic*; it may be further classified as simple or traumatic, and purulent or septic.

The *acute form* of inflammation runs through its different stages quickly, each being distinguished by well-marked symptoms, as in acute pulpitis. In the *chronic form* the inflammatory action not only runs a longer and more indefinite course, but is milder in all its symptoms. It may have a beginning in this mild way, often existing without being recognized; usually, however, it occurs as a sequence of the acute form.

The wound resulting from an extracted tooth may be repaired

without destruction of tissue, the inflammatory process being immediately utilized to restore the breach in continuity.

An example of simple or traumatic inflammation may be seen in the following imaginary case: A tooth is extracted for regulating purposes, or on account of an inflamed pulp; the alveolar dental periosteum and surrounding tissues are in a normal condition. The inflammatory process is begun at the site of the solution of continuity, and if the patient is in a sound physical state, *i.e.* if there is no systemic infection and no local microbic infection of the wound, all the migratory cells are immediately devoted to the work of repair, there being practically no bacteria to combat. The inflammatory process is thus utilized to restore the breach in continuity, and this is its legitimate function.

But the dreaded microbe may take advantage of the following conditions illustrating septic inflammation: The patient, whose vitality has been weakened by previous disease, has an acute alveolar abscess involving a tooth nearly destroyed by caries; which with the unhygienic condition of the mouth affords ideal conditions for the propagation of bacteria and their entrance into the affected tissues. The overwhelming numbers of bacteria overcome the phagocytes, which are converted into pus-cells, and destruction of tissue follows. It is the entrance of bacteria which does harm; in every case they are the disturbing element, whose presence is abnormal and injurious.

The accumulation of inflammatory products continues as the warfare between phagocyte and bacterium goes on, the inhibition or destruction of the bacterium causing the death of the phagocyte and its conversion into pus. The accumulation of pus and its subsequent degeneration may cause much destruction of tissue at the site of the local injury, and poisons generated in this affected area may spread throughout the system, causing constitutional symptoms, when final recovery is a question of the chemotactic warfare and the vitality of the patient.

Inflammation, therefore, must end either in health, or in the death of the part affected; if in health, the inflammation is said to terminate by resolution; if in death, by dissolution, ulceration, or gangrene.

**Extension of Inflammation.**—The term “extension” suggests at once a small beginning with increase in the severity of the symptoms as well as in the amount of territory invaded. The plain

deduction is, therefore, that while all inflammations, of whatever character, are at first strictly local, they may afterward spread, involving large surfaces of the body and bringing the entire system into general sympathy. Inflammation may spread from one part of the body to another in five different ways, viz.: By continuity of structure; by contiguity of structure; by means of the lymphatics; through the agency of the nervous system; and by the blood. The rapidity with which inflammation travels from one part of the body to another varies greatly, depending upon the character of the irritant and the structure involved.

**EXTENSION BY CONTINUITY OF STRUCTURE.**—By this means, the inflammatory action, once begun, passes along the same kind of structure, unhindered by varying degrees of resistance; for example, erysipelas of the skin may at first show an inflammatory surface no larger than a finger-nail, but it may extend over the greater part of the body in a few hours.

**EXTENSION BY CONTIGUITY OF STRUCTURE.**—The word itself conveys a very good idea of the way in which disease spreads, and may only be made clearer by examples which illustrate it. For instance, an inflammation of the lung may extend to the pleura which covers it or lies contiguous to it. Inflammation is often likely to spread from one part of the eye to another, simply for the reason that different parts lie in close contact one with another, as the conjunctiva and the sclerotic membrane.

**EXTENSION BY THE LYMPHATICS.**—The lymphatics, it is well known, carry poisonous matters to their glandular centers, to be radiated off into the entire system, as in the case of a dental student who was extracting a carious tooth, a sharp portion of which wounded his finger. The wound itself was slight, but the young man nearly lost his life in consequence of the general septic poisoning which followed.

**EXTENSION BY THE NERVOUS SYSTEM.**—The nerves seem to act as an agency in transmitting the inflammatory process in certain instances, but the manner in which this is accomplished is little understood at the present day. We may say that it is through sympathy. And what is sympathy? We are scarcely wiser than before. We can only cite an example for illustration, such as the familiar one of parotitis, in which the disease suddenly leaves the parotid gland and descends to the testicle.

**EXTENSION BY THE BLOOD.**—The blood itself may be the

agency by which poisonous matters are carried from one part to another. An inflammatory center may throw off or furnish poisonous particles to the circulation, which conveys them to distant parts of the body.

**Symptoms.**—The symptoms of inflammation may be classed as (a) local and (b) constitutional.

**LOCAL SYMPTOMS.**—“*Rubor, calor cum tumore et dolore*” (Celsus). Redness, heat, with swelling and pain, are still recognized as essential factors in the majority of well-pronounced cases of inflammation. In addition to these “cardinal” symptoms should be mentioned with considerable emphasis that of disordered function. These symptoms vary in accordance with the texture and function of the structure which is affected, and there are exceptions in which many of them are absent.

**Discoloration.**—The degree of redness depends upon the vascularity of the structure; that is, in those parts which are capable of receiving a great deal of blood, as the mucous membrane of the mouth, the skin, and cellular tissue. While this is true, the rapidity of the discoloration is also influenced by the intensity of the inflammatory action, which in acute cases causes distinct redness in a very short time.

**Pain.**—In acute inflammations, pain is nearly always present in proportion to the intensity of the morbid action; and its character, as well as amount, aids greatly in diagnosis and may throw much light upon the case. The degree of pain is one of great interest and importance, inasmuch as it varies to so great an extent in different individuals.

In regard to the character of the pain, it requires a vocabulary of adjectives to describe all the varieties. It is described as sharp, lancinating, stabbing, boring, acute, throbbing, sickening, itching, burning, dull, gnawing, scalding, gritting, beating, etc. Pain may be intermittent, remittent, or paroxysmal. It is usually felt at the point of morbid action, or at the point of greatest intensity, but it not uncommonly manifests itself at a distance from it, or it may travel from one place to another. Sometimes pain is absent, although inflammation of a serious nature is present. This is to be looked upon as a dangerous condition, inasmuch as the disease may be unnoticed until it has made serious progress. On the other hand, the pain may be so severe that in a few minutes it will weaken a previously strong person so that he can scarcely stand;

yet it gives warning of inestimable value, and furnishes priceless information in regard to the disease. For instance, an intermittent, sharp, lancinating pain is characteristic of neuralgia; a throbbing pain indicates the formation of pus.

Posture often influences pain greatly; thus, an aching tooth may be entirely free from pain during the day, but may ache violently as soon as the patient lies down at night; an abscess on the hand may cause little pain while the member is elevated in a sling, but the moment it is lowered the suffering is aggravated to an unbearable degree. In cases of pulpitis the symptoms are modified by environment, as stated in the chapter on that subject.

*Swelling.*—With few exceptions, swelling is present to some extent in all inflammations. The amount of swelling, as well as the rapidity with which it progresses, depends upon the structure involved and the character of the irritant which produces the inflammation. The structures in which swelling is likely to be slight, or entirely absent, are the tendons, cartilages, bones, vessels, and nerves. Mucous membranes also suffer little in this way, but tissues lying immediately beneath often swell to a considerable extent.

On the other hand, the faucial and pharyngeal tonsils, the glottis and uvula, being more or less loosely constructed of cellular tissue, are likely to swell to a great extent. The scalp and the face are also examples of tissue in which large swellings may occur, the face often swelling so greatly from pericementitis and alveolar abscess that the features are scarcely recognizable. Those parts which admit of large swellings are also those which allow rapid swellings. It need hardly be said that the swelling often acts in a beneficial way in locating the inflammatory action, and especially in mitigating the pain, having the effect of depleting the part in much the same way as local bleeding or the action of a cathartic on the bowels. The swelling is not always thus beneficial, for if it be slower in progress and consist of a hard fibrinous deposit, it may by pressure cause stagnation in the capillary vessels and death of the part affected.

*Heat.*—Heat is a common factor in inflammation and forms an important aid in diagnosis. In alveolar abscess the local heat and dryness of the part is at once detected by a touch of the finger. If the morbid action continues, the entire system sympathizes with it, and general fever is the result, as indicated by its various symptoms.



*Disordered Function.*—This symptom is rarely absent, though often varying in degree and manner. An increase in sensibility of the part is one of the most common effects of inflammation, the slightest pressure causing great distress. In peritonitis the weight of a sheet is often unbearable, and in acute pericementitis the affected tooth is excessively painful to the least touch of the finger, the tongue, or antagonizing tooth. Parts which are more or less insensible to the touch in a sound state, such as bones, ligaments, and tendons, become extremely sensitive when they are inflamed, thus interfering with their proper functions.

In inflammation of the tongue there is a loss of the sense of taste; in that of the nose, a loss of the sense of smell. In laryngitis the voice is changed and often suspended altogether. Pericementitis interferes with the function of mastication, and gastritis hinders digestion. The function of secretion is nearly always modified; for instance, the skin is dry and the urine scanty. The function of the absorbent vessels is also changed; and while the absorbents are actively taking up and removing affected tissue, they refuse to take up foreign matter. As a practical illustration, the dentist does not expect his arsenical paste to accomplish the destruction of a tooth pulp while that organ is the subject of an acute inflammatory process.

CONSTITUTIONAL SYMPTOMS.—If a local inflammation terminates quickly by resolution, or the morbid action be slight, it may not be recognized by the general system; but in severe cases, or even in mild ones if the structure involved be an important one, the entire organism responds in sympathy with it; sometimes in a few hours after local inflammation has been established, and at other times several days elapse, according to the nature of the exciting cause, the physical and mental condition of the patient, and the part affected.

In order to ascertain the degree of *fever*, the pulse\* should be examined, and the temperature taken by means of a clinical ther-

\* It is well to become familiar with the normal state of the pulse in all patients, so that in emergencies, or in administering anesthetics, the operator may act with greater intelligence and ability. The necessity for precaution is obvious when it is remembered that the normal pulse may be as low as forty or as high as one hundred beats per minute.

The points to be noticed in the heart-beat are frequency, hardness, fullness, and quickness. The average number of beats to the minute in the

mometer placed in the armpit, under the tongue, in the rectum, or in urine immediately after it has been voided.

It will also be noticed that the eyes are unnaturally red and suffused, the skin dry, and the extremities hot. The respirations are increased in frequency and often performed with difficulty.

The *digestive organs* suffer also; the tongue is red at the tip and edges, dry, tremulous, and usually coated with a whitish fur, varying to a yellow and brown. The taste is perverted or wanting, the saliva scanty, and the thirst intense. The appetite is lacking and often supplanted by nausea and disgust for food. The bowels are usually constipated. The kidneys give expression to the disease in the suppression of urine to a considerable degree, sometimes to one-half or one-third the usual quantity. The color is changed to a deep red, with more or less sediment of a brick color.

The *muscles* partake of the general discomfort, as indicated by a sense of lassitude, stiffness and soreness, with occasional darting pains.

The *brain* shows its vital connection with the injured part by an irritable state of mind, inability to sleep, and sometimes, in severe cases, delirium.

**Intimate Nature of Inflammation.**—In considering the finer processes of inflammation we look beyond organs to the elementary tissues from which the inflammation proceeds. Let us first consider the symptom *heat*.

*Heat* alone is sufficient to account for certain other symptoms, as thirst, diminished secretion, constipation, loss of appetite, etc. Heat is one of the most prominent symptoms of the inflammatory process, and it was formerly believed that this must be controlled in order to cure the patient; but it may be possible that the heat is in some way beneficial, especially in inflammatory diseases characterized by the invasion of bacteria, for it is a recognized fact that bac-

healthy adult is 70; this in inflammation may be increased to 85, 90, 100, or even 120, according to the severity of the disease.

A "hard" pulse resists the pressure of the finger, and rolls under it like a tense cord, being due to the great force with which the blood is forced into the arteries.

A "full" pulse, as the term indicates, has reference to the amount of blood in the vessel, actually increasing its size, which is appreciated by the touch and the vessel is recognized as being larger than usual.

A "quick" pulse is recognized by the touch as being abrupt, the beats occurring with great suddenness, or the pulse may be hard and quick at the same time.

teria are susceptible to changes of temperature, and that extremes of high or low temperature check their growth. It has been found that certain micro-organisms which are capable of producing disease when introduced into the body thrive at the normal body temperature, but cease to flourish when the bodily heat is raised. From this point of view the symptom heat assists the white corpuscle in the struggle for life against invading bacteria, and may be beneficial.

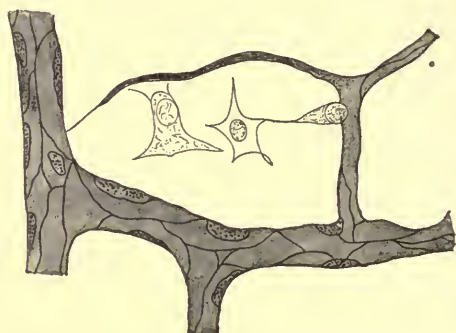
*Swelling* tells us much of the character of the inflammatory process, and is an important and constant factor in all acute forms; yet it is not an essential element, for there are chronic forms in which there is shrinkage of the parts, rather than swelling. A quickened circulation of the blood in inflammation has been noted, but this may not necessarily account for the swelling of the inflamed part, for blood and lymph may flow to the part in increased quantities; but if the flow from the part is equal to the flow to it, there is no accumulation of what is termed inflammatory exudation, and therefore no swelling, while if there is an obstruction to the exit of fluids from the part, there is swelling. This is the result, therefore, of the accumulation of blood and lymph in the inflamed area, representing material which has escaped from the vessels and which has undergone various modifications.

CELL-MIGRATION.—The main feature in this process is the *escape* of the white corpuscles, or what is known as the “migration of the leucocytes,” first observed by Cohnheim. This takes place in the veins and capillaries, there being no evidence that migration of blood-corpuscles takes place from the arteries, although these vessels may become distended with blood. Observation of the inflammatory process shows a rapid blood-current which is followed by exudation and obstruction. At first the blood-stream shows no change in the relation of the red and the white corpuscles to each other, but later the movement of the white corpuscles is retarded, and they glide more slowly along the sides of the vessel wall and eventually become attached, perhaps, for a short time, when they are again carried along by the current, to become at last, however, attached to the wall, the tendency of the white corpuscles to stick to the vessel walls becoming more and more pronounced until the leucocyte fastens itself to the side of the vessel and stays there, thence gradually working its way through to the outside. The corpuscle seems to squeeze itself through,

becoming much changed in shape in the process. After a time the red blood-cells follow suit and are seen outside the vessel walls, together with a quantity of serum which has escaped also.\*

The inflammatory exudation once outside the bloodvessels extends in different directions, forming masses near the vessel which grow less numerous as the exudation recedes from it. It is not supposed that these corpuscles extend haphazard into the tissues, but that they follow certain definite channels, lymph- or blood-channels, and it has been observed that during inflammation there is an increased flow of lymph through the larger as well as the smaller lymph-vessels.

FIG. 1.



That the white blood-cells actually go through the vessel walls is shown by introducing a coloring material into the blood, staining the white corpuscles seen first inside the vessel and afterward outside. Note the structure of the vessel wall. (Fig. 1.) The wall is silvered so that the outlines of the endothelial cells which compose it may be seen. The joints or margins of these cells may be supposed to allow the blood-cells to pass through them at times, but there is no direct evidence to show that stomata exist in the vessel walls. By injecting a colored fluid under sufficient pressure, a quantity of pigment has been found outside the vessel, favoring the supposition that this pigment escaped through stomata or apertures existing in the walls of the bloodvessels; but there exists the possibility of the pressure being sufficient to rup-

\* The red cells have no inherent power of passing through the vessel walls, but it has been suggested that it is possible that they may pass by pressure through the enlarged stomata made by the passage of the white cells.

ture the vessel walls and that the pigment escaped through the rent thus made. There may, however, exist minute pores, beyond the power of the microscope at present to reveal, yet large enough to permit the escape of the white blood-corpuscles by the process of squeezing through, in which their shape is changed and their diameter diminished to one-half or more. It is probable, also, that the inflammatory process renders the vessel wall more permeable. However this may be, the fact that blood-corpuscles pass through the walls of the vessels is easily demonstrated, as shown by the following experiments made by the writer in 1884.

The method found to be most convenient for this purpose was that in which the frog's mesentery is used; its fineness being a quality which fits it admirably for microscopic examination. The frog was curarized, and laid on its back on a large object-stage. An incision along the left side opened the abdomen, and a loop of intestine was drawn out, great care being taken not to unduly injure the parts or induce hemorrhage. The mesentery was then drawn gently over a thin, circular cover-glass, enclosed by a ring of cork, and fastened to the stage with Canada balsam or wax. The mere exposure of the mesentery to the air has been found sufficient to start inflammatory action. "Indifferent solution"\* was used to prevent the exposed parts from drying.

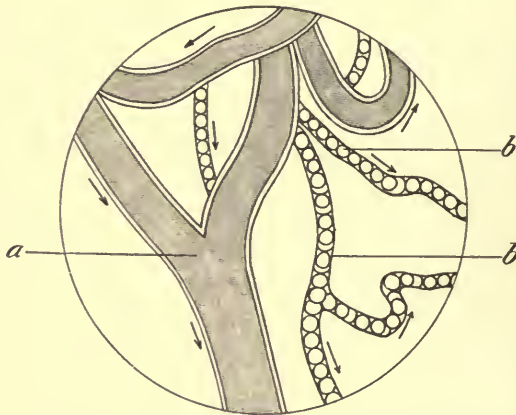
At first a general dilatation of the vessels was noticed, beginning with the arteries and extending to the capillaries and veins, and while the flow of blood through these vessels was at first more rapid (Fig. 2) it was retarded later on until it became slower than normal, and the blood-cells, which formerly could not be distinguished individually, were then easily recognized. (Fig. 3.) The blood now began to accumulate in the capillaries and veins. At a later period the white blood-cells were seen throwing out processes which passed into the wall of the vessel, and eventually through it. This escape or migration of the white cells is termed diapedesis, and by this process in six or eight hours the veins and capillaries were surrounded by these leucocytes, which gradually found their way into the surrounding tissue. (Fig. 4; see also Fig. 5.) It was noticed that if the mesentery became strained so that the circulation was interrupted, migration ceased at that point.

Bouchard thinks that the endothelial cells in the vessel may

\* "Indifferent fluid" or "normal salt solution" is composed of one teaspoonful (scant) of sodium chlorid to one pint of water.

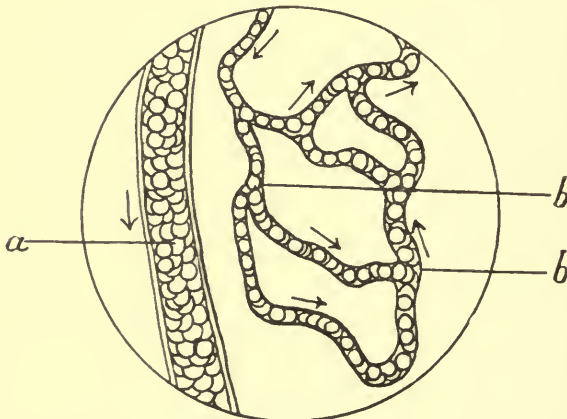
contract and assume a round form, leaving large openings between them through which the corpuscles pass; also, that the migration of the leucocytes is due to active ameboid movements on their part, possibly assisted by a more porous condition of the walls of the vessels.

FIG. 2.



*a.* Vein. *b b.* Capillaries. The vessels are slightly dilated, and the blood-current accelerated so that it is impossible to distinguish the individual corpuscles, except in the smallest capillaries. In the vein is seen a swiftly passing yellowish stream.

FIG. 3.

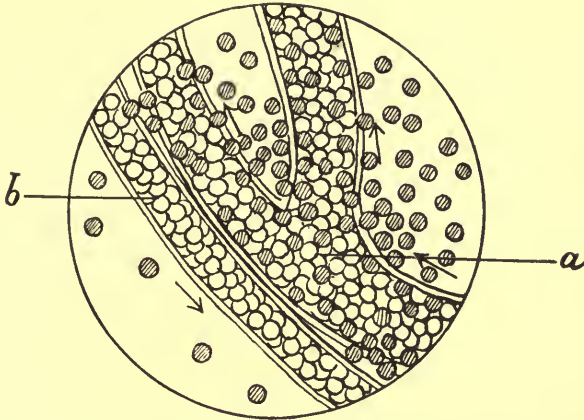


*a.* Vein. *b b.* Capillaries. Retardation of current, and crowding of the cells.

The fact that the white and red cells will escape into a tissue whose cells are dead seems to contradict the theory which supposes that increased activity of neighboring cells will cause exudation.

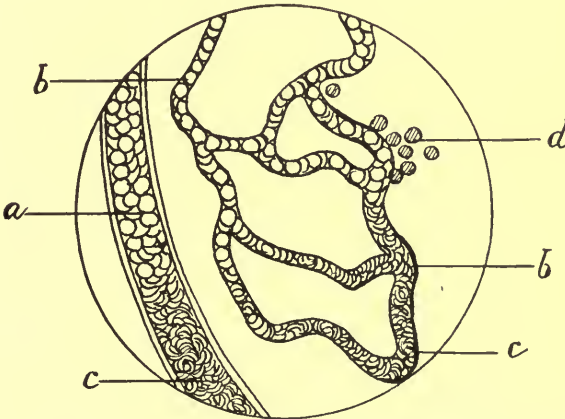
Moreover, recent research seems to warrant the supposition that certain products of bacteria, when located near the bloodvessels, have the power of attracting white blood-cells. It was first shown

FIG. 4.



*a.* Vein. *b.* Artery. The migration and the peripheral distribution of the white blood-cells are shown by the round black figures. (The specimen as here represented had been under observation eight hours.)

FIG. 5.



*a.* Vein. *bb.* Capillaries. *cc.* Complete stasis. *d.* Escaped white blood-cells. At this stage the preparation had been under observation about four hours. Stasis here observed is due to the application of tincture of capsicum.

by Engelmann that chemical substances had the power of attracting or repelling cells capable of independent motion (chemotaxis). Later, this process was observed in the movements of the leuco-

cytes by Gabrischweisky. Capillary tubes partly filled with certain substances and placed in the tissues of animals became filled with leucocytes; when these tubes were filled with indifferent substances, only a small number of leucocytes entered them; other substances exerted a repellent action.

*Purpose of Cell-Migration.*—These observations indicate the beneficent purpose of the leucocytes in inflamed tissue. Any dead material in the body quickly becomes filled with leucocytes. In this dead material, chemical substances are formed which attract the leucocytes. At points of inflammation around masses of staphylococci they are attracted not only by the necrotic tissue, but by the bacteria themselves. Metchnikoff has shown that the leucocytes have the power (phagocytosis) of taking up and destroying bacteria, and their presence therefore must afford protection to the organism. This fluid exudation may also afford a useful purpose in diluting poisonous substances, and in washing them away.

As further proof of the attractive power of chemical substances, necrotic tissue, and bacteria, it has been shown that finely powdered glass may be introduced into the tissue causing a new formation of tissue, an infiltration of granulation cells, etc., without the migration of any leucocytes.

If we now return to the migrating cell we shall find that it becomes modified in its passage from the vessel to and through the tissues. Both blood-cell and serum are changed; this is effected by the absorption of outside material into the cell as well as by a giving up or elimination of portions of the cell contents. These and probably other changes so completely modify the blood-cells and serum that they would not be recognized after their escape from the vessels into the surrounding tissue.

“Pus.”—We have spoken of the fluid which passes through the vessels, as plasma, red and white corpuscles, etc. We have also said that in the passage of these constituents from the vessels to the surrounding tissue they become modified, or changed so as not to be recognized; they are therefore entitled to a new name. The term “pus,” however, includes more than this; it includes what are known as the white blood-corpuscles, the lymph-corpuscles, the wandering cells, and the mucous corpuscles, all of which have migrating powers.

The observation has been made that the lymph-corpuscle possesses the same characteristics as those found in the white blood-



corpuscle. The lymph-corpuscles are seen to contain one or more nuclei, which are relatively large compared with the amount of protoplasm surrounding them. These same characteristics have been noticed in the cells of the blood. Both in blood and in pus, cells are observed to contain one or more nuclei. In view of these observations, therefore, the term lymph-corpuscles has been applied simply on account of their location; for instance, in the lymph-glands they are known as lymph-corpuscles, in the blood-vessels as white blood-corpuscles, and in the tissue surrounding these vessels as pus-corpuscles.

Still further, there is reason to believe that the migrated white blood-corpuscle divides and subdivides in the inflammatory process; indeed, there seems to be no other way of accounting for the great number of these corpuscles present in inflammatory exudation.

These inflammatory products continue to form as long as the inflammation is continued, but when it does end it is in one of three ways,—in resolution, in production, or in destruction; and when the cause or causes are removed and restoration to health has begun, we assume as an essential fact that the formation of these products has ceased.

And now we are concerned in their removal. How is it to be accomplished? We may have the inflammatory exudation in all stages of fluidity, and under some circumstances nearly solid, in which case the cells die and are removed by "fatty degeneration." As the cells are removed by this process, space is thus afforded for the outflow of the lymph-current, and a considerable amount of the inflammatory product is carried away through the agency of the lymphatics. These products are still further reduced by the return of the living cells to the lymph- and bloodvessels. Thus the various materials return to the channels from which they came, and the normal functions are again established.

## DIVERSE CONDITIONS PRESENTING TO THE DENTAL PRACTITIONER.

## CHAPTER III.

## SYNCOPE.

**Synonym.**—Fainting.

**Definition.**—This is a symptom of a condition in which the heart fails to send the blood to the extremities, and especially to the brain.

**Etiology.**—Syncope may be caused by a great variety of circumstances and conditions, among which are a close and overheated room; the sight of blood or of some operation; various drugs, as cocain; some slight operation affecting the peripheral distribution of the fifth nerve, as the treatment of a root-canal, squeezing a pimple, etc. Fear very often causes faintness.

**Treatment.**—While the treatment should be varied to suit the different circumstances in each case, the following is given as a brief outline: First lower the head; admit fresh air, or use a fan; loosen the clothing; see that the tongue does not fall back in the throat and obstruct breathing; apply water to the face, and put a few drops of aqua ammoniæ on a napkin and hold it cautiously to the nose. If the patient can swallow, administer thirty drops of aromatic spirits of ammonia in a little water, or fifteen drops of tincture of capsicum in water. During the treatment, if the patient does not recover immediately, assistants may be employed in chafing the hands and in applying warmth to the feet.

It should be remembered that slowly sipping from a glass of water will have a more stimulating effect upon the heart than a small dose of brandy quickly swallowed. The act of swallowing seems to remove the inhibitory influence over the heart, allowing it to pulsate more freely.

If the above means fail, aromatic spirits of ammonia, or brandy, may be injected subcutaneously, and artificial respiration practiced.

## CHAPTER IV.

## HYSTERIA.\*

**Synonym.**—Hysterics.

**Definition.**—Hysteria is described as a functional disturbance of the cerebro-spinal axis, characterized either by special mental symptoms or by sensory, motor, vasomotor, or visceral disorders, dependent upon a variety of abnormal physical conditions.

**Etiology.** REMOTE CAUSES.—All agree that *heredity* is an important factor in the development of this disease. Briquet has shown that from hysterical women the disease has been transmitted to more than half the daughters in the two following generations. It is undoubtedly true that hysteria is often connected more or less intimately with certain other morbid states of the system, but there is little evidence to show that it is dependent upon any particular disease. It is frequently noticed in connection with a tuberculous diathesis. Grasset has recently contributed an article in which he expresses his belief that there is a direct connection existing between the tuberculous diathesis and hysteria. By this he does not mean that all hysterical subjects have tubercles in the lungs, but that in various generations suffering from such a diathesis, one manifestation of it is often found in hysteria.

He gives several interesting cases to substantiate this theory, but it would be easy to prove also by statistics that so common a disease as tuberculosis was related to many other complaints.

It is generally conceded that *a certain mental constitution* predisposes to hysteria. This condition is described as a state in which volition is not well balanced; the patient is changeable, capricious, passing rapidly from joy to sadness, from laughter to tears.

Hysteria is liable to occur at any age, but it is well understood that it occurs with greater frequency at certain periods of life. Statistics show that hysteria occurs more frequently between the ages of fifteen and thirty than at any other time.

\* In view of the fact that hysterical patients have not infrequently complained of being the victims of criminal assaults, it would be a wise precaution to have a witness in the room during operations for patients with known hysterical tendencies.

*Certain occupations* predispose to hysteria, especially those which necessitate physical fatigue and undue mental exertion. Men often suffer from hysteria as the result of overwork conjoined with financial embarrassment. It is met with not infrequently among teachers, particularly those who are engaged in the exhausting labor of preparing children for examinations. The injurious effect of overwork in the American school or college in the production of hysteria is undoubted, acting both as a predisposing and exciting cause of this disorder.

One of the essential characteristics of hysteria is an inordinate craving for sympathy, which may or may not be under the patient's control. This sympathy may become in time a direct cause; for example, there once came under the writer's observation an attack of hysteria in a young woman who was attended by a sympathizing companion. No sooner were the symptoms abated than the second young woman was attacked by the same trouble. The first, as soon as her companion revived, was again hysterical, and so the two cases continued, alternating several times before the complete recovery of either took place.

**IMMEDIATE DENTAL CAUSES.**—Nervous shock, produced in various ways, may be a direct cause of hysteria; for example, it may occur as the result of prolonged and severe dental operations, also of ordinary dental operations upon a susceptible patient during the menstrual period. It occurs frequently after the administration of an anesthetic to extract a tooth, or after other dental operations. These nervous shocks are more likely to produce hysteria in those who have been subjected to mental strain and overwork; in such persons, not only may hysteria be produced by the operations and conditions above mentioned, but even by the witnessing of an operation upon another.

**Pathology.**—The pathology of hysteria has not at the present time shown us any radical anatomical changes. When these have occurred they have always been found to be connected with some of the various complications which may attend hysteria. The ancients thought that the uterus was chiefly concerned in hysteria, as its name indicates. As late as 1876 it was stated by Woodbury\* that cases might be termed hysterical only when the pathological sources of the symptoms were found in the uterus or ovaries; and when the uterus and organs associated in function are not in a

\* See *Medical and Surgical Reporter*, December 2, 1876.

morbid condition no symptoms can correctly be called hysteria. But Dr. Chas. K. Mills\* states the case better, in these words: "As the uterus and ovaries are the most important female organs, they are therefore a frequent source of reflex irritation in hysterical patients."

Later observations, however, go to show that hysterical symptoms are nearly as frequently manifested in men as in women. For instance, both men and women composed the religious sect known in 1760, as the Jumpers. In their religious frenzy they would jump for hours at a time. The Jumping Frenchmen of northern Maine furnish a striking example of this affection occurring in men. Frenchmen who were not jumpers have worked in the same camp with those affected, for months, without being influenced, when suddenly they also have become victims, in the following manner: One of the jumpers in a position from behind calls out "boo," when those who are affected by this as suddenly echo "boo," jump to their feet, and continue to leap about for many hours, during which time they are joined by others. Ever after this, those who have been thus influenced feel impelled to obey the slightest command, and to imitate their fellows or join them in their frenzy of jumping about. A similar affection was known among the Siberians in which both men and women were affected. The condition was known to the Russians as "miryachit." The obedience of hypnotized subjects has much similarity with the affection just described, and may well claim attention as having a somewhat close relationship. In these instances, some kind of suggestion was necessary, which after it was made was carried out independently of the will.

Dr. Mills concisely states the pathological situation as follows:

1st. The anatomical changes in hysteria are temporary.

2d. These changes may be at any level of the cerebro-spinal axis, but are most commonly and most extensively cerebral.

3rd. They are both dynamic and vascular. The dynamic are of some undemonstrable molecular character; the vascular are either spastic or paretic, most frequently the former.

4th. The psychical element enters, in that either, on the one hand, violent mental stimuli which originate in the cerebral hemispheres are transmitted to vasomotor conductors, or, on the other

\* Pepper's "System of Medicine," vol. v. p. 210.

hand, psychical passivity or torpor permits the undue activity of the lower nervous levels.

**Symptoms.**—Dr. Mills has described four classes of hysterical cases, which not only help in using the symptoms for diagnosis, but give at a glance an admirable and comprehensive view of the disease in its different phases. His classification is as follows:

1st. Cases in which the symptoms are involuntary.

2d. Cases in which the symptoms are induced and become involuntary.

3rd. Cases in which the symptoms are acted or simulated, but in which the patient, because of impaired mental power, is irresistibly impelled to their performance.

4th. Cases in which the symptoms are purely acts of deception which are under the control of the patient.

In the first class it may seem difficult to see how the psychical element comes in if the symptoms are purely involuntary, but it should be remembered that in the beginning the hysterical symptoms or expressions may have been induced by psychical influence; these being repeated, form a habit which is so strong that all expressions of hysterical condition are entirely beyond the patient's control. Often the hysterical countenance or facial expressions may be observed. In mild cases no radical symptoms are to be observed, only a mental exhilaration and mobility. Sometimes there is complaint that a ball is rising in the throat (*globus hystericus*).

An hysterical attack may come in a variety of ways, suddenly or insidiously, with or without warning. A typical and most constant condition of an hysterical attack is shown in alternate laughing and crying, often in wild and delirious laughter followed suddenly by violent convulsive sobbing and weeping. By "convulsive" in this condition is not meant a rigid, tonic spasm, but a wild throwing about of the arms and legs, jerky movements of the body, often accompanied by shouting, screaming, laughing, etc., or there may be utter silence during these convulsive movements, or again, a low mumbling which cannot be understood.

As illustrating prominent characteristics of hysteria, and at the same time exhibiting symptoms of this disease, the following may be helpful: In the Charité Hospital in Berlin, in 1801, a patient fell into strong convulsions; immediately afterward six other patients were affected in the same way, and finally eight more were

attacked. Mitchell remarks, "The hysterical state, however produced, is a fruitful source of mimicry of disease in its every form, from the mildest of pains up to the most complete and carefully devised frauds. Its sensitiveness and mobility, its timidity and emotionalness, its greed of attention, of sympathy, and of power in all shapes, supply both motive and help, so that while we must be careful not to see mimicry in every hysteric symptom, we must, in people of this temperament, be unusually watchful for this form of trouble, and at least reasonably suspicious of every peculiar or unusual phenomenon."

One of the most mysterious symptoms or conditions connected with hysteria is what is called a "phantom tumor." These tumors may occur in different parts of the abdominal wall, and vary in size and character. They are diagnosed by administering an anesthetic, when the tumor disappears. Among the many other hysterical manifestations are anesthesia (usually local), deafness, blindness, perversions of the senses of smell and taste, hyperesthesia, painful diseases of the joints, etc.

**Course, Duration, etc.**—The duration and general course of this disease are as uncertain as the symptoms and pathology, especially in reference to the acute attacks, but the underlying predisposing condition is essentially chronic.

As a general rule, in uncomplicated cases, the disease tends to abatement with advancing age, and its presence apparently does not tend to shorten life in any appreciable degree.

**Prognosis.**—The prognosis is uncertain, as to complete and permanent recovery, depending much upon the cause. If the hysterical condition is inherent in the individual, and has been of long standing, the prognosis is bad; on the other hand, if it be recently developed in a previously healthy person, there is much room for hope.

**Diagnosis.**—Generally, hysteria presents no great difficulty in diagnosis, but there are many exceptional cases in which the practitioner finds himself in doubt. Hysteria simulates many diseases; for instance, epilepsy. From this disease it may be separated by remembering that in epilepsy we have the suddenness of attack, dilated pupils, absolute loss of consciousness, and asphyxia, with biting of the tongue, etc.; yet hysteria sometimes passes over into a condition bordering on epilepsy,—*hystero-epilepsy*.

Hysteria may be distinguished from laryngitis, peritonitis, etc.,

by noting the temperature of the body and by close examinations. The tenderness over the parts in hysteria depends more upon the mental condition than that which attends inflammation. Also, in the case of an involvement of the larynx, an inspection of this organ with the laryngoscopic mirror will show the absence of true inflammation.

Phantom tumors are diagnosed, as already mentioned, by the use of an anesthetic, under which they disappear; also by the aid of palpation and percussion the nature of their contents may be ascertained. It is sometimes extremely difficult to determine whether hysterical patients are shamming or not, but in the ordinary cases in which the hysterical condition is purposely assumed, watchfulness will suffice.

In those cases arising in dental practice a thorough knowledge of the symptoms will be of service, and in the majority of cases a correct diagnosis may be made.

**Treatment.**—When an acute attack of hysteria occurs at the dental office, it is no time for the study of the essential morbid phenomena or for any prolonged investigation as to the cause, but the case is one of emergency and the symptoms must be treated immediately. Neither is it necessary or advisable in a dental work of this sort to discuss the preventive and moral treatment to be advocated, or to enter into an elaborate investigation into the etiological factors in the case with a view of removing the cause; the treatment of this affection will therefore be considered only in its application to such cases as are likely to arise in dental practice.

Whatever the medicinal treatment may be, there is always a moral principle involved which must be kept steadily in mind in the treatment of an hysterical case. Thus we have found, in the discussion of causes, that an hysterical condition is brought into prominence and nourished by sympathy and indulgence, if indeed it is not dependent upon these qualities in others; therefore it is necessary in treatment to be firm yet kind, to insist upon obedience, never wavering in the carrying out of any measures which may be proposed in the presence of the patient. Such patients are very watchful to notice any weakness on the part of the doctor, making it all the more important for him to preserve strict discipline in himself as well as in patients under his care.

There are various phases of hysterical manifestations, and the treatment should vary accordingly. A condition often met with



is one in which a spasmodic element enters; it often comes on in the form of an apparent syncope, followed by the spasmodic condition. The loss of consciousness may be partial or complete, and the spasms are usually tonic in character. In such cases the treatment must first be directed to the apparent syncope. It so happens that a dash of cold water in the face is one of the most effective local measures for this fainting condition and at the same time it has the most salutary effect upon the hysterical state; it is therefore to be commended in these cases. Meanwhile the patient's head should be lowered sufficiently to invite a flow of blood in that direction. If syncope is profound, a hypodermic injection of aromatic spirits of ammonia or brandy may be given. When the patient has sufficiently revived as far as circulation is concerned, and the spasmodic condition continues, then the administration of sodium bromid or potassium bromid is of value. For the alternating laughing and crying condition, in addition to moral restraint a full dose of sodium bromid, or a teaspoonful of the elixir of valerianate of ammonium, may be administered in water. Alcoholic stimulants should rarely, if ever, be used; for in those cases in which the extremities are cold and the circulation is weak, the elixir above mentioned will usually be sufficiently stimulating. Symptoms are thus combated as they arise, and further curative treatment with the idea of removing the cause should be referred to the general practitioner. This may not always be necessary, as many cases of hysteria are dependent upon some temporary excitement and need no further treatment.

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## CHAPTER V.

### NEURALGIA.

**Definition.**—Neuralgia is a disease of the nervous system which as yet has not been wholly accounted for by any peripheral lesion, and which is characterized by intermittent pain usually described as darting, stabbing, boring, etc.

**Etiology and Pathology.**—It must be admitted that it is quite impossible to make out a clear statement of the etiology of this

subject as distinguished from its pathology. In discussing causes it is difficult to arrive at a decision as to what is cause and what is effect. Very little can be said definitely in regard to the pathology of neuralgia. There are those who believe that it is an expression of a neurosis, which is a functional affection of the nerve-centers. There is much to support this in the fact that many persons suffer from neuralgia without apparent outward cause or irritation. Other writers believe neuralgia to be due to a congested condition of the nerves, or to some pressure; that of a tumor, for example. Reynolds thinks it probable that in all cases of neuralgia there is either atrophy or a tendency to it, in the sensory root of the painful nerve or in the central gray matter with which it comes in closest connection.

That a neurotic condition is hereditary is quite well established, as it has been observed to be transmitted to successive generations of a family. There has also been noticed in the same family a tendency to other neuroses, as insanity, paralysis, hypochondriasis, etc. Again, it may be said that neuralgia may coexist with any of these affections. With this tendency to neuralgia there may be transmitted, also, a weakened or faulty nervous system. In support of the idea of heredity just expressed, and of inherent constitutional weakness, especially in the nervous system, we may recall many cases of neuralgia of the fifth nerve in which no local or peripheral cause has been sufficient to explain the condition, and in which we must assume some constitutional peculiarity or weakness in the individual, and it will probably be found upon investigation that these exceptional cases belong to neurotic families. Reynolds says that excessive drinking tends to produce degeneration of the nervous centers and predisposes to neuralgia, and that the descendants of drunkards, who usually give evidences of an enfeebled nervous organism, are decidedly prone to this disease.

In neuralgia of the fifth nerve, variously designated as prosopalgia, tic douloureux, epileptiform neuralgia, Fothergill's disease, etc., the underlying causes are practically the same as those which produce the disease in other parts. Certain dyscrasiæ, as results of lead-poisoning, syphilis, malaria, etc., which may be classed as causes predisposing to the disease in general, are especially connected with neuralgia of the fifth nerve; to these should be added certain immediate causes, as changes in the structure of the nerve, exostoses, pericementitis, irritation of the dental pulp from various

sources, hypercementosis, dental erosion, impacted teeth, irregular eruption of the wisdom teeth, etc. In fact, nerve irritation, from whatever source, which in itself is not sufficient to produce neuralgic pain may yet be accountable for neuralgia in its severest form when coupled with the underlying or predisposing cause.

**Symptoms.**—We may expect to find expressions of this disease in persons in whom there is a neurotic diathesis, and in those who are enfeebled from any cause. It should be remembered that while a patient may present a fairly healthy appearance and have a good amount of muscular strength, he may yet be in a debilitated condition. Upon a closer examination of these causes it will be found that the nervous system has given warning, in one way or another, of its weakened condition, and on inquiry into the history of the case a clear story of hereditary transmission will usually be obtained.

The pain of neuralgia is paroxysmal, especially so at first. As it goes on, the intervals between the paroxysms of pain grow less and less, and the regularity with which they come on is interrupted. While the nature of the pain may vary under different conditions, it is usually of a sharp lancinating character, darting like an electric shock and running through the parts affected with the rapidity of lightning. It may vary from this to a dull ache, or to a pain like that produced by thrusting needles into the skin. In neuralgia of the fifth nerve, and especially that designated as *tic douloureux*, the first attacks may be moderate and transient, not unlike an ordinary toothache, and may even be located in some particular tooth, or may shift from one tooth to another. Neuralgia in the past has been the cause of the loss of many teeth; one after another has been extracted in the vain hope of finding the painful one. It may continue for weeks or even months before the pain becomes strikingly characteristic, and when this point is reached there is nothing more excruciating than the torture which is suffered. The pain comes on like a lightning-stroke, and the muscles of the face on the affected side are convulsed, the eyes suffused with tears, and the patient groans and cries out as one in the extremity of agony. In the intervals between these attacks, while there may be no pain, very frequently tender spots may be found along the course of the superficial nerves. Another characteristic of this condition is the extreme sensitiveness of the patient to the merest trifles, such as a slight breath of air, the slamming of a door, or any

movement on his own part. He hardly dares to breathe in his suspense, expecting the onset of the next attack. When these paroxysms of pain are brought on by eating, and they become so continuous that not only the appetite but sleep is lost, then the general health suffers; otherwise there may be no serious impairment of the health.

Neuralgia of the fifth nerve may occur in one or all of its three divisions; more frequently it is confined to one. If the ophthalmic division of this nerve is affected, the pain is located in the forehead and temples, darting through the eye and in the eyelid, the most tender spot being at the supraorbital foramen. If the second division is affected, the pain is felt in the superior maxilla, in the upper teeth and the upper lip; and one may look for the tender point at the infraorbital foramen. If the inferior maxillary division is affected the pain is felt in the lower jaw and in the teeth. The tender spot in this case may be looked for in the region of the mental foramen.

In the light of these statements, one cannot expect to surely locate the immediate cause of neuralgic pain, even if it exists in some particular tooth; but none the less surely may such a cause exist, and one should search diligently throughout the entire dentures if the pain affects either of them. If the cause is not then apparent the eyes should be examined, also the nose and the post-nasal space.

**Diagnosis.**—The following points are to be observed in the diagnosis: Where and in what direction is the pain? Is it unilateral? Does it correspond to the course of a certain nerve-branch or branches? Is it of an intermittent character? Are tender spots to be found after a certain stage along the superficial nerves? And, lastly, has the patient or any of his family previously suffered from neuralgia?

**Treatment.**—The treatment of neuralgia should have one or more of the following objects in view: First, the removal of the local or immediate cause; second, the improvement of the general condition; third, the immediate relief of pain by the use of narcotic stimulants, and those remedies which have a direct influence upon the affected nerve. In enumerating the different local causes arising within the mouth the impression should be conveyed, not that these alone are responsible for the condition which is under discussion, but that the neuralgic diathesis, which is nearly always pres-

ent, plus an irritated pulp or dental nerve, are together sufficient to cause neuralgia. In the absence of either of these factors there would be no neuralgic symptom. This point needs emphasis, for the reason that the laity, and many dental practitioners as well, are prone to designate the pain arising from pulpitis or pericementitis, in certain stages, as that of neuralgia. One can easily see the drift of popular opinion from the fact that when a patient is told that the pain which he has is neuralgia, he is immediately reconciled to it, and does not expect the dentist to do anything for its radical cure. The cause having been found, whether it be an irritation of the pulp from a large metal filling, pulp-stones, irritation of the pericementum, erosion, impacted teeth, crowded teeth, ocular troubles, obstructed ducts or outlets in the mouth or nose, salivary calculi, or other foreign bodies, the treatment as elsewhere indicated for these conditions should be instituted.

In the consideration of constitutional treatment, the diet should receive attention. In nearly all cases nutrition is impaired, and in such cases it is impossible to overestimate the importance of supplying animal fats to the system. It is probably true that those persons who are in greatest need of fats have a dislike for fatty foods and have consequently avoided their use. J. Russell Reynolds, of London, says that several times in his practice he has seen patients entirely lose neuralgic pain of long standing after the adoption of a simple alteration of their diet by which the proportion of fatty ingredients in it was considerably increased. Among the fats, cod-liver oil should occupy the first place. But this may disagree with the stomach, and in that case as much butter as possible should be used with the food, and cream should be taken in such quantities as the patient can bear. In cases of marked anemia, iron in some form not injurious to the teeth should be employed. As arsenic is applicable to so many cases, a pill containing both iron and arsenic may be recommended; for instance, arsenate of iron,  $\frac{1}{8}$  of a grain three times daily, after food.

If there is a suspicion that malaria may be connected with the case, quinin should be prescribed; it should be tried in all cases in which the pains are markedly intermittent.

Among those constitutional remedies which have for their object the alteration of the blood, the potassium iodid is useful. Many cases of neuralgia arise from syphilis, due probably to a local deposit somewhere along the course of the affected nerve. In such

a case the potassium iodid should be administered in large doses. If, in other cases, the neuralgia is due to a rheumatic or gouty diathesis, the patient should receive antirheumatic treatment.

Of the narcotic stimulant remedies, especially in neuralgia of the fifth nerve with dental origin, hyoscyamus is to be commended; it is as efficient as its rival remedy, belladonna, and possesses in addition an hypnotic property. In cases of suspected neuralgia, or of dental irritation with neuralgic symptoms, gelsemium is markedly successful; but for the immediate relief of pain there is no remedy that can be compared to opium.\* One of the best ways in which to use it is in a combination of morphin and belladonna; or what is better, a subcutaneous injection of morphin and atropin; morphin gr.  $\frac{1}{8}$ , and atropin gr.  $\frac{1}{12}$ . Aconite, in certain cases of neuralgia, is an excellent remedy. The many preparations of aconite vary greatly in strength, but one of the safest of them is that recommended in the Ph. Germ., of a ten per cent. tincture, of which the maximum single dose for an adult is  $\text{m} \text{ix}$ .

Electricity should be mentioned among remedies for neuralgia, but it is uncertain in its action from the fact that it is so little understood. The galvanic current has been used along the course of the affected nerves with astonishingly good results in cases of sciatic neuralgia, but there is a lack of experience in its application to the fifth nerve.

In regard to the general treatment and hygiene, sunshine is very beneficial. The patient should be out in the sun as much as possible, even to the extent of lying with the entire body exposed to the rays of the sun for many hours in the day.

Patients who are sensitive to changes of the weather should be particularly careful to wear proper clothing, and should strengthen and equalize the cutaneous circulation by friction and baths. Sleep and rest are essential. Easily digested and nourishing food is of the greatest importance, since neuralgia patients often have insufficient nutrition. A diet of eggs and milk given at short intervals during the day will be found beneficial. Dr. Weir Mitchell's regimen has much in it that may be adopted with advantage.

Lastly, a change to a warm, dry climate will often effect a cure.

\* Great caution should be used to avoid inducing the opium habit.

## CHAPTER VI.

## CONSIDERATION OF SUBJECTS INVOLVED IN THE ADMINISTRATION OF ANESTHETIC AGENTS.

**The Patient.**—It is true that in many cases the administering of an anesthetic is attended with little or no risk, yet there are conditions demanding a careful inquiry both into the nature of the anesthetic and the physical state of the patient. It has been said that the use of chloroform for a surgical operation upon a patient who is affected with heart disease is safer than without the use of this anesthetic; that the shock of the operation would prove far more serious than the effect of the anesthetic agent. This may or may not be true; much depends upon the mode of administration, which may be modified in accordance with the condition of the patient, and very much depends upon the stage of the disease, the general condition of the individual, and the existence of complications.

There must also be taken into account the operation itself; its character, short or prolonged, minor or major; the probable loss of blood, etc.; therefore no rule can be made which shall govern all cases. A hundred conditions as to administration, the anesthetic, the condition of the patient, and the operation, may come into the question whether a patient with heart disease may or may not safely take an anesthetic. Therefore, in naming conditions under which it would not be wise to administer an anesthetic, one should take the above factors into consideration.

It will be found in practice, that there are few cases in which some anesthetic, local or general, is not admissible. For example, in certain cases in which it may be deemed unsafe to administer ether, chloroform, or nitrous oxid, whiskey may be substituted with good effect.

A patient may shrink from the simple fact that he is to be rendered unconscious, as shown by the frequent remark, "I would rather suffer pain than lose consciousness." With patients in whom ether, or other general anesthetic, is contra-indicated, a resort may be had to some safe local anesthetic, as a 1 to 200

solution of carbolic acid. Others have declared that they did not fear the pain especially, but that they did not wish to be conscious when the operation was performed; in such cases, the mere extraction of a tooth with the fingers has been known to cause alarming pallor of the face and palpitation of the heart.

In cases of extreme nervous exhaustion and anemia in which severe operations about the mouth cannot be delayed and when an anesthetic is imperative, the greatest care is necessary in order to keep up the heart's action; the keenest watchfulness and best judgment must be used in order to avoid shock and pain on the one hand, and the taking of too much anesthetic on the other. In advanced cases of pulmonary tuberculosis, ether should generally be prohibited, yet it has been administered in cases of pronounced phthisis with safety. It is contra-indicated in tumors of the brain, or when the brain is in an irritable, congested condition.

Any obstruction to the breathing is proportionately hazardous, as this condition favors asphyxia by interfering with the proper oxygenation of the blood. Such obstructions may be edema of the glottis, enlarged tonsils, or some inflammatory condition of the lung or its lining membrane. In Bright's disease of the kidneys, in cases in which there has been degeneration of structure, the administration of ether is attended with considerable risk, yet it has been administered many times safely to patients having pronounced kidney disease.

Ether has also been administered to patients suffering from what is called heart disease, without ill effect; for instance, in valvular lesions, stenosis, etc., but there is one condition of the heart in which ether should not be given; it is what is known as "fatty heart," or fatty degeneration of the heart. This is a condition of the heart in which the organ may rupture, or death set in, at a time when no organ in the body can be found sufficiently diseased to be held accountable. The change in the heart structure is well recognized after death; there being a substitution for the heart-muscle fiber of fat granules and oil, but there is no infallible sign during life by which we can know that this change is taking place; we may, however, by the observation of certain symptoms, have our suspicions sufficiently aroused to be on our guard.

The heart in which there is a fatty degeneration going on is a weak one, characterized by a weak circulation, as denoted by the pulse and by feeble, ill-defined heart-sounds. Sometimes the



pulse-rate is low, and sometimes high, but rarely changing from one to the other. There is in connection with the above symptoms a gradual loss of flesh. The "arcus senilis," an expression of fatty degeneration in the eye, has been held to be diagnostic of fatty heart, but this is not conclusive. Further symptoms are pain across the upper part of the sternum, and severe pain in the heart itself. The patient occasionally draws a long breath, and suffers from seizures in which his breath seems to cease for a time, and he becomes unconscious.

Dropsy is neither a constant nor a diagnostic symptom; its presence or absence does not indicate anything, nor would all the above symptoms be necessarily found in fatty heart. Persons who have this disease are often afflicted with faintness, and a sensation of cold in the extremities.

With the structure of the heart thus weakened by the substitution of fat, it is not surprising, from the pressure within its walls which is required to force the blood into the general circulation, that these walls may gradually yield and dilatation occur, with its complication of symptoms; and that, occasionally, the organ itself may be ruptured.

Therefore, it is always best that the operator should be fully apprised of the patient's condition by a thorough examination, either by himself or a competent diagnostician; and that he should govern himself accordingly, either by withholding the anesthetic entirely, or by using the precautions which the condition of the patient demands.

**The Agent.**—The choice of the anesthetic should be based upon the patient's condition and the character of the operation. Practically, at the present time the choice will lie between ether, nitrous oxid, and chloroform; while in other cases drugs, as morphin, atropin, spiritus frumenti, etc., may be indicated; and in still other cases rapid breathing or hypnotism may be required.

In *nitrous oxid* we have an agent which is comparatively safe, not unpleasant in its action, sufficiently powerful, but of short duration. It is in daily use, and its record has now become established so that it takes favorable rank among other anesthetics.

It is thought that many former accidents occurred on account of impure gas, as it was manufactured for use with imperfect apparatus and kept in tanks an indefinite time. Whatever weight is attached to this, there is no excuse for using an impure article now,

and he who does not make sure that he is using an absolutely pure article is deserving of the severest condemnation.

Bartholow describes the first effects of this gas as filling the patient's mind with illusions, causing him to break out into singing, declamation, sobbing, etc., and often to show a fighting tendency. He adds that when this agent is used to produce anesthesia for surgical purposes the inhalation is forced, the countenance assumes a frightful aspect, the face becomes pale, there is stertorous breathing, the eyes protrude, and the face changes to a bluish and purplish tint. This description should be modified in the light of modern experience. Small quantities of nitrous oxid, administered for the purpose of obtunding sensitive dentin, with or without the admission of air, rarely produce the laughing element or a fighting tendency; indeed the excitement attending the inhalation of nitrous oxid is no more than may be observed in a similar use of ether or chloroform.

Furthermore, the admixture of air, or oxygen gas, does not appear to cause excitement, but, on the other hand it has proved to be a decided advance in the administration of this agent, inasmuch as it obviates entirely the asphyxiating symptoms.

To Dr. Frederic Hewitt of London belongs the credit of devising and publishing a method by which a definite amount of oxygen gas may be admitted and mixed with the nitrous oxid at will.\* It takes a little longer to obtain full anesthesia, but the results are very satisfactory. While some operators prefer to admit air instead of oxygen, Dr. Hewitt believes that oxygen gas possesses marked advantages over air. Some eminent writers hold the opinion that the effect of nitrous oxid gas is one of asphyxia, pure and simple, but while symptoms of asphyxia may be present under the full effect of  $N_2O$ , there is a true anesthetic effect also, as shown in a paper published in the *Dental Cosmos* for November 1895, by Dr. J. D. Thomas of Philadelphia.

*Sulfuric ether* is probably the safest and at the same time the most efficient anesthetic agent known, but chloroform is used exclusively in many European hospitals and in some of the States of this country.

The *relative merits of ether and chloroform* have been well eluci-

\* See *Journal of the British Dental Association* for June 1894; also paper by Dr. E. C. Kirk, *Dental Cosmos* for December 1894.

dated in an article by W. S. Caldwell, M.D.\* He has noticed the gradual increase in the use of ether over chloroform as an anesthetic, especially in Great Britain during the last thirty years. Dr. Caldwell says that when he is reminded of the safety of chloroform if properly administered, he recalls with a shudder the deaths that he has seen occur while patients were being operated on by the great lights of surgery in Paris, Vienna, and Berlin; while he has never seen a patient die under the administration of ether. He states that the mortality reports showing the number of deaths by chloroform and ether are compiled, in the main, from the statistics kept by large hospitals where anesthetics are most skillfully given. He concludes that as chloroform is the more dangerous agent, its advocates admitting that it requires more skill for its administration; and as such skill is not possessed, in his opinion, by one in one hundred, that anesthetic should be used which, though unskillfully given, is not likely to result in the death of the patient.

Dr. Caldwell sent out in August, 1896, over two hundred circular letters to surgeons of the United States, north of Baltimore and St. Louis, asking answers to the following questions:

1. Do you generally use ether or chloroform in your practice as an anesthetic agent?
2. State briefly your reasons for preferring the one or the other.
3. How many deaths have you had in your practice from chloroform? From ether?
4. How many deaths do you know of that have occurred in the practice of other surgeons from chloroform? From ether?

The results of these questions, as he remarks, were as sectional as politics. Nearly every advocate of chloroform was west of Buffalo. Chicago was about equally divided between chloroform and ether. St. Louis was largely for chloroform, while New York, Philadelphia and Boston use ether almost exclusively. Of all those who answered the questions, sixty per cent. use ether, twenty-five per cent. use chloroform, and fifteen per cent. use various mixtures of ether and chloroform, mostly the A. C. E. mixture. One hundred and twenty-seven deaths were reported from anesthesia either in their own practice or known in the practice of others. Of these fifteen were from ether and one hundred and twelve from chloroform.

\* *Journal of the American Medical Association* for Dec. 19, 1896.

Prof. Roswell Park of Buffalo, the only advocate of chloroform in the East, when he answered the foregoing questions, said: "I believe chloroform equally as safe as ether in proper hands, with proper precautions, and it is otherwise preferable." He says he has lost one patient on the table from chloroform, and knows of three or four others that have died in the practice of other surgeons under the same anesthetic. He says: "Ether does not kill as many on the table, but many more afterward, because of various complications; hence my preference for chloroform."

Those who prefer chloroform usually give these reasons:

1. It acts more quickly.
2. It is more pleasant to the patient.
3. It produces less nausea.
4. It is more safe to use with an artificial light.
5. Its after-effects are less injurious.

Dr. Caldwell makes the following comments concerning the above reasons:

As to the first, he thinks the statement is not well founded, for he succeeds, with an improved inhaler, in anesthetizing the patient with ether in an average of four and one-half minutes.

Regarding the second point, he thinks that the fact that chloroform is more pleasant to the patient should not weigh against its greater danger.

The third statement, that chloroform causes less nausea, is entirely untrue. Immediately on recovery from ether the patient may regurgitate a small quantity of mucus from his throat, as ether increases this, but regarding the persistent vomiting that occurs in the next few hours after anesthesia, this is more likely to occur from chloroform than ether,—a position which is sustained by Hewitt in his work on Anesthetics. Dr. Caldwell speaks of his own experience, having taken an anesthetic more than a hundred times; when he took chloroform he usually vomited more or less for the next twenty-four hours, while in the case of ether, nausea ceased in a short time.

In regard to the danger of using ether with artificial light, it is asked why the use of chloroform is not restricted to cases operated on at night.

The after-effects of ether are probably exaggerated, and it is a question whether reported cases of bronchial irritation, etc., would not have occurred had any other anesthetic been used.

Prof. Gaillard Thomas of New York says: "Ether! ether! ether! A practice of forty years has taught me that ether is safe and effectual, and that chloroform is attended with great danger. I have had no deaths from chloroform, but have spent many a *mauvais quart d'heure* in resuscitating a patient at the point of death from chloroform."

Prof. C. B. Penrose of Philadelphia says: "I always use ether, for I believe the mortality of ether is very much less than that of chloroform. I believe, however, the danger from ether is underestimated. It is usually administered before a prolonged operation by the most inexperienced physician present, and I think many more would survive prolonged operations if the anesthetic were administered by a man of experience. I would prefer the inexperienced man for an assistant and the most experienced man for the anesthetizer, if I was obliged to choose. I believe that deaths sometimes occur twenty-four or forty-eight hours after an operation which have been induced by an improper administration of the anesthetic."

Regarding the A. C. E. mixture, clinical experience does not support its general use. It may be readily understood that the mixture contains drugs of different volatility, requiring different methods of administration, and that one can never be sure of its ingredients.

Dr. H. C. Wood says: "All these mixtures are, in my opinion, more dangerous than the individual drugs of which they are composed, and their use should be positively eschewed."

Ethyl bromid has not yet succeeded in making its way into popular use. It has not demonstrated its superiority or safety over chloroform, although some good statistical results have been shown.

Regarding mixtures, it should be said that nitrous oxid gas and ether have been used with success, usually beginning the administration with the nitrous oxid and continuing with ether, although the reverse of this order has proved most satisfactory.

Dr. C. L. Schleich of Berlin has used a mixture for general anesthesia which promises good results. The principle upon which Dr. Schleich bases his conclusions is that "The absorption of a general anesthetic is chiefly regulated by the relation of the temperature of the patient to the boiling-point, or point of maximum evaporation, of the anesthetic. If the point of maximum

evaporation is near to the temperature of the patient, as much will be exhaled during expiration as is inhaled on inspiration." The maximum evaporating point of chloroform is much higher than that of the body temperature, therefore in the use of this agent it will be absorbed by the blood in larger quantities than is needed, and it will therefore tax all the parenchymatous organs proportionately in its elimination."

Dr. Schleich makes a mixture of chloroform, petroleum, ether, and sulfuric ether in various proportions, by which he may change the boiling-point of the mixture at will. Of these agents, Dr. Schleich has prepared three mixtures, having different boiling-points. Mixture I. has a boiling-point equal to that of the body, which may be employed in operations requiring a short time only, while the other mixtures, II. and III., having a higher boiling-point, are intended for longer operations, requiring a more profound anesthesia. The method of administration is on the same principle as with other anesthetics, care being exercised not to administer an overdose. The formulæ for these mixtures are as follows:

*Mixture I.* (Boiling-point, 38° C.)

Chloroform,	45 parts.
Petroleum ether,	15 "
Sulfuric ether,	180 "

*Mixture II.* (Boiling-point, 40° C.)

Chloroform,	45 parts.
Petroleum ether,	15 "
Sulfuric ether,	150 "

*Mixture III.* (Boiling-point, 42° C.)

Chloroform,	30 parts.
Petroleum ether,	15 "
Sulfuric ether,	80 "

Dr. Willy Meyer, of New York, reports favorably on the use of this solution in one hundred cases, in which he notes that there has been but "little excitement, and rarely cyanosis; the pulse has been of excellent quality; the respirations have been unimpaired, except when the anesthetizer has been negligent; there has been no hypersecretion of mucus, and no consecutive bronchitis or pneumonia; vomiting has occurred in only forty-four per cent., and albuminuria in only four per cent. of the cases; and the return to

consciousness has been more rapid than after either chloroform or ether narcosis."

If chloroform is to be employed, it is undoubtedly safer to adopt the recent method of admitting oxygen with the chloroform vapor. The oxygen is made to pass into a bottle containing chloroform, and the combined vapors are then conducted to the patient. The oxygen is under control, and may be increased in amount as the condition of the patient demands it. When it is desired to resuscitate the patient, pure oxygen is administered. It is claimed that this method is safer than the old method of using chloroform, and that it is not accompanied by nausea and the other unpleasant after-effects.

This method should be regarded as one in which oxygen is employed as a safeguard only, and it must be borne in mind that its employment does not obviate the fact that chloroform is the anesthetic used, and that dangerous results may yet occur.

The admixture of oxygen with nitrous oxid gas, as suggested by Dr. Hewitt of London, is a decided advance in the administration of the agent.

**The Method.**—Before the question of anesthetic, of instruments, etc., comes that of the anesthetizer himself. Has he had experience, and is he in a proper physical condition, not only to use the best judgment in regard to the varying conditions of the patient, but to act promptly and efficiently in any emergency that may arise? Is he in every way well prepared to cope with the various obstructions to respiration, as occlusion of the glottis by any foreign substance coming from the stomach, or by the tongue falling backward, or paralysis? Has he shown himself skillful and wise in meeting such dangers as heart-failure, cerebral hemorrhage, or severe shock? The anesthetizer should meet all these requirements, for he has no light task to perform, but one of grave responsibility, requiring the closest attention from the moment the patient enters until he passes from under his care. While the majority of surgeons, especially those connected with large hospitals, have skilled anesthetizers, there is too great a tendency to employ students and others who are utterly unqualified for this important work. The production of anesthesia should never be entrusted to any medical student who has studied a little; a human life is taken in hand, and an agent administered which is so powerful that it suspends, one after another, the various functions of the body,

until, if continued, death takes place. Many times the patient approaches death so nearly that it requires the keenest observation with the tenderest care on the one hand, and instantaneous action with courage on the other, to prevent a fatal result.

PREPARATION FOR THE OPERATION.—Instruments should be selected for the operation, and placed where they may be available. Besides the essential operative instruments, there should be at hand a mouth-prop, an instrument capable of adjustment, so as to open the jaws slightly, or more, as the case may be; also a tongue-depressor and forceps for pulling out the tongue; an instrument or instruments for the removal of any foreign body that may lodge in the throat, and a hypodermic syringe. A solution of carbolic acid 1 : 40 is also at hand, in which to dip instruments or to keep them immersed. Restoratives, usually aqua ammoniæ for inhalation and aromatic spirits of ammonia for internal or subcutaneous use, brandy or whiskey, and tablets of strychnin sulfate, gr.  $\frac{1}{80}$  to  $\frac{1}{30}$ . It is best to have the strychnin already dissolved and the syringe charged with it.

When the instruments are in readiness, but covered so as to be out of sight, the patient may enter. He should be told that some anesthetic is to be administered to produce sleep and freedom from pain; that he need not be afraid, as his welfare will be guarded most carefully; that he will do well to yield himself entirely to the operator. With these or other assuring words the anesthetic may be administered, it being understood that previous to this time the patient's physical condition has been ascertained, and his clothing loosened. No food should have been taken for ten or twelve hours at least. If the patient is very weak an enema of peptonized milk, with or without some stimulant, may be administered at least two hours before the operation. If the patient is weak and debilitated, it is considered good practice to inject subcutaneously, gr.  $\frac{1}{8}$  to  $\frac{1}{4}$  of morphin and gr.  $\frac{1}{120}$  to  $\frac{1}{100}$  of atropin previous to the inhalation.

Some anesthetizers make it a rule to examine the heart and respiration just previous to the administration; this should always be done at some time, preferably at some previous sitting.

The hair should be noticed; combs, hairpins, and earrings should be removed. Examine the mouth for very loose teeth, or partial or full sets of teeth, all of which should be removed.

It is during these preliminaries that therapeutic suggestion



comes in to allay the fear of the patient, and to assist in the carrying out of one's directions. Begin with a few words of conversation, and by the voice and manner of the patient you may learn much as to his nervous condition. The degree to which you may carry these suggestions will be governed by your own facility of manner and power, the needs of the patient, and the circumstances in general.

The patient should then be instructed how to breathe, after which the position should be fixed, this being determined by the anesthetic used. With nitrous oxid the horizontal position is not imperative, as in chloroform, but a semi-reclining position may be arranged when the operation will admit it. The clothing about the waist should always be loosened, whatever anesthetic agent may be used.

In administering nitrous oxid it is better to use a mouth-tube, one of the older style, which does not cover the face. After the patient is shown just how to breathe, he is allowed to take a few inhalations of air, when the gas is quietly turned on. The object in having the inhaler above mentioned is three-fold: First, it enables the operator to see more of the patient's face, and thereby to regulate the passage of air through the nose, or the proper amount of oxygen into the inhaler. Second, the patient must feel less as if he were being smothered than when a hood is placed over the face.

Whenever it is practicable, the upper and lower jaws should be separated and maintained in this position by means of a suitable prop, for the reason that there is usually more or less rigidity, and the period of anesthesia being short the operator has no time to waste in trying to open the jaws. With the prop in position, the tube is placed in the mouth and the patient instructed to close the lips over it; if it is his first experience, and there is difficulty in obtaining a deep respiration, good results may be obtained by asking the patient to blow as upon a trumpet; this is necessarily followed by a deep inspiration. Upon the first indications of discoloration of the face, let in a little air, or oxygen, and regulate it according to the appearance of the face. The patient may be asked if the effects are beginning to be felt, and the operator may judge by the response. When no response is made and the breathing begins to be heavy and stertorous, the anesthetic should be withdrawn.

For ether anesthesia the face should be anointed with vaselin for the protection which it affords the skin. Do not begin by pouring on a large quantity of ether, crowding the inhaler over the face and forcing the inhalation at this point; rather let the patient breathe through the inhaler a moment without the anesthetic, then add a few drops at a time, gradually increasing the amount until the maximum quantity is used.

The stage or extent to which anesthesia shall be carried depends upon the length of time the operation is to consume, the part of the body to be operated on, the gravity of the operation, and the condition of the patient. Short operations, like opening an abscess or extracting a tooth, would require only the primary stage, which often arrives quickly and which is known by asking the patient some question or to do something. If there is no response, it may be concluded that the primary stage has been reached. If the operation is on the eye, or is some difficult operation between the jaws, or on the bladder, the full relaxation of the third stage should be attained. The condition of the patient may require a modification of these requirements in any stage. If the operation is upon the throat, or naso-pharynx, the patient should be carried beyond the stage of excitement, but only just beyond it, it being desirable to obtain as light anesthesia as possible consistent with a painless operation. The reason is that if reflex irritability of the pharynx is destroyed, blood or other material may get into the trachea.

For operating in the mouth or associate parts, Prof. Thomas Fillebrown of Boston has devised an excellent apparatus for maintaining anesthesia at just the desired point, while the operation is going on. It is described as follows: A bellows, connected by rubber tubing with the long tube of a twelve-ounce wash-bottle, with a stopcock intervening to regulate the flow of air. From the bottle extends a half-inch rubber tube to the patient. The bottle is filled one-third full of ether. The air passing over the ether is discharged through the second tube a few inches from the patient's face. Dr. Fillebrown has found that if the administration is prolonged, the temperature within the bottle becomes so reduced that the air is not saturated, requiring the warmth of the hand or a cloth applied to the bottle so that the temperature shall not be below 60° F.

The effect of anesthetics upon the body is gradual, and the different stages are usually classified as follows:

1. A preliminary stage of excitement, which may vary much according to the temperament of the patient. This is, with ether, followed by a very short period of anesthesia.
2. A stage of excitement, which also varies with the individual.
3. A stage of relaxation, unconsciousness, and insensibility to pain.

In the stage of excitement there are often violent demonstrations on the part of the patient. The respirations are rapid, the face is flushed, the eyes are staring, the muscles rigid; and in those of an extremely nervous temperament, or in alcoholics, a belligerent attitude may be taken, and the delirium may otherwise be fierce and prolonged. The remedy for this is to push the anesthetic, controlling the patient as best you may, but without force if possible.

When the third stage has been reached, the patient does not respond to the passing of the fingers over the eyelashes, or to touching the conjunctiva. If the arm or leg be now raised, it drops without resistance,—there is complete relaxation. When these conditions are obtained, the patient is ready for operation. If anesthesia is carried farther than this stage the patient's life is in jeopardy.

THE TREATMENT OF UNFAVORABLE CONDITIONS DURING AND AFTER ANESTHESIA.—During the administration of an anesthetic and the performance of the operation, and until the patient has fully recovered, the anesthetizer should be on the alert for unfavorable symptoms from every possible source. Nothing relating to the patient's condition should escape his notice. It is not enough, during the administration of ether, to watch the respiration only, on the principle that so long as breathing is maintained the patient is safe; one must watch everything. It may be noticed that the face is becoming discolored, and the breathing irregular and noisy; this is a symptom which indicates an obstruction to breathing, and it may occur from nervous spasm, or reflex action due to the irritating action of the anesthetic in the throat. It may also occur from the direct action of the anesthetic upon the respiratory centers, from mucus or some foreign body which has become lodged in the throat, or it may be due to some unusual position of the body; for example, the head may be thrown forward so that the chin rests upon the chest, thus seriously impeding respiration.

It has been stated that incomplete or partial anesthesia is a

source of danger during the performance of an operation, and the position taken is a reasonable one, but it is apt to be confused with the primary stage. Primary anesthesia, while it lasts, is quite complete, and short operations may be done without pain. In many instances it is quite impossible to induce primary anesthesia, the patient's sensibilities remaining fully alive until the exciting stage is reached. In such cases, therefore, it would be manifestly unwise, as well as dangerous, to inflict pain. In view of these considerations it is obvious that this danger may be avoided by securing full anesthesia before beginning the operation.

*Treatment of Obstructions to Breathing.*—Respiration may be impeded by nervous spasm, and if the patient be hypersensitive the best treatment is prophylactic, and may consist in the administration of sodium bromid, 5 grains, three times during the previous day, and 10 grains half an hour previous to the operation. But in cases of nervous spasm during the administration of an anesthetic, the agent should be withdrawn and re-administered in a more gradual manner. This is precisely the thing to be done in a case of suspended breathing from the direct action of the anesthetic upon the respiratory centers. If mucus collects in the throat, it should be removed by turning the patient over, face downward, or by swabbing the throat by means of properly shaped forceps armed with absorbent cotton or antiseptic sponge.

If a tooth or other foreign body becomes lodged in the throat it is better to first turn the patient over on the face, and if the foreign body does not fall out, insert the finger in the throat, sweeping it from side to side in order to bring out the substance. These methods failing, resort must be had to laryngeal forceps or other instruments for this purpose.

In cases of impeded respiration due to the improper position of the body, it should be understood that in order to have free respiration the chin should be thrown well back from the breast, the tongue should not be allowed to drop back into the throat, and that as a remedy for this the angle of the lower jaw may be pushed forward.

Another condition of danger is failure of the heart, as indicated by its pulsation becoming weak and irregular, and by the growing pallor of the face. In such a condition the anesthetic should be withdrawn at once, the head lowered, the respiration stimulated by the application of aqua ammoniæ to the nose, and if necessary a

subcutaneous injection of strychnin, gr.  $\frac{1}{30}$ , or twenty drops of aromatic spirits of ammonia, or a dram of brandy should be given, or oxygen gas may be administered by inhalation. If the heart-failure persists, the patient must be inverted, or artificial respiration tried. A powerful stimulant to the respiration and circulation consists in turning the patient face downward, and applying the end of a towel wet in cold water to the spine between the shoulderblades, by the method of flagellation. Manual dilatation of the sphincter ani also has a powerful reflex action in stimulating respiration.

Some of the following conditions demand watchfulness and a temporary withdrawal of the anesthetic:

A gasping respiration, in which the mouth is opened widely and the air drawn in convulsively, is to be regarded as indicative of some serious disturbance; a stertorous respiration should be closely watched, and the anesthetic removed accordingly.

Hiccough has been regarded as a grave symptom, and the anesthetic should either wholly or partially withdraw the anesthetic in every case until the hiccough ceases.

If nausea or vomiting occurs from the administration of an anesthetic it may as well be encouraged until it is over, for the stomach is almost sure to rid itself of its contents sooner or later.

A rapid dilatation of the pupil indicates collapse.

*After-Effects.*—The cerebral congestion which is induced to a greater or less extent by ether narcosis is often sufficient to produce a severe headache, which in many cases passes away in a short time, but in others is more or less persistent. In such cases the object is to reduce the amount of blood in the brain and to increase the amount in the lower extremities. This may be effected by cold applications to the head and warmth to the feet.

Often a full dose of morphin acts with benefit in these cases by controlling the nausea and vomiting which usually accompany headache. Another remedy, often efficacious in vomiting from any cause, is sodium bromid in minute doses;  $\frac{1}{2}$  of a grain may be placed on the tongue and washed down with a swallow of water; this to be repeated every fifteen minutes.

Hysteria in its various forms may often follow the administration of an anesthetic, and it should be promptly met with the proper treatment.

*Local Anesthesia.*—Since the introduction of cocain and its anes-

thetic property became generally known, in 1884, local anesthesia has been increasingly employed. There are two fundamental methods by which it may be produced; one in which the parts are anesthetized by means of extreme cold produced by freezing mixtures and evaporating spray, and the other, by bringing some drug having local anesthetic properties in contact with the terminal filaments of sensory nerves. Extremes of cold or heat may produce local insensibility to pain, but cold has been most frequently employed.

Ethyl chlorid, sulfuric ether, and various combinations of ether, chloroform, and alcohol, have been frequently used as a spray to produce local anesthesia.

Heat, in the form of hot air or steam, has been used principally in the obtunding of hypersensitive dentin.\*

There are many drugs having a local anesthetic effect by means of their paralyzing influence on the terminal filaments of the sensory nerves, and they may be applied to the surface or injected into the tissue, but the parenchymatous injection is by far the most effective. Such drugs are carbolic acid, tincture of aconite root, eucain hydrochlorid,† cocain hydrochlorid, tropacocain, etc.

Tropacocain is said to have advantages over cocain, it being less toxic, but cocain is by far the most useful; it may be applied to the surface of mucous membranes and absorption will take place in different degrees with proportionate anesthesia. This is not true when applied to the skin, the subcutaneous injection being necessary in such cases. In situations in which it is difficult to secure complete anesthesia, resort may be had to cataphoresis‡ or to the parenchymatous injection.

While cocain is to be commended as the best local anesthetic, it should be known that it is a powerful drug, and therefore must be used intelligently and with great caution. Extensive applications to the surface of the interior of the mouth, nose, or pharynx should not be made, even with a solution containing but four per

\* See chapter on Hypersensitive Dentin.

† The writer's experiments on the lower animals show that eucain is more toxic than cocain. In the human mouth, however, in therapeutic amounts, no toxic symptoms have appeared; but, with the same number of administrations, as much can be said of cocain. Eucain is not so effective as cocain when simply applied to mucous membranes.

‡ See chapter on Hypersensitive Dentin.

cent. of cocain, but greater caution should be used when injecting this drug. The full dose should not exceed  $\frac{1}{2}$  of a grain.

But cocain is the more readily to be commended now, in view of the fact that solutions of this drug may be made effectual while containing only 1 part to 500 or 1000 of water. This fact was brought out by Reclus, and later by Dr. C. L. Schleich of Berlin, who has further developed the method of producing local anesthesia. Dr. Schleich showed that the injection of a solution of salt and other drugs had an anesthetic effect, dependent upon the distension or infiltration of the tissues with the solution. He found practically that cocain was essential in order to make the injection itself painless. Dr. Schleich made use of three different solutions as follows:

<i>Strong:</i>	Cocain hydrochlorid,	gr. 3;
	Morphin sulfate,	gr. $\frac{1}{3}$ ;
	Sodium chlorid,	gr. 3;
	Saturated boric acid solution,	$\bar{5}$ $3\frac{1}{2}$ .
	(or, Water, $\bar{5}$ $3\frac{1}{2}$ , carbolic acid,	$\text{℥}$ $\frac{1}{10}$ .)
<i>Normal:</i>	Cocain hydrochlorid,	gr. $1\frac{1}{2}$ ;
	Morphin sulfate,	gr. $\frac{1}{3}$ ;
	Sodium chlorid,	gr. 3;
	Saturated boric acid solution,	$\bar{5}$ $3\frac{1}{2}$ .
	(or, Water, $\bar{5}$ $3\frac{1}{2}$ , carbolic acid,	$\text{℥}$ $\frac{1}{10}$ .)
<i>Weak:</i>	Cocain hydrochlorid,	gr. $\frac{1}{6}$ ;
	Morphin sulfate,	gr. $\frac{1}{12}$ ;
	Sodium chlorid,	gr. 3;
	Saturated boric acid solution,	$\bar{5}$ $3\frac{1}{2}$ .
	(or, Water, $\bar{5}$ $3\frac{1}{2}$ , carbolic acid,	$\text{℥}$ $\frac{1}{10}$ .)

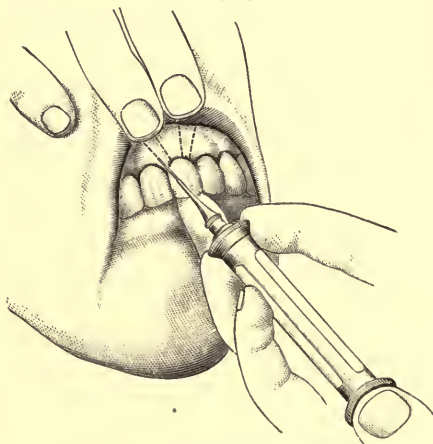
The recent use of weak solutions of cocain in this country has demonstrated that a solution containing 1 part of cocain to 500 of distilled water\* is sufficient to produce complete local anesthesia under proper conditions.

The technique of the operation to produce local anesthesia by parenchymatous injection should be very carefully observed in order to insure success. It is in substance as follows: The parts into which the injections are to be made should be cleansed with some antiseptic wash; the syringe should be strong, with a fine needle point, reinforced for half its length; it should be aseptic, having been washed with a two per cent. solution of formaldehyde.

\* The "normal salt solution," made by dissolving a scant teaspoonful of sodium chlorid to a pint of water, may be used instead of plain water.

The syringe may now be filled and the air expelled by pointing the needle directly upward, and pressing upon the piston until the liquid appears. The direct application of a strong solution of cocain or carbolic acid at the point where the needle is to be first inserted will enable the operator to introduce the needle with but little pain. The needle is firmly introduced with the aperture toward the tissue, just beneath the surface, and a very little solution injected; wait a few seconds, then thrust the needle in a little farther and inject more. Now withdraw the needle and introduce it just within the wheal, or circle of infiltrated tissue which you have been careful to make, and inject again, making as large a wheal as

FIG. 6.



Method of injecting anesthetic.

practicable, and so on until the entire area which it is desirable to anesthetize has been saturated with the solution. The operation may then be conducted within the infiltrated area.

The method of injecting anesthetic agents for the extraction of teeth is illustrated in Fig. 6. Even with very weak solutions, the operator should be careful not to inject beyond the gum tissue into the soft vascular structures of the cheek, or those in the vicinity of the third molar.

Some of the operations about the soft tissues of the mouth to which local anesthesia is especially adapted are, for example, lancing the gum, cutting away gum tissue overlying lower third molars, making an artificial fistula, extracting teeth, removing dental pulps, etc.



## CHAPTER VII.

## MENSTRUATION; PREGNANCY.

## MENSTRUATION.

**Synonyms.**—Catamenia; Monthly sickness; Periods; Flowing; Menses.

**Definition.**—A periodical discharge of blood from the uterus, occurring, as a rule, once in twenty-eight days. During pregnancy and lactation this process is usually suspended.

**First Appearance.**—The first appearance of the menses corresponds with what is known as the age of puberty, which marks a period of active physical development in certain directions, and indicates the ability to conceive and bear children.

Race and climate appear to have an influence over the appearance of the menstrual flow, while other factors may also act to cause an appearance of the menses in infancy, or to delay it until adult life, but the average age, in temperate climates, is fifteen.

**Duration.**—In healthy women the flow usually occurs with great regularity, and many are able to foretell its appearance almost to an hour. The discharge lasts, as a rule, about four days, but the time varies greatly, even in health.

**Effects upon the General System.**—The vascular excitement attending the menstrual flow cannot fail to influence the entire system. The nervous system is especially affected. Irritability of mind and general nervous excitement render the woman extremely sensitive under dental and other operations. While the general sympathy and disturbance vary greatly in different persons, this period should be avoided, if possible, in making appointments for dental sittings.

With these considerations in mind it is evident that the dentist should follow a woman's own suggestions as to the best time for an appointment; and, if necessary, should advise that it be made for a time when she is feeling at her best, as the operations will then be easier to bear. Severe cases of painful or profuse menstruation need not be considered here, as the patient at such periods is incapable of keeping a dental appointment.

**Vicarious Menstruation.**—The possibility of *vicarious menstruation from the mouth* should be known, although it is of rare occurrence. The most frequent seat of vicarious menstruation is the nose, and nearly as often the gums. The flow of blood may come from the stomach, or lungs, and in each case it may be seen in the mouth without positive knowledge as to its source.

In these cases of suspected vicarious menstruation coming from the mouth, means to check the flow should be made with great circumspection, medical advice being obtained.

#### PREGNANCY.

**Effect upon the General System.**—Pregnancy, like dentition, is, in a healthy person, a physiological process, but often one of excessive activity, and so closely bordering on the abnormal that the slightest irritating cause is, in proportion to the susceptibility, sufficient to put in motion a pathological process. With this excessive physiological activity, the intimate nervous connection between the generative organs and other parts of the body is shown in many ways; for example, in the morning sickness which is sometimes so severe as to imperil life; in strange fancies, undue fear, abnormal sensitiveness of the entire nervous system, depraved appetite, etc. With these conditions prevailing in greater or less degree, there is frequently added actual disease, either in the reproductive organs or in other parts of the body, which aggravates every symptom and predisposes the system to various pathological processes.

**Operations during Pregnancy.**—With the foregoing premises in view, there is only one conclusion to follow, viz. to avoid operations of a surgical nature in every case, unless by so doing there may be greater injury and disturbance. Often there may be a modification of usual dental operations so that the teeth may be put in a comfortable and safe condition until the patient is in a suitable state of health to bear whatever may be required.

When surgical operations are imperative, and the patient is sensitive and fearful, it is wise not only to assure the patient by suggestion, but to administer some sedative, such as sodium bromid. If a more powerful remedy is needed, "chlorodyne" is an efficient remedy, but as the different formulæ of this preparation vary greatly in strength, care should be taken to discriminate between them. If sodium bromid is prescribed it may be admin-

istered two days before the sitting, with a maximum dose a half-hour before the operation. As a rule, the patient is more susceptible to harm from operations during the third, fourth, and eighth months of pregnancy.

**Anesthetics during Pregnancy.**—There seems to be no reasonable ground for withholding an anesthetic from the pregnant patient; moreover, it would be cruel, barbarous, and unscientific not to afford the means of alleviating pain and shock. Of this there should be no question, especially as it has never been shown that the ordinary anesthetics have any poisonous or other injurious effect upon mother or child.

There has been, and still is, a difference of opinion, however, as to the extent to which anesthesia should be carried. This may be left to the good judgment of the operator, although it may be said that the profound anesthesia of the third stage is rarely required. In severe operations, therefore, an anesthetic should be used in order to avoid pain, fear, and shock; yet while ether and nitrous oxid have each been administered to pregnant patients with safety, it is best to avoid the operation and the anesthetic in every case when one is not forced by existing circumstances to proceed.

**Possible Results of Operations during Pregnancy.**—The effects of dental operations upon a pregnant woman may be two-fold: 1. Abortion, miscarriage, or premature labor. 2. Some injurious effect upon the fetus or upon the mother.

To know in any case if any of the above-mentioned results are to take place is impossible; but a full knowledge of the pregnant condition, as it exists in the average woman, should teach the operator to avoid, in every case, any procedure which is likely to injure either mother or child, for the reason that it is impossible to measure the susceptibility of each patient.

Women have aborted when every possible precaution was taken to prevent it, and several cases are known in which women have failed to bring about abortion after having tried in various ways to produce this result.

Anything which makes a profound impression on the nervous system, either by shock, pain, or fright, may affect either mother or child in various ways. It may have an indefinite, though decidedly irritating effect upon the general nervous system, which may result in abortion.

Of those causes likely to occur in connection with dental opera-

tions, severe toothache itself may be one. The patient may receive a fright through the carelessness of the dentist in conversation, or from the manner of operating, or from the length of time it consumes. The mere act of taking an anesthetic, together with its effects, may produce abortion or premature delivery, but it is doubtful if a pure anesthetic has any poisonous effect on the blood.

**Effects of Pregnancy on the Teeth.**—The most potent cause of ill effects upon the teeth as the result of the gravid condition lies in the fact that many childbearing women are not equal to the task of supplying nutriment for themselves and the fetus *in utero*, which develops and grows entirely by drawing all the necessary nutrient materials for bone, muscle, and nerve from the circulation of the mother. There is also, in many cases, hyperacidity of the saliva. The deranged nervous system which accompanies this condition to a greater or less degree may so affect digestion and assimilation that the blood is impoverished and the teeth are not properly nourished. This failure to supply the necessary materials and vitality to the teeth renders them susceptible to the acid-producing organisms of the mouth, and decay is the result.

**Treatment.**—For the local acidity, alkaline washes of lime-water, a strong solution of bicarbonate of soda, or “milk of magnesia” may be used for frequently rinsing the mouth. It may be advisable and even necessary to prescribe the use of some antacid internally; for instance, “Saratoga Vichy water,” an agreeable and efficient table water, which may be used freely, a pint at each meal, or at two meals in the day. The other indication, viz. the insufficient supply of lime-salts, may be met in two general ways: 1. The improvement of the general health in every possible way, so that the lime contained in the ordinary food may be assimilated. 2. The administration of some preparation of lime, such as the lactophosphate, Fellows’ or Gardner’s syrup of the phosphates of lime and soda.

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## CHAPTER VIII.

### HEMORRHAGE.

**Synonym.**—Bleeding.

**Definition.**—Escape of blood from the body or from the usual channels in which it is confined.

**Etiology.**—Cases of persistent hemorrhage within the oral cavity occur most frequently as the result of the extraction of teeth. Occasionally hemorrhage may occur from the breaking down of necrotic tissues, or from a wound caused by a fractured tooth, or traumatism from any other cause. These may be considered direct or immediate causes of hemorrhage, and as such they have very little to do with the serious and sometimes alarming hemorrhage which depends upon some predisposing or constitutional cause. A certain amount of hemorrhage following an operation or a traumatic injury is not injurious, and needs no artificial assistance to check it; therefore any flow of blood not excessive should be left to itself, as hemostatics or appliances do harm rather than good in such cases. It is the predisposing or underlying cause that is to be considered as serious, and it is the continued or secondary, and not necessarily the primary hemorrhage which causes alarm.

It is very often the case, when we have controlled bleeding and are congratulating ourselves upon the success that has attended our efforts and the permanence which is likely to follow as a consequence, that a hemorrhage unexpectedly recurs of a more serious nature than the one preceding it. This is so common an occurrence as to have been classed as secondary hemorrhage. It may occur at various periods, from that of a few hours after the operation to days and even weeks. It is not necessarily preceded by primary hemorrhage, but may come on when the loss of blood in the first instance was insignificant, and when everything, so far as the results attained were concerned, gave promise of a most favorable issue.

There are certain styptics which are to be avoided in some cases, as being either direct or indirect causes of secondary hemorrhage; for example, "Monsel's solution" of the persulfate of iron, although possessing many valuable qualities as a styptic, has one serious objection, and that is, injury to the part to which it is applied. If the wound be of any great extent, it is quite likely to cause sloughing of the parts, thus inducing secondary hemorrhage.

*Hemophilia*, or what is known as a hemorrhagic diathesis, is a peculiar constitutional condition which seems to consist in a want of contractility of the vessels and the absence of coagulability of the blood. The blood in this variety of hemorrhage oozes from the part like water from a sponge, its color being neither scarlet nor dark, but intermediate between the two; it may not be excessive in

quantity at first, but may be checked for a time and reappear again after several hours. There seems to be no obvious fault with the blood that issues from the recent wound; it coagulates after flowing off, though it does not do so to any amount in the wound itself, and it possesses an equal quantity of fibrin in this diathesis with that in the blood from other persons; but as the hemorrhage continues this character of the blood is lost, it no longer coagulates, it becomes thin and watery, and leaks forth more readily if not more abundantly than before.

It is sometimes observed that the characteristics of a hemorrhagic diathesis may be induced in a previously healthy person by privation of fresh air, light, and nourishment, and by confinement in a low, damp situation; but that they disappear upon placing the patient in conditions favorable to health; this condition is, however, nearly always inherited, in fact there are few if any diseases with so marked a tendency to hereditary transmission.

Fortunately persons with this tendency to bleed generally become aware of the fact before they reach adult life and are thus able to inform the doctor of the hidden danger. One characteristic of the disease is seen in a liability to bleed from the slightest breaking of the surface, as in biting the tongue or scratching the gums. The blood leaks forth incessantly, and no more effort to stay its flow appears to be made either by contraction of the blood-vessels, or by clotting of the blood, than if the stream were water, flowing through a piece of inelastic tube.

In a remarkable case reported by the late Dr. John A. Swett of New York, this disease existed in all the children of a family, eighteen in number. All except one had died in consequence of it, and this one was then suffering from profuse hemorrhages from the nose and rectum.

A still more remarkable case is described by Dr. Hughes of Kentucky. The predisposition here was associated with a rheumatic diathesis, and was satisfactorily traced back as far as five generations. It was confined exclusively to the male branches of the different families, but the females invariably transmitted it to their offspring. Many of the individuals died from the cut of the lancet, and two simply from the application of blisters, the vesicles being filled with blood instead of water.

Of the remote cause or causes of this disease nothing is known. The immediate causes may be indicated under two heads as follows:

1st. A want of coagulability in the blood.

2d. An imperfectly organized state of the capillary vessels.

**Treatment.**—The treatment of hemorrhage involves at least two propositions. The first, prophylactic, calls for treatment with the view of preventing an attack of bleeding; the second considers the means of arresting existing hemorrhage.

The two leading indications are to promote coagulability of the blood, and to increase the contractility of the capillary vessels.

The acetate of lead is useful as an agent, internally, to assist in the coagulating of the blood, while opium affords important aid in controlling the action of the heart in addition to its effect upon the blood. The acetate of lead may also have some effect upon the contractility of the capillary vessels, but in the fulfillment of this object ergot is far more powerful, acting on the non-striated contractile fibers of the minor arteries. It should be administered in the form of the fluid extract, twenty to thirty drops in water, repeated according to the exigencies of the case.

Nearly all the cases of serious hemorrhage with which the dentist has to deal are those resulting from the extraction of teeth, but it is to be remembered that much may often be accomplished in the way of preventive treatment, which should be instituted whenever a knowledge of the previous history or of the present condition indicates the existence of a hemorrhagic diathesis. Preventive treatment must consist in the removal of the causes which have led to the existing diathesis, and prompt hygienic means should be used to restore the system to a normal condition. The writer has had success in the use of small doses of fluid extract of ergot, fifteen drops in water three times daily for two weeks previous to the operation.

Treatment for hemorrhage following the extraction of a tooth must vary according to the circumstances. For instance, the patient is weak and anemic, and can ill afford to lose a large amount of blood. The hemorrhage following the removal of the tooth is alarming; the blood flows into the mouth with great rapidity and with considerable force. The patient is excited, the carotids may be seen throbbing at the neck, and the heart may be felt thumping against the chest wall. Now in such a case, excluding hemorrhagic diathesis, if proper treatment is promptly rendered the hemorrhage may be arrested within a short time. It is important at once to allay the fears of the patient, to maintain

the upright position, and to apply pressure with the finger over a pledget of cotton firmly placed in the alveolus. Meanwhile the face may be bathed with cold water, or an ice-bag placed on the head, and some sedative may be prepared and administered. This may be the tincture of opium, or sodium bromid. If it is probable that hemorrhage may occur after the patient has left the office, the fluid extract of ergot is the best remedy.

A more serious hemorrhage is something like the following: A patient presents himself with a persistent bleeding which occurred several hours after an operation, and it resists the ordinary treatment. The face is pale and haggard, the lips are stained, the tongue is blackened by the use of styptics, and the teeth are covered with stringy clots of blood. The first and most important thing to do is thoroughly to clean out the clotted blood from the socket of the tooth. The imperfect removal of the clot is probably one of the most common obstacles to the successful treatment of hemorrhage. It is easily seen that the clotted blood must prevent the action of any styptic remedy, as well as pressure at the bleeding-point. After the removal of the clot the most effective local treatment consists in the combined use of a styptic with pressure, and this should be maintained until bleeding has ceased. A paste may be made of tannic acid and glycerin, which should be carried to the bottom of the alveolus by means of a small pledget of cotton. The first pieces which are introduced should be small, in order that they may be carried entirely to the bottom of the socket; these may be followed by larger pieces until the cavity is thoroughly plugged. Various means are used to obtain pressure upon this plug, but if the case be an urgent one the finger is best until danger seems to be over. A compress may be placed over the plug in the alveolus, and the jaws bound together by a bandage placed over the top of the head and beneath the chin.

In case of hemorrhage coming from the sockets of several teeth or from an entire denture, after removing all clots an impression may be taken in wax, gutta-percha, or modelling composition, and maintained in position until on its removal bleeding is found to have ceased.

It has often been the case, in the author's experience, that the hemorrhage does not come from all the tooth-sockets alike, and it has been his custom to find the most active bleeding-points and treat them with styptics and pressure as above described. Success



depends upon the thoroughness with which the first piece of cotton is driven to its place.

If there is to be a choice between Monsel's powder, or solution, and tannin, the choice should be final; in other words, do not use tannin and Monsel's solution of iron in the same case, as the ink thus formed by chemical reaction has no beneficial effect, and it is sure to get on surrounding tissues, staining them and making an unsightly appearance.

The chlorid of ethyl spray has been used to check alveolar hemorrhage, and while this has been reported as successful, the author would avoid it if possible, on account of its injurious effect upon the tissues, preventing the proper healing of the wound.

The galvano-cautery may be applied, with a proper electrode, directly to the bottom of the socket. It is a very effective agent in controlling hemorrhage, besides having the advantage of acting only at the point to which it is applied. There is this disadvantage, that the flowing blood may prevent thorough cauterization of the parts. The electrolytic needle may be applied in the same way, but it causes considerable pain, so that if there is a choice the preference should be given to the cautery.

Another effective means of checking hemorrhage, especially that from bone, consists in the use of Horsley's antiseptic wax. Prof. W. W. Keen of Philadelphia introduced its use into the Jefferson College Hospital. This preparation consists of beeswax, seven parts; almond oil, one part; salicylic acid, one part. A small quantity of this wax may be pressed against a bleeding bone or surface, or introduced into the bottom of the alveolus. This preparation would be especially indicated in the hemorrhage coming from cancellous bone or following the removal of an epulis or an exostosis.

Alum, phénol sodique, tinctures of catechu, kino, and myrrh may be used in cases of emergency, when more powerful styptics are not available.

The writer recalls a remarkable case which occurred on board ship, of a persistent and very serious hemorrhage, in which, in the absence of a better remedy, the sole of a boot was scraped and the substance thus obtained was packed into the alveolus. It was effectual in controlling the bleeding; thus, as it was said, "a sole was used to save a soul."

The *constitutional treatment* is important, because such treatment

seeks to remove the underlying and predisposing causes of the hemorrhage. These may be classed under three heads: first, the imperfect condition of the blood itself; second, a relaxed state of the capillaries; third, the excessive force with which the blood is propelled through the vessels (blood-pressure).

The constitutional treatment should be directed with all three of these conditions in view. The first condition is one which is imperfectly understood as to etiology, but the object of its treatment is plain, that of promoting the coagulability of the blood. For this purpose there are two remedies which are much used, gallic acid and acetate of lead.

℞—Acidi gallici,	ʒj;
Aquæ cinnamomi,	ʒiij. M.

*Sig.*—Three or four teaspoonfuls every hour.

The acetate of lead may be administered in two- to five-grain doses in water, every three hours. It is an old and tried remedy. Abundant clinical experience supports its use and it undoubtedly has an effect on remote parts. Besides promoting the coagulability of the blood, it slows the heart and constricts the vessels.

To contract the capillaries, the author has used ergot of rye extensively, both as a hemostatic and as a prophylactic remedy. It may be administered in doses of twenty to thirty drops of the fluid extract in water.

In the administration of ergot much depends upon the urgency of the case. In severe and alarming cases it has been given in teaspoonful doses. The writer would suggest, in an ordinary case of profuse hemorrhage, the administration of twenty to thirty drops in water every half-hour, till three doses have been taken.

As a prophylactic, fifteen to twenty drops in water should be taken three times daily for a week previous to operating.

In the third condition, the control of the heart's action is often overlooked. This should never be the case; it is inconsistent and unreasonable to go on applying local remedies while the heart is allowed to run wild, forcing the blood out through the wounded vessels, often in spite of pressure and local styptics; for it may be more important to lessen the heart's action than to plug the alveolus in a case of alveolar hemorrhage. The plugging ought to be done; the other should not be left undone.

For the purpose of controlling the heart, there is no remedy equal to opium. It may be administered in any form, although the

crude opium has been suggested as having better effect. The author has used the ordinary tincture, often in connection with acetate of lead. These two remedies taken during the same time, but in separate doses, constitute one of the most powerful systemic hemostatics known.

The position of the body should be such as to elevate the bleeding part. If the patient is in bed, have the shoulders well bolstered up.

Ice may be held in the mouth, or the opposite extreme may be followed, viz. the application of hot water by means of a syringe.

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## CHAPTER IX.

### CONSTIPATION.

**Synonyms.**—Fecal retention; Costiveness.

**Relation to the Treatment of Dental Diseases.**—The constipated condition is one of obstruction to a greater or less extent, and this means an accumulation of effete material throughout the system, not only in the intestinal canal but in the blood. Such a condition favors local congestions both on account of the general obstruction and the poisonous matters which have been absorbed.

In view of these premises it will be seen how important it is to remove this condition in order to treat successfully any inflammation of the mouth or structures involving the teeth. It is a matter of daily observation to note the headaches which are the result of constipation alone, and if headaches, why not neuralgia when there is a sufficient irritant in or about some tooth?

What folly it is to treat an incipient acute alveolar abscess with anodynes alone, while this underlying cause of the trouble is still present! This is equally true of all inflammations, such as pulpitis, pericementitis, gingivitis, stomatitis, etc.

**Treatment.**—The treatment of constipation will be given only in a general way and briefly, as follows: Sufficient exercise, in the open air if possible; special exercise designed to give strength to the abdominal muscles; suitable baths, such as a hot bath followed

by a cold douche, if the patient is able to react from it. Massage, or kneading the bowels, is often of service; regularity at stool should be maintained.

A large amount of water should be taken before breakfast and during the day, beginning with one or two glasses and increasing to six or eight. It can usually be taken if the patient will drink a little at a time, waiting a few minutes between draughts.

A most beneficial treatment is the injection of one-half to one gallon of warm water into the bowel, holding it for some minutes. It thoroughly removes all fecal matter, irrigates the bowel, and washes any pockets which may have been made by constipation of long standing.

The patient should adopt a diet which avoids sweets and much meat, and consists largely of vegetables and fruit. Calomel may be used in acute cases, one-tenth grain every hour for from three to five hours, and if there is no effect before the next morning a dose of magnesium sulfate in a glass of water may be taken before breakfast.

In cases of long standing, cascara sagrada is an efficient remedy which may be continued for months, while calomel should be given only in temporary cases for a day or two.

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## CHAPTER X.

### SWALLOWING PLATES AND OTHER FOREIGN BODIES.

THE number and variety of foreign bodies which have been purposely and accidentally swallowed is enormous, and the list of swallows includes all ages and conditions of human beings, from the child a few months old to the professional sword-swallowers and others who have exhibited from time to time in various parts of the world.

As examples of the many articles which have been swallowed, may be mentioned knives, pebbles, broken glass, living mice, fish, insects, nails, watches, pipes, spoons, and, what is of especial importance to the dentist, plates containing artificial teeth.

Easton mentions the case of a young man who accidentally swallowed a partial gold plate with teeth attached. He had taken castor oil when seen the following day, and was suffering considerable pain in the stomach. He was advised to eat heartily of food and to avoid aperients. On the following day, after several free movements, he felt a sharp pain in the lower part of his back. A large enema was given and the plate came away. This plate did service for nine years more, when it was again swallowed, but this time nothing was seen of it for a month afterward, when it was unexpectedly discharged from the anus.

In the *Lancet* for Dec. 10, 1881, there is an account of the swallowing of a vulcanite plate which was passed forty-two hours afterward. Gardner relates the case of a woman of thirty-three years who swallowed a plate containing two teeth; a sharp angle of the plate caught in a fold of the stomach, causing profuse hemorrhage and ultimate death.

In 1886, Dr. M. H. Richardson of Boston\* performed gastrotomy for the removal of a plate with teeth, it being the first case on record in which the hand was introduced into the stomach for the purpose of removing a foreign body. The plate in this case was located in the esophagus about two inches from the cardiac opening into the stomach. The patient was a teamster, aged thirty-seven, and the plate had been in the esophagus eleven months. There was constant pain, great emaciation, and inability to swallow food. Recovery followed the operation and the man went back to work in eleven weeks.

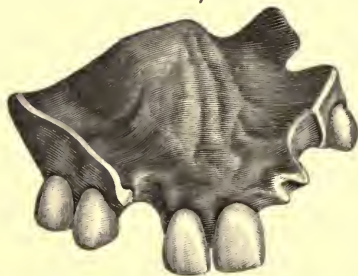
The following case was reported to the Massachusetts Dental Society by Dr. Elbridge C. Leach of Boston, to whose courtesy the writer is indebted for the facts here given: The patient, G. W. S., aged forty, was awakened early on the morning of November 9, 1884, by an uncomfortable feeling in his throat. On inspection his wife could see his partial upper denture in the fauces, and could touch it with her finger but was unable to remove it. The family physician was called, who was likewise unable to remove the plate, which had then disappeared from sight. A special train took the patient to Boston, where, at the Massachusetts General Hospital, another attempt was made to remove the plate, without success. Finally, it was pressed down into the stomach and the patient allowed to go home. For ten days the

\* *Boston Medical and Surgical Journal*, 1886, vol. ii. p. 569.

patient suffered from the manipulations in his throat, after which time, he went about his duties as conductor on the New York and New England Railroad. He continued thus without an unusual symptom, until February 22, 1885, when he had difficulty in defecation, having some pain and feeling a hard lump in the rectum. After manipulation a mass was removed in which the plate was found, quite firmly imbedded. Fig. 7 is an exact reproduction of the denture, the longest diameter of which was two inches, the shortest diameter being one inch and three-eighths.

An interesting case, as to the number and character of foreign bodies swallowed, the successful performance of gastrotomy, and the first use of the Roentgen rays for the location of foreign bodies

FIG. 7.



in the stomach, is as follows:\* The patient, "Signor Ranana," aged twenty-two, was a professional "swallower" and termed himself the "human ostrich." Gastrotomy was performed by A. H. Meisenbach, M.D., April 7, 1897, at the Rebekah Hospital, St. Louis, Mo. One hundred and twenty-seven objects, including staples for barbed fence-wire, two-inch nails, pocket-knife blades, cartridges, glass, etc., were removed,—in all, one pound. The patient made a good recovery.

Gooch quotes the case of a man who swallowed a knife, which was voided at the groin nine months afterward. Laurentius Joubert, in the sixteenth century, tells of a case in which a knife was swallowed, remaining in the body two years. In 1691 a country lad of Saxony, while playing tricks with a knife six and one-half inches long, swallowed it, point first. It was successfully extracted from the stomach, where it had been two years and seven months.

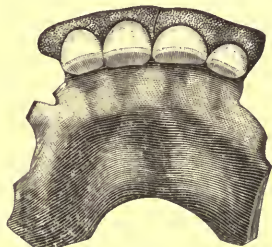
\* The first case on record in which pneumonia followed the use of the X rays.

Chopart\* relates the case of a ravenous galley-slave, who died in 1774, and in whose stomach were found fifty-two foreign bodies, including a barrel-hoop nineteen inches long, nails, pieces of pipe, buckles, spoons, glass, seeds, and a knife.

Velpeau mentions a case in which a fork was passed from the anus twenty months after it was swallowed. In the Royal College of Surgeons of London there is a steel button-hook three and one-half inches long, which had been accidentally swallowed and was passed three weeks later without unfavorable symptoms.

While in many cases large and irregular bodies have been swallowed, and have passed through the alimentary canal without serious illness or loss of life, it should nevertheless be understood

FIG. 8.



Tooth-plate, actual size.

that there is always great risk; and especially is this the case when the foreign body lodges in the esophagus, and cannot be moved either upward or downward. When this condition exists, esophagotomy should at once be performed; delay is fatal.

Of the one hundred and sixty-nine reported cases of esophagotomy for the removal of foreign bodies, fifty-one were for the removal of plates with artificial teeth; with thirty-six recoveries and fifteen deaths.

The following cases are examples which give emphasis to these remarks: The first case was one in which Dr. John O. Roe, of Rochester, N. Y., performed esophagotomy† for the removal of a partial denture. (Fig. 8.) The patient had swallowed the plate five days previous to the operation, consequently that portion of the esophagus surrounding the foreign body was much inflamed.

\* *Quarterly Journal of the Calcutta Medical and Physical Society*, 1837, i. 291.

† *Journal of the American Medical Association*, March 26, 1898.

The operation was performed without accident, the plate removed, and for four days the patient seemed to be making a good recovery; but on the fifth, a chill, succeeded by a rising temperature and inflammation of the lungs, was followed by death. In another case of esophagotomy, performed by Wilson\* for the removal of a partial denture, the operation, performed for a patient aged sixty-five, was followed by death.

**Treatment.**—The dentist should caution his patients in regard to wearing partial dentures at night, and not to neglect having plates repaired when necessary, for it is interesting to note that in the above case the plate originally had clasps which held it in position, but these having been broken off had not been replaced, the result eventually being loss of life.

When a foreign body is swallowed it is sometimes arrested in its course near the fauces, or within reach of instruments by which it may be extracted through the mouth. In other cases it may pass into the trachea, often necessitating tracheotomy; and in still other cases it may pass into the esophagus, and become fixed at any point where it happens to lodge, in which case an operation for its removal should not be delayed. In fact, there is a possibility of irregular or sharp-pointed bodies becoming imbedded in the tissues at any point in the alimentary canal. If the body swallowed passes into the stomach, it is popularly supposed that the patient should abstain from food, but this idea is unscientific. The proper treatment in such a case is to feed the person upon large quantities of boiled rice, or other similar material; the object being to distend not only the stomach, but the entire intestinal tract. This distension opens the folds of tissue and thus prevents the foreign body from lodging in them; it also serves to carry along the substance, as well as to detach it from any places where it may have become fixed. This treatment should be persisted in for a long time, if necessary.

If the X ray or other conclusive evidence shows that the foreign body is in the stomach and persists in remaining there, it may be deemed expedient or even necessary to attempt the removal of the foreign substance by means of a surgical operation, such as gastrotomy.

\* *Liverpool Medical Journal*, July 1894, p. 480.

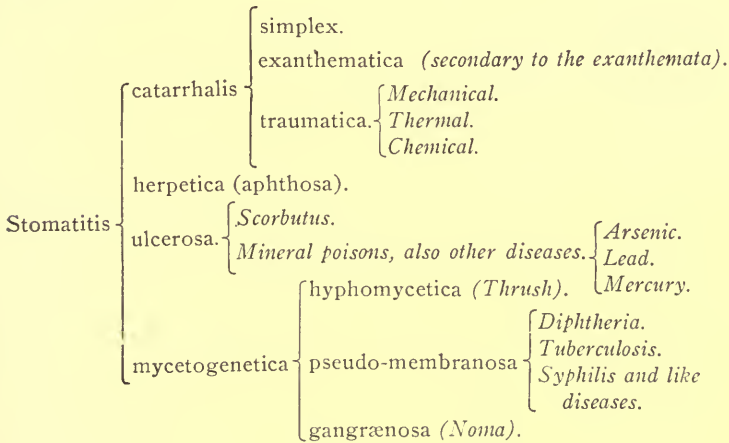


GENERAL DISEASES HAVING LOCAL EXPRESSION  
IN THE MOUTH.

CHAPTER XI.

STOMATITIS.

THE following classification of diseases affecting the mucous membrane of the mouth has been adopted by the American Pediatric Society:



CATARRHAL STOMATITIS.

**Synonyms.**—Simple stomatitis; Common diffuse inflammation of the mouth.

**Etiology.**—Catarrhal stomatitis is a mild disease not easily recognized, and which under proper treatment lasts only a few days; yet this slight affection, if allowed to go unrestricted, may lead to ulceration.

It is most frequently observed in infants between two months and one year old; and more particularly among the poor, for reasons which will be shown.

The various causes of this disease may be summed up in one sentence, viz. some irritant to the mucous membrane. The various

irritating agents may be mechanical, thermal, or chemical, or the disease may be due to micro-organisms.

While the eruption of the teeth may be attended with increased vascularity, it is not in itself sufficient to produce a general catarrhal stomatitis. Lack of cleanliness is a commonly accepted cause that is always evident upon inspection. A dyspeptic condition always predisposes one to stomatitis, the oral mucous membrane participating in the general irritable condition, being directly acted upon by the acid secretions which accompany the digestive disturbance.

At the present time it has not been shown that any forms of bacteria are causative. It is true, however, that any abnormal condition of the mucous membrane must, in proportion to the degree of departure from health, furnish conditions under which the lower forms of life would thrive. A scrofulous diathesis, or the results of some former disease, may act as predisposing causes of stomatitis.

Other causes, acting directly, are a fractured tooth with sharp edges, an alveolar abscess opening into the mouth, the excessive use of confectionery, or the wearing of regulating appliances which are not properly cleansed.

**Pathology.**—The parts involved in the catarrhal form of stomatitis are all those which make up the oral cavity, viz. the tongue, the cheeks, the mucous membrane covering the jaws, the inner surface of the lips, the soft and the hard palate.

In the early stages the membrane presents an erythematous appearance; later, the true catarrhal. At first there is simply an overfilling of the bloodvessels; in other words, hyperemia of the mucous membrane.\*

The secretions of the mouth are often suppressed at first, but after the pathological condition is fully established they are increased. The mucous membrane lining the cheeks is often marked by the teeth, as shown by slight depressions. The color of this membrane, especially in the little depressions made by the teeth, is paler than in the other parts of the mouth, while the corresponding elevations surrounding the depressions are marked by increased vascularity; the vessels being dilated and thus weakened so that the slightest injury causes more or less bleeding. The lips are

\* In the newly born, however, it should be remembered, a hyperemic condition normally exists during the first week of life.

swollen and tense, the mucous membrane is reddened, and the surface shows small round prominences caused by the accumulation of secretion in the muciparous follicles due to an obstruction of their ducts. Should complete occlusion of the ducts occur, the glands become greatly enlarged, forming cysts. If a cyst is opened and discharged of its thickened mucus, it is likely to refill repeatedly unless active treatment is instituted.

On inspection, the tongue is seen to be covered with a dry, whitish coating, which after a time becomes moist and is removed in patches along the edges and toward its center. Later the coating changes in color to gray or yellow. The lymphatic glands are nearly always enlarged, indicating by their size the intensity of the disease.

**Symptoms.**—The local symptoms of stomatitis are pain and dryness, followed by an increased flow of saliva. The mouth is dry and hot from the beginning and the taste becomes perverted. An infant goes to the breast as a hungry child would, but soon it lets go the nipple and begins to cry. This is repeated until the little one is exhausted and finally refuses the breast altogether, preferring hunger to pain. The flow of saliva is often profuse, flowing over the lips and chin, irritating the skin and producing an eczema which may last long after the drooling has subsided.

The general condition of the patient varies to a considerable extent, but there is usually at night some fever, the temperature ranging from  $101^{\circ}$  to  $102^{\circ}$  F. In some cases the temperature may go as high as  $104^{\circ}$  F.; this, of course, demands special attention.

**Course, Duration, etc.**—Catarrhal stomatitis usually lasts but a few days if properly treated. It may run into a chronic form, and into ulceration, if left to itself, but even then it is amenable to treatment.

**Prognosis.**—Catarrhal stomatitis responds readily to treatment, but if neglected serious results may follow. For instance, if the child is prevented from taking food because of the pain induced thereby, the system will be weakened to such an extent as to make recovery doubtful.

**Diagnosis.**—The prominent signs by which this form of stomatitis is distinguished from the others are the marked redness of the mucous membrane, the absence of white patches or vesicles (although superficial ulceration may occur at different points), and the temporary character of the disease, which lasts but a few days.

If it does last longer, it is then that ulceration occurs. The ulceration may be distinguished from syphilitic mucous patches by the history, form, and duration of the patches. The syphilitic ulcer is not so sharply defined, and contains an ash-gray slough closely attached; it is sluggish and heals with difficulty, appearing and disappearing; besides, there will be syphilitic lesions in other parts of the body attended by characteristic symptoms.

**Treatment.**—Although the disease usually lasts but a few days, prophylactic treatment should be conscientiously carried out, as the possibility always remains that this may be the beginning of more serious troubles. Cleanliness is of supreme importance, and mothers should be taught the necessity of keeping the mouth as well as the skin of the child clean at all times. The cleansing process depends somewhat upon the age and condition of the patient, for an infant or restless child will not always allow a spray or the use of an instrument; in such cases it is well to use absorbent cotton dipped in warm water and wrapped around the finger as an application. The nipples of the mother or nurse may be a source of infection,\* and if artificial feeding be practiced the nursing bottle should be made aseptic by washing thoroughly and placing it in water which is subsequently heated to the boiling-point; the nipple should be turned inside out and thoroughly scrubbed.

The quantity and quality of the food should be strictly regulated, and it should also be remembered that unduly warm articles of food cause pain as well as irritation.

Examine the teeth, if there are any, to see if there are sharp edges, or if they in any way act as irritants, either mechanically or chemically on account of uncleanness.

The food should usually be given cold if the child is artificially fed. Lime-water added to the milk is often of great benefit; one part of lime-water to two parts of milk.

If there are points of ulceration, they may be touched with nitrate of silver melted on the point of a silver or glass probe, or with carbolic acid on the point of a probe.

To allay the heat of the mouth, frequent rinsing with cold

\* The nipples should be bathed, after nursing, with the following solution:

℞—Sodii boratis,	gr. xxx;	
Glycerini,	ʒij;	
Aquæ destil.,	ad ʒiv.	M.

water, or (for infants) a piece of linen dipped in ice-water and inserted into the mouth, or bits of ice wrapped in linen and used in the same way, will be found to be very soothing. Local applications and mouth-washes are useful. A solution of silver nitrate, one grain to the ounce of water, may be applied to the affected mucous surfaces with a camel's-hair brush, or the following may be used in the same way:

R—Acid. carbolicæ, Calvert's No. 1, gtt. xv;  
 Ol. gaultheriæ, gtt. ij;  
 Tinct. cardamomi comp., ʒij;  
 Aquæ, q. s. ad ʒiv. M.

*Sig.*—Apply to the mouth with a camel's-hair brush.

Professor Hare of Philadelphia recommends the following:

R—Potass. chloratis, gr. xxx;  
 Tinct. myrrhæ, ℥ xij;  
 Elixir calisayæ, q. s. ad flʒiij. M.

*Sig.*—Use as a mouth-wash.

#### STOMATITIS HERPETICA.

**Synonyms.**—Stomatitis aphthosa; Canker; Aphthous stomatitis.

**Definition.**—Spots of different color appearing within the mouth and situated under the epithelium, circumscribed by an areola varying in color.

**Etiology.**—Many opinions have been expressed on this subject, but no satisfactory conclusion as to the cause of this affection has yet been reached. No lesions have been found which can be considered conclusive on this point. Caustics have been applied by Gerhardt, producing lesions in the mouth similar to aphthæ, but aphthous stomatitis occurs without apparent external cause. The agency of bacteria in the etiology is not supported by the latest researches. It has been shown by Bohn that the greatest number of cases occur between the first and third years of age, and it may be something more than a coincidence that the process of teething is actively going on during this time, and that it may have something to do in producing aphthæ. But we find aphthous stomatitis associated with pneumonia, gastric and intestinal disorders, ague, etc. It has been suggested that this disease must originate through the nervous system, and some interesting theories have been advanced, but we are still in the dark as to the cause of stomatitis aphthosa.

**Pathology.**—The term "aphthæ" was formerly applied to all

inflammations of the mucous membrane of the mouth, but it is now, or should be, restricted to the spots or ulcerations above described. The condition presented is popularly known as "canker." (See Plate I.)

As to the exact nature of these spots, there is still doubt expressed, some believing them to be a vesicular eruption, while others declare them to be a solid exudation. Bohn and others insist that they have never seen the fluid supposed to be contained in these vesicles. Many authorities use the terms aphthous and follicular interchangeably; Bellard and others express their belief that follicular stomatitis is the origin of all aphthæ.

Follicular inflammation may not proceed so far as to cause ulceration, the inflamed follicles contrasting with the surrounding mucous membrane. This form of inflammation is characterized by small round spots, red and slightly elevated, hard to the touch, somewhat like shot under the skin, and, if the inflammation continues, the hard spots soften in the center and ulceration takes place. The origin of aphthæ is also said sometimes to be in a vesicular eruption which appears not only in the follicles, but in any part of the mucous membrane of the mouth. The vesicles, if seen early, are filled with a clear fluid which in time becomes whitish, around which is seen a circle of inflammation. After the rupture of the vesicle a small ulcer appears with a grayish-yellow base, the margins of which are sharply defined and of bright red color. These ulcers are usually very sensitive and painful.

Aphthous ulcerations are most frequently found on the inner surface of the lip and cheek, in the sinus between the cheek and gums, and along the sides of the tongue.

We have spoken of aphthous ulcers. It should be noted that there are objections made to such a use of this term. Bohn objects on the ground that it is exceedingly rare to find pus in any perceptible quantity in what is called an aphthous ulcer. His objection is reasonable on the ground that pus is an essential element in the formation of an ulcer. After all, it is best to bear in mind that we are dealing with a term in constant and frequent use, and that while, strictly speaking, in aphthous excavations, the destruction of tissue may not be that of an ulcer, nevertheless we are practically dealing with an ulcer; indeed, constitutional disturbances may be quite as severe as if pus were being formed. Fortunately, however, such cases even in children are very rare.

PLATE I.



STOMATITIS HERPETICA.





**Symptoms.**—A preliminary redness of the mucous membrane of the mouth is followed suddenly by the characteristic aphthous spots, which develop within twenty-four hours. These spots of a yellowish-white color may appear singly or in groups, and may be seen in any part of the mouth, and occasionally over the surface of the pharynx. Although the spots may be associated closely together in many cases, it is rare to see what is termed confluent aphthæ. After the eruption, as first presented, has existed for twenty-four hours, it loses its epithelial covering, and there is left what is called an aphthous ulcer. This is formed by the pre-existing red line, within which is the depression made by the loss of the epithelial layer.

In a few days the borders of the ulcer may be seen to approach the center, covering the depression with a new epithelial layer; or some aphthæ may be absorbed without the outer epithelial layer breaking. There may also be complications caused by these denuded surfaces becoming infected, in which case a suppurative process is established. The case is usually prolonged by successive crops of aphthæ for from ten to fourteen days.

Examinations of the exudation, up to the present time, have shown small cell-fibers and low forms well known as inhabitants of the mouth, but no pathogenic forms which could be said to cause the eruption above described.

The constitutional symptoms vary much with each case; often little disturbance ensues, although the irritation in the mouth always causes more or less pain or restlessness, salivation, coated tongue, and loss of appetite.

**Prognosis.**—The prognosis is favorable. The disease is self-limited and occasions no serious injury to the structures which it involves, neither is it dangerous to life, with the rare exception of the confluent form in children, in which the constitutional disturbance is profound, as indicated by the diarrhea and vomiting, and the spread of the local disease to other parts of the alimentary canal.

**Diagnosis.**—In distinguishing aphthous patches from diphtheria the following points should be noticed: In diphtheria the exudation usually begins as a small white spot or pellicle on the soft palate or tonsils. The aphthous sores occur as a curd-like mass on the lips, gums, or cheeks, extending backward to the pharynx. The diphtheritic spots advance toward the lips. In

diphtheria the exudation widens as it develops and extends into the posterior nares and down the larynx; with aphthæ this is not the case. In every case of suspected diphtheria a bit of the exudation should be obtained on the point of a sterile platinum probe to be subjected to a culture-test by one who is expert in the process, which will settle the diagnosis beyond a doubt so far as diphtheria is concerned.

It should be remembered that many authorities consider aphthous stomatitis and the form known as "thrush" as one and the same disease. The points of difference to be noted are: In aphthæ the small ulcers show when the white crusts are removed; the vesicular nature of the disease in its first stages; the grayish covering of the ulcers, which is soluble in ether and shows many oil-globules under the microscope; while in "thrush" there is a special fungus, of the mold form, although of what precise character of mold has not yet been ascertained.

**Treatment.**—A course of medicine is little needed for the treatment of stomatitis proper, although it may be necessary in treating complications or depraved states of the system. If purgatives are required, a small dose of rhubarb and soda may be given to children. Potassium chlorate alone, also in conjunction with iron, is often given, but the benefit is questionable. Locally, the object is to lessen the pain of the ulcers and prevent infection, both these objects being accomplished by the application of nitrate of silver or carbolic acid. Demulcent washes, as mucilage, should be used until the inflammation subsides, when astringents may be employed, such as a solution of alum, acetate of lead, or sulfate of copper or zinc, applied to the ulcers with a camel's-hair brush.

#### STOMATITIS HYPHOMYCETICA.

**Synonyms.**—Stomatitis pseudo-membranosa; Thrush; Soor; White mouth, or Le muguet (Fr.); Schwämmchen (Germ.); Stomatitis cremosa.

**Etiology.**—This form of stomatitis is due to a fungus which finds lodgment in the mucous membrane of the mouth. This growth is one of the mold fungi, and was formerly supposed to be the *Oidium albicans*, but it is now known that it is not this organism which produces thrush, although the precise form of mold has not yet been determined. Under the microscope the curdy exudation has been found to consist of thickened epithelium-cells together

with sporules, forming clusters from the midst of which long, thread-like, jointed and branching plants arise, intertwining with one another. The sporules which are floating about in the air, on being inhaled attach themselves to the mucous surface, and when favorable conditions exist they develop and propagate. The growth of this fungus, as well as that of other microscopic fungi, seems to be greatly favored by an acid condition of the oral secretions. Some previously defective state of the body may have wrought the change from the normal alkaline fluid to one of acidity, and thus the necessary soil is furnished by which the fungus is developed and the diseased condition of the mouth is produced.

It is known that this fungus is very widely distributed, being found upon every mucous membrane in the body, and in some instances within the substance of the brain and lungs. It is generally conceded that this disease is found most commonly in infants during the first two or three weeks of life, but it is also known to occur at any period of life. It is commonly observed that a catarrhal stomatitis may accompany the parasitic form, often preceding it; and that a child suffering with any form of stomatitis is more liable to thrush by reason of the existence of the other form. It has been demonstrated, however, that some form of irritation to the mucous membrane, a break in the continuity or a rupture of the surface, is necessary before it becomes diphtheritic. It has been observed, especially in cases of infants, that when there has been an abrasion of the mouth from any cause, thrush has immediately followed in consequence, but this does not take away the strong probability that the swollen and displaced epithelial cells of catarrhal or other forms of stomatitis afford an easy entrance to the parasite.

The statement in the "American System of Dentistry," that this disease does not attack healthy persons, but confines itself to emaciated children and persons in the last stages of phthisis, does not agree with the experience of Forchheimer, who says: "I have seen several instances in which apparently healthy infants have been affected with thrush." The same author also describes the case of a healthy child who had thrush, and that of a sick child who was exposed to infection and did not get it; and he says: "As far as general good health is concerned, it must be admitted, then, that when it has an effect upon the production of thrush it must be an induced one. That such is the case must be admitted upon

close examination; the indirect effect is produced by some change in the mouth by means of which a proper soil is formed for the fungus." At the same time we all know that a depraved bodily condition in general must favor the progress of all diseases, and that thrush is no exception to this rule. Moreover, it is well known that the disease is most often found in asylums and hospitals for children. Cohen states that the poor health of the child seems less accountable for the disease than the unsanitary condition of buildings and surroundings, and that consequently it is much less frequent in private than in public practice.

Meigs and Pepper consider the central cause of this disease to lie in a failure of nutrition, under which the general vitality ebbs slowly away; and they are inclined to the opinion that the deficiency in the supply of water in much of the artificial food administered to young children is a causal factor in producing this disease.

**Pathology.**—The condition of the oral mucous membrane gives expression very quickly to the invasion of thrush. In a few hours masses of a curdy substance may be seen adhering to the tissues to the extent that a slight bleeding occurs when it is forcibly removed. In children whose systems have been much reduced by previous disease, these masses often coalesce into a membraniform product, varying from a gray or yellowish color to a brown, according as it has been exposed to the air, or from admixture of blood.

About this time, the congestion of the mucous membrane subsides and it becomes comparatively anemic; the deposit also becomes less adherent, and after a time it may be removed easily by the finger without causing hemorrhage. The entrance of the parasite is between the epithelial cells, separating one layer from another as the fungus develops; this development is in the form of spores without mycelium. From this the parasite grows in both directions toward the connective tissue. The growth thus begins in small spots which may or may not become confluent. Propagation may go on from the first crop, or several places may be inoculated from the same source.

In severe cases the patches enlarge, forming masses with very little intervening tissue not involved. The mucous membrane of the tongue is usually first attacked, beginning with specks at the tip and edges, thence spreading to the central portion and to the

glands at its base. From the tongue it extends to the lips, cheeks, gums, the soft and the hard palate. The disease is not limited, however, to these structures; it may cover the entire mucous membrane of the mouth. From the pharynx it may reach the epiglottis, and even the larynx (Lelut). It has been observed on the vocal bands by Parrot.

It has never been observed about the orifices of the Eustachian tubes or in the posterior nares. It seems that the squamous epithelium is most favorably formed for the rapid development of this parasite. In rare instances it has been found in the intestinal canal (Seux, Bouchut, Robin), and oftener upon the nipples of the nurse.

**Symptoms.**—The earliest symptom, in infants, is the distress occasioned by nursing, giving rise to cries of pain; if the cry is hoarse, it attracts attention to the vocal cords as being involved. These outward expressions invite inspection of the mouth, when the characteristic lesions, as described under pathology, are observed. The subjective symptoms vary with the intensity of the affection; there may be simple diarrhea or gastro-enteritis, etc., on the one hand, or there may be tuberculosis or kindred diseases on the other, thus indicating the peculiar kind of constitutional predisposition.

**Prognosis.**—The duration of the disease is rarely more than eight days in children otherwise strong and in conditions favorable to proper treatment; but in children who are the subjects of a constitutional diathesis it may continue indefinitely, the result being determined more by the causal disease than the lesions in the mouth. It will thus be seen that the prognosis depends more upon the patient than the disease itself. The younger the child and the more extensive the eruption, the worse the prognosis.

**Diagnosis.**—In infants, the examination of the mouth, after noting that the child is unable to nurse, reveals the inflammatory condition of the mucous membrane. It begins at the extremity of the tongue. Often the tongue is very dry and tender to the touch. The secretions of the mouth are acid and all its parts are hot and sensitive. The microscope, however, comes in as a deciding factor in the case, always showing the presence of the parasite already described.

**Treatment.**—The etiology of the disease, as we have seen, is in relation largely with the digestive tract, the kinds of food, and

in infants with the condition as to cleanliness of artificial feeding apparatus.

As there is no perfect substitute for mother's milk, it is advisable to secure a wet-nurse rather than to depend upon any form of artificial food, or even the milk of any of the lower animals. The next choice is the use of cow's-milk; which may be modified as follows (subject to change according to the indications): Two parts cow's-milk, one of lime-water, and one of pure water. The most scrupulous care must be exercised to secure cleanliness of the vessels in which food is prepared and given. This is imperative, as it is useless to apply remedies while still supplying soil in which the special fungus causing the disease thrives and grows. If a substitute for milk seem desirable, it may be found in weak soups in which there is no sugar or casein to undergo fermentation and cause acidity; honey and syrups should be avoided for the same reason.

In simple cases the treatment may be largely local. It is important to remove the patches every two or three hours with a soft cloth moistened in warm water, or in a solution composed of a teaspoonful of sodium bicarbonate added to a cup of water. This alkaline wash serves the double purpose of facilitating the removal of the growth and neutralizing the acidity of the secretions. Borax may be added to the above, or applied alone in the proportion of twenty grains to the ounce of water. The removal of the patches requires considerable care and dexterity, and the alkaline wash should be used freely and often, so that no force is needed to detach them, and it should be borne in mind that while it is important to remove these patches, roughness and undue haste must be avoided.

In chronic forms potassium chlorate may also be used as a wash for the mouth. Brandy and water is an excellent application, and may be applied with a camel's-hair brush; also applications of listerine and glycerol, equal parts, are serviceable. Constitutional treatment must depend upon the symptoms, or upon any underlying disease which may have acted as a predisposing cause. Cod-liver oil is often indicated and may be administered to children in doses of one-half dram three times daily. If there be fetor of breath, and the lips and gums are swollen, potassic chlorate should be given every four hours in doses of three grains each, dissolved in water.

**ULCERATIVE STOMATITIS.**

**Definition.**—Inflammation of the mouth, usually unilateral, ending in ulceration of the mucous membrane.

**Etiology.**—This form of stomatitis is closely associated with bad hygienic conditions such as exist in crowded tenement-houses, or scanty food and clothing. Disease may act as a predisposing cause, as measles or scorbutus. Ulcerative stomatitis is often epidemic.

**Pathology.**—This is a disease whose principal characteristic is the formation of thick yellow patches of membrane, adherent to the submucus tissue, with inflammation, erosion, and ulceration of the subjacent parts. Although cancrum oris has sometimes been described under this head, such usage is hardly justifiable, as the character of the ulcer in cancrum oris is entirely different from that which is properly termed ulcerative stomatitis.

What is known as membranous stomatitis is most likely an early stage of the ulcerative form, which, under treatment or otherwise, does not proceed to ulceration.

**Symptoms.**—The patches of membrane vary in appearance as the disease progresses, being white at first, then gray, and sometimes at last almost black; the surrounding mucous membrane is inflamed, and if the adherent membrane is forcibly removed from the patches in the first stages it reveals an eroded, bleeding surface. If it goes on to ulceration the membrane becomes less adherent and finally comes off, leaving an ulcer with irregular red margins, covered with a thick yellowish exudation. Beyond this there are no characteristic constitutional symptoms to mark the progress of the disease.

Sometimes in young infants there is slight fever, general languor, and impaired appetite. As the disease progresses, fetor of breath, salivation, and painful deglutition are manifested, and the mouth is hot and sensitive to the touch. Swallowing of the fetid saliva causes diarrhea; the cheeks sometimes swell and the submaxillary and sublingual glands become inflamed on the affected side. The other side of the mouth may become affected, but always to a less extent. The disease occurs more frequently in the autumn months.

**Duration.**—Without treatment, the disease is liable to run on for many weeks, or even months, being influenced and prolonged

by intercurrent diseases; but under proper care and treatment it may be limited to eight or ten days.

**Prognosis.**—The prognosis is good in ordinary cases; occasionally the disease is protracted, suppuration and innutrition bringing about a fatal result.

**Diagnosis.**—Attention to the pathology, and the remembrance that the disease is usually unilateral, will assist in forming the diagnosis. Ulcerative is distinguished from catarrhal stomatitis by its peculiar, fetid odor; and from cancrum oris by the absence of induration of the skin of the cheek over the swollen mucous membrane and by the diffuse character of the swelling. Ulcerative stomatitis never extends beyond the cavity of the mouth. It should be remembered that aphthous stomatitis may coexist with the ulcerative form.

**Treatment.**—Prophylaxis is important here as in other forms. Cases should be isolated from the rest of the family, not so much because of the contagiousness of the disease itself, but because other members of the family, having the same predisposing conditions of life, are especially susceptible. They should at the same time receive prophylactic treatment also. In this disease, bread pills will not answer; potassium chlorate is the remedy. Like guaiac in quinsy, potassium chlorate seems to be almost specific in ulcerative stomatitis. This drug may be administered to children in doses of two to five grains three times daily, and ten to twelve grains for adults.\* A gargle, ten to twenty grains to the ounce of water, may be used with effect. A spray of Dobell's solution will also be found serviceable. If the ulcerated points are slow to heal, they should be touched with a silver-nitrate solution, ten grains to the ounce of water, or with tincture of iodine. Trichloroacetic acid is also an excellent local caustic. So far as the writer has observed, the local application of hydrogen peroxid has been of benefit. Local irritants, as jagged edges of teeth or necrosed bone, should be removed. The constitutional treatment, as above indicated, in addition to all that may be comprised under hygiene, may include laxatives and general tonics and nutritives such as iron, cinchona, and cod-liver oil.

\* Caution should be exercised in administering potassium chlorate to infants and children, as some are extremely susceptible even to minute doses. The drug should be withdrawn at once when drowsiness, suppression of urine, and weakness of the heart are noticed.



**GANGRENOUS STOMATITIS.**

**Definition.**—A non-contagious deuteropathic inflammation of the interior of the mouth, almost invariably unilateral, and characterized by a peculiar gangrenous destruction of all the tissues of the cheek from within outward. (Cohen.)

**Synonyms.**—Water cancer; Aquatic cancer; Cancrum oris; Stomato-necrosis; Gangræna oris; Necrosis infantilis; Noma; Gangrenous erosion of the cheek; Scorbutic cancer; Sloughing phagedæna of the mouth; Buccal anthrax.

**Etiology.**—This is a rare disease, probably one case in many thousands of stomatitis, and the few cases found are mostly in hospital practice. It occurs as a rule in children from the third to the fifth year. Bad hygienic conditions, chronic illness, debilitating maladies, are among the predisposing causes. It is probably not contagious; it may follow acute or chronic diseases. Among predisposing diseases are measles, scarlatina, whooping-cough, typhus fever, tuberculosis, and mercurial stomatitis.

**Pathology.**—All the tissues forming the buccal wall are invaded, and the ulcerated parts slough off. As in many other diseases of the oral tissues, it is thought that certain micro-organisms play a conspicuous part in the rôle of this disease. Froriep\* first called attention to the presence, in this disease, of living organisms resembling yeast-fungi. Grawitz† found bacilli in nearly pure culture, which were described by Loeffler‡ as similar to the bacillus seen in diphtheria of calves.

Post-mortem examinations show the vessels of the affected parts to be filled with clots, thus accounting for the absence of hemorrhage in this disease.

**Symptoms.**—The disease is insidious, giving very little pain at first, and the symptoms may be masked by the presence of some other disease. Among the earliest and most prominent symptoms which may be noticed are swelling of the cheek, fetor of breath, and profuse salivation, the swelling of the face being specially characteristic. The skin appears to be tightly stretched over the swelling, is red and shiny, with a bright red spot in the center, and is very tender to the touch. An examination of the mouth shows,

\* "Chirurgische Kupfertafern." 1884.

† *Deutsche med. Wochenschrift*, 1889.

‡ *Ibid.*, No. 15.

on the buccal wall or on the gums, or more frequently at the junction of the cheek with the gums, a small ulcer, irregular in outline, with jagged edges and with a brownish slough attached. The edges are of a bright red color and bleed easily. It spreads rapidly, conveying the same condition to the adjoining and contiguous parts. If it begins in the gums it spreads to the buccal walls, or if it is seen first on the buccal wall it is observed to extend to the gums, sometimes loosening the teeth so that they fall out.

As the ulcerative process goes on in the mouth, the external swelling changes also; the bright red spot in the center of the swelling increases in size, and changes from a livid color to one that is quite black. This increases in area, and the destruction of tissue goes on until, usually within seven days, the slough is thrown off. Death may, however, take place before the cavity of the mouth is laid open.

**Prognosis.**—The prognosis is generally unfavorable, depending upon the stage of the disease at which treatment is instituted. Early operative or medical treatment offers a hope, while the untreated cases nearly always terminate fatally.

**Treatment.**—The treatment is both local and constitutional. Early local measures are very important; these consist in applying to the ulcers strong trichloroacetic or nitric acid by means of a pointed glass rod or a bit of lint twisted on the end of a stick; being careful not to burn healthy tissue, while at the same time the ulcers should be most thoroughly cauterized, after which an antiseptic wash should be used; for instance:

℞—Acidi carbolici,	gtt. xv;
Aquæ,	ʒiv. M.

*Sig.*—Mouth-wash.

After rinsing the mouth, a piece of lint soaked in the wash should be left applied to the ulcers for about four hours, when it should be changed and the parts again washed.

The constitutional treatment consists in tonics, good nourishment, and stimulants. Potassium chlorate may be given in doses of from three to ten grains. Very likely purgatives will be necessary, and castor oil is commended as one of the most efficient. If the ulcer continues to spread, it will need another application of acid. The condition of the ulcer indicates the severity and progress of the disease. Surgical treatment, if instituted early, offers some hope; it consists in the removal of the diseased tissues.

## CHAPTER XII.

## DIPHThERIA.

**Definition.**—An acute contagious and epidemic disease with the principal local manifestation in the throat, accompanied by systemic poisoning.

**Etiology.**—There is a specific poison for diphtheria,—the Klebs-Loeffler bacillus, which produces the disease whenever the necessary conditions prevail. Diphtheria is highly contagious. The poison exists principally in the secretions of the throat, and it is probably through this agency that the disease is communicated. The medical attendant or the nurse may receive the breath or particles of mucus while the patient is coughing, and thus contract the disease. Articles of clothing may carry the poison for a long distance, and retain it for a long time. A common drinking-cup, children's playthings, such as whistles, harmonicas, etc., may be the means of conveying the disease. The period of incubation varies from two to eight or ten days.

**Symptoms.**—In the simple or catarrhal form the disease begins much as a common cold, with more or less malaise, dullness, slight fever, and headache. The throat is irritated and usually painful. In more severe cases these symptoms are very pronounced, with the addition of nausea and vomiting.

On inspection of the throat, the tongue is seen to have a thick white coating. The palate and tonsils reveal grayish-white patches, thin and firmly attached. These patches increase in size and coalesce, at the same time becoming thicker, the margin being distinctly outlined against the deep red mucous membrane.

In the croupous form of this disease there is likely to be a sudden rise in temperature, a spreading and thickening of the membrane, and enlargement of the cervical glands. The swelling of the neck may reach an enormous size, and the secretion of the affected glands is offensive, which with the other decomposing secretions gives to the breath an extremely offensive odor. These and the products of decomposition may enter the blood and produce septicemia.

**Diagnosis.**—Take a scraping from the throat in the vicinity of

the patches or over them, by means of a sterilized platinum point, and after rubbing it on the culture medium provided for this purpose, return the latter to the bottle or receptacle, and send it to some expert or agent of the board of health to be examined. The presence of the bacilli determines the diagnosis. This disease may be confounded with acute follicular tonsillitis, which, however, may be distinguished from diphtheria by the appearance of small ulcers, corresponding to as many follicles in the tonsil, that contain a white, cheesy secretion. The superficial portions of these small ulcers are easily detached, which is not the case in diphtheria.

The diphtheritic membrane is tough and leathery, firmly adherent, and if removed it forms again. The white spots of aphthous stomatitis begin on the lips and tip of the tongue and spread backward, while in diphtheria the patches are situated on the posterior wall of the pharynx and tonsils, and spread, if at all, forward.\*

**Treatment.**—The principles of treatment include keeping the nose and mouth disinfected by means of a spray or douche with some antiseptic solution. The mouth should be rinsed frequently, and the throat gargled. The secretions should be isolated and destroyed, as in these lies the danger of contagion.

Stimulants and nourishment should be used freely. Local applications which have an especial effect on the membrane are of service. Lactic acid and water, well diluted, so that it has only a slightly acid taste, may be used with a swab or sprayed into the throat by means of an atomizer, after which, powdered sulfur may be applied by means of a powder-blower. Tincture of the iron chlorid has been much used in the same way as the lactic acid; it may be also administered internally.

There seems to be no doubt that "antitoxin" exerts a marked influence on the disease, and that it has reduced the mortality to a great extent.

Formaldehyde gas is not only accepted as the best disinfectant for rooms, but it has been used successfully during the course of the disease. Formaldehyde is a gaseous product of the oxidation of methyl alcohol, and a solution containing forty per cent. of the gas is furnished under the name of "formalin" or "formol," of which 1 part to 200 of water may be used in the mouth.

\*It is important that the dentist be able to diagnose diphtheria; to differentiate it from aphthous stomatitis; that he be aware of the facility by which it may be propagated from one person to another; that he govern himself accordingly.

## CHAPTER XIII.

## SCURVY.

**Synonym.**—Scorbutus.

**Definition.**—A general disease, characterized by malnutrition and having a marked local expression in the mouth; brought about by living upon one kind of food, or food deficient in vegetable matter.

**Etiology.**—There have been a great many theories proposed as to the cause of the condition known as scurvy. Of these, depressing mental influences and despondency were often connected with the disease. But in this the mistake was probably made of placing these mental conditions as causative rather than as an accompaniment of the disease. Much evidence goes to show that no degree of mental exhilaration could ward off the disease while the determining causes are acting; neither could any degree of mental despondency induce it while proper food was taken.

Various atmospheric qualities were at one time regarded as being active causes; impurities such as exist in the holds of ships, and in crowded habitations or cities, being appropriate examples. Observers as early as the seventeenth century considered cold, also, as an active cause of scurvy, especially when combined with dampness. On the other hand, a very high temperature has been considered a cause. Again, authorities have held responsible for it excessive exertion followed by great fatigue and exhaustion; while, in contrast to this, equally good authorities have placed considerable emphasis upon indolent habits and lack of exercise as a determining cause of the disease. Most observers, however, have studied the food and drink question in order to find the exciting causes of scurvy, and in the study of this question many opinions have been advanced, which it seems unnecessary to enumerate here.

When this disease occurred on land it seemed somewhat different from scurvy occurring at sea, and the fact of its frequency on shipboard brought out the erroneous opinion that sailors' diet and its saline materials were active in causing scurvy. This idea has now been discarded by numerous authors, who have concluded that the chief cause of scurvy lies in a deficiency of vegetable food,

especially of the fresh, succulent kind. A consideration of the treatment of this disease will bring out the fact that the food of the patients has been lacking in variety. Especially is this the case with scorbutic children whose diet consists mainly of one article of food.

Dr. Thomas Buzzard makes two statements which are interesting and conclusive: "There is no case on record of scurvy occurring in a person who has been adequately supplied with fresh, succulent vegetables of good quality. The occurrence of scurvy in persons living upon salt meats may be prevented by the regular administration of fresh vegetables or the juice of lemons." Barlow sums up the etiology of this subject in the following: "The prolonged use of a defective diet induces the symptoms."

**Pathology.**—The particular morbid appearances which are present in scurvy occurring in infants and children is illustrated by the following cases.

The first was a child of thirteen months, apparently well nourished, presenting dark cherry-red tumors hanging over the partially erupted incisor teeth of both jaws. The surface of these tumors was tough and shiny, not having a tendency to bleed, but a free hemorrhage followed an incision into them. There were no hemorrhagic spots on any other part of the body, but the lower extremities presented marked rheumatic symptoms. A change was made in the diet, from Mellin's food (which had been exclusively given) to broths, with the addition of grape-juice. The recovery was so rapid and pronounced that there was no room for doubt as to the diagnosis.\*

At the present time, however, errors in diagnosis are less frequently made, and the disease is more commonly recognized since the eleven cases reported by Northrup in 1891, followed by those of Rotch, Starr, and others.

One of the cases reported by Dr. I. N. Love, at the meeting of the American Medical Association at Baltimore in May 1895, is of interest. It related to twins, eight months old. Both had a history of marasmus. The food,—consisting of cow's-milk, boiled and diluted largely with water or lime-water,—and the surroundings and conditions were all exactly alike in both cases, yet one child developed scurvy and the other did not. It is significant

\*From remarks by the writer published in the *Boston Medical and Surgical Journal*.

that while the child suffering from scurvy died in three days from the time he was seen by Dr. Love, the surviving patient, being put upon antiscorbutic remedies, began to thrive and soon became well nourished. Dr. Love also states that in this case the gums were spongy, with a tendency to bleed, though no teeth had yet appeared.

It would seem that the otherwise normal irritation attending the eruption of the teeth is necessary to produce the spongy growth of the gums when a tendency to scurvy exists. In other words, scorbutic infants before the eruption of the teeth present a normal appearance of the gums, or the growth may appear at the site of the erupting teeth, while in those parts of the jaw in which there are no teeth the gums are normal.

In this case of Dr. Love's, while the teeth were not fully erupted, the process of eruption was probably going on, for we should note that the eruption of the incisor teeth usually occurs between the seventh and ninth months, and this child was then eight months old. It would be difficult, of course, to state just how far advanced the process of tooth-eruption must be, in order to produce the characteristic local expression on the gums; that would depend upon the susceptibility in each individual case, but this factor should be taken into consideration when statements are made that no outgrowth or spongy condition of the gum appears before the eruption of the teeth.

**Symptoms.**—The symptoms in a case of scurvy are few, but very marked and characteristic. One of the earliest is a change in the color of the skin, which presents a pale, sallow, or greenish tint. It will be noticed that the patient is listless, with an aversion to exercise. Upon inquiry, the appetite may be found to be defective; sometimes fairly good, in other cases entirely wanting, depending much upon the stage of the disease. The tongue is heavily coated, the breath fetid, and the gums are exceedingly painful to the touch, often bleeding easily. This, together with the swelling, interferes with mastication so that the patient eats little or nothing. In most cases there is some constipation. Another characteristic symptom is the condition of the lower extremities, which, according to the writer's experience, is decidedly rheumatic, and if the disease is allowed to advance, swelling may occur in the flexures of the joints. There is no fever and the patient usually sleeps well. If the case is well advanced, petechiæ are observed, more commonly

about the legs and thighs; they are small and of a reddish-brown color. If the disease still progresses, these spots are likely to increase in size. An additional symptom is that the patient gets out of breath without apparent cause.

Some cases of scurvy have been reported in which the gums have been normal, but these cases must be rare.

**Prognosis.**—The prognosis is generally favorable, but much depends upon early treatment and the extent to which vital organs, as the brain, heart, and lungs, are involved.

**Diagnosis.**—The diagnosis may be established upon observance of the following: A history of defective diet, usually that in which one article has been the chief food. The body may be plump but with a decided anemic appearance; there may be coated tongue, fetid breath, and rheumatic symptoms in the lower extremities, varying from pseudo-paralysis to stiffness of the joints, and increasing to such an extent that there is much pain upon the slightest movement of the limbs. The appearance of the gums is characteristic. They are often swollen to a great extent, and in the form of tumors in the location of erupting or erupted teeth, sometimes presenting a hard, shiny appearance, and in other cases bleeding upon the slightest touch. These swellings or tumors occur only around the teeth. Finally, the diagnosis is complete when notice is taken of the almost magical improvement under the use of antiscorbutic remedies.

**Treatment.**—The treatment is very simple. In the case already given, that of a child thirteen months old, the only treatment consisted in a change from Mellin's food, which had been exclusively taken, to grape-juice and fresh cow's-milk. Another case was that of a girl twelve years of age, who had been boarding at an hotel in the White Mountains, where she had partaken freely and constantly of meats. Although fresh air and exercise were not lacking, a marked case of scurvy was the result. The only treatment consisted in a few doses of calomel of one-tenth of a grain each, and a diet in which for meat there were substituted fresh vegetables, milk, etc. The patient drank freely of grape-juice. At the end of forty-eight hours a marked change for the better was noted, and at the end of six days the gums approximated a normal appearance. The swelling of the gums in this case was such that large portions required amputation in order that the patient might bring the teeth together in mastication.



The following case, described by Dr. Albert H. Burr of Chicago, presents so many points of interest that the writer takes pleasure in quoting freely from it:

Dorothy R., thirteen and a half months old, had been brought to Chicago from a distant State, by the advice of the family physician, to be treated for a supposed spinal trouble. She was placed under the care of one of our best orthopedists. The diagnosis was rhachitis, with slight spinal curvature. As the child was too weak for any corrective appliances the specialist addressed himself to general tonics and restoratives with the view of improving the anemia and malnutrition. At the end of six weeks the child, which at first seemed to be materially improved, was found to be decidedly worse, and for two weeks had not been able to lift its head from the pillow. Emaciation was progressive, and the specialist expressed the opinion that the case was hopeless and the child must soon die from marasmus.

The history as given by the mother was this: Up to eight months of age the child appeared well nourished and in the best of health. About this time it became fretful, grew pale, and began to lose flesh. Purple spots appeared over its shoulders, back, and thighs, which suppurred and many of them were lanced, leaving marks similar to the pitting of small-pox. The lower extremities were painful on being handled and the child ceased to move them voluntarily. Its diet from birth had been Mellin's food exclusively. The mother had lost her ability to nurse on account of multiple abscesses of her breasts at a previous birth.

At this time the child was very anemic and much emaciated, weighing but thirteen and a half pounds. It could not lift its head or move its body or thighs, and was handled on a pillow. The right femur and left scapula were perceptibly swollen. Dentition was delayed. The upper and lower middle incisors only were erupted, and these were almost hidden by spongy ecchymotic gums. In the roof of the mouth was a purplish tumor with an eroded apex. The fetor of its breath was marked. The body was bathed in sweat. The stools were hard and variegated in light drab and dark slate colors, with an offensive odor like that of a carnivorous animal. The child cried with pain on being handled and was fretful and wakeful during the nights. This array of symptoms completed a picture of pitiful distress.

*Treatment.*—The food was changed at once to fresh cow's-milk and barley flour as a basis. Orange-juice and raw scraped beef were given daily, which the child took with the greatest avidity. Scraped apple and tender sprigs of fresh lettuce and cabbage were also allowed by way of variety. A cool sponge bath at 75° F., with gentle friction, was given every morning for its tonic effect. To change the character of the stools and disinfect as far as possible the intestinal tract, calomel tablets,  $\frac{1}{10}$  of a grain every two hours, and a powder composed of guaiacal carbonate,  $\frac{1}{6}$  of a grain, and protonuclein, one grain every four hours, were ordered given. Hydrolein was administered three times daily for its alternative and reconstructive properties. The improvement, even in so short a time as twenty-

four hours, was gratifying and astonishing. At the end of forty-eight hours the character of the stools was changed, the fetor of the breath had disappeared, and the child was inclined to amuse itself. After the fourth day it could lift its head, and its nights were restful. At the end of the first week all traces of spongy gums and sore mouth had disappeared; it began to laugh and crow and exercise its limbs and thighs, and no longer dreaded handling. At the end of the second week it had gained one pound; could lift its feet above its head for the first time in several months. All remedies, except hydrolein and occasional doses of mild chlorid, were now discontinued. A soft-boiled egg with rolled cracker was allowed every other day, alternating the scraped beef. Third week: Anemia has disappeared. Can sit alone. Has erupted upper lateral incisors. Three weeks ago there were no signs of these teeth. Is taken out daily for exercise. Fourth week: Has gained in weight, rolls about on the rug and tries to creep. Discharged cured and returned home at end of six weeks. A change like this, after six months of helplessness and untold suffering, seems little less than magical.

The points of interest in this case are: The supposed suppuration of the hemorrhagic lesions, which the family physician diagnosed and treated as eczema; the swelling over the femur and scapula, and slight curvature of lumbar region, diagnosed and treated for six weeks by a noted orthopedist as rickets, and lastly the rapid recovery under antiscorbutic treatment.

The foremost problem in the consideration of every disease is how to prevent it. Scorbutus is a preventable disease. How shall we guard against and limit this recently diagnosed and apparently increasing disorder? We shall not find it in the homes of the poor, nor among the laboring classes, so often as among the well-to-do and in the houses of affluence, for the mothers in the commoner walks of life more uniformly suckle their babes, and this is prophylactic. Barlow says: "In no single case at the time of the malady has the child been breast-fed."

1. Woman herself should be physically prepared for better motherhood, so that she may be capable of yielding her offspring the only food nature intended for it.

2. Mothers should be impressed with the fact that there is no perfect substitute for breast-milk, and that next to the right of being well born, the babe has an inalienable right to nature's food, and no trivial excuse or surmountable difficulty should hazard its life or health.

3. If for any reason the breast-milk is inadequate, or has entirely failed, the nearest approach to it is to be found in the modified cow's-milk of our modern laboratories, or the home modification of cow's-milk after the plans given by Rotch in his recent and most valuable work on pediatrics.

4. Above all, no continuous administration of any sterilized, Pasteurized, peptonized, or condensed milk or any dry commercial food should be given to the exclusion of fresh or raw elements of diet. In what this antiscorbutic property consists, which is found in fresh foods and is lacking in the artificially prepared and manipulated foods, is not yet determined, but it is more than likely that the important offices performed by the normal

germs of the gastro-intestinal tract in the complicated processes of digestion are incapable of being completed with artificial food, and thus putrefactive changes in imperfectly digested pabulum lead to auto-infection and malnutrition.

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## CHAPTER XIV.

### RHACHITIS.

**Synonyms.**—Some of the more common synonyms are: Rickets; Rhachitismus; Osteomalacia; Spina nodosa.

**Definition.**—A disease occurring in infancy and early childhood, characterized by a deficiency in growth and quality of the bones, resulting in deformities, etc.

**Etiology.**—The primal cause of this disease may be stated in one word,—mal-assimilation. It occurs frequently among the poor and ill-fed, but it also occurs among the well-to-do. A predisposition to this disease is undoubtedly inherited. High and fashionable life, as well as bad hygiene and extreme poverty, depress the bodily powers of the mother, and tend to the production of rickety children. While rhachitis may occur in any part of the world, it is rarely found in tropical regions, though frequent in low, damp situations. It is said to be more common in Europe than in this country.

**Pathology.**—This disease may be congenital, but the more marked characteristics are shown as the child is developing. The imperfect calcification of the bones results in certain deformities which are very apparent, as seen in the contracted chest, distorted spine, and bow-legs. In the deficiency of bone-development the teeth share in the general misfortune; indeed, the teeth are among the first tissues to be affected, as not only retarded dentition but irregularities of the teeth are a marked characteristic of rhachitic children. The tooth-form is also apt to be irregular, and it is often diminutive in size. The structure of these rhachitic teeth is such that caries rapidly develops.

**Symptoms.**—Some of the above pathological conditions may also be classed as symptoms; in addition it may be stated that children suffering from rhachitis are observed to perspire easily,

and are irritable in temper. There is general emaciation due to indigestion and the consequent intestinal disturbances. The appetite is either depraved or lacking, and sometimes vomiting occurs. The child is often unable to walk, and is generally indisposed to any exertion. There is usually tenderness along the spine and in other parts of the body. The wearied and aged countenance is also characteristic.

**Treatment.**—The main object in treatment is to secure proper nutrition. To this end good hygienic conditions must be obtained. The clothing should be warm, and, if the child is nursing, special attention should be given to the milk. If the mother be affected with syphilis or a cachexia she should not nurse the child, although the milk is healthful. If a good wet-nurse cannot be had, it is important that the best substitute should be provided, which is probably cow's milk to which is added one-fourth part of lime-water. Cod-liver oil is one of the most potent remedies that can be employed in this condition. The hypophosphites of lime and soda are also very efficient, and often small doses of iron are indicated.

Subjects of this disease should not be allowed to creep or walk too early.

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## CHAPTER XV.

### SCROFULA.

**Synonyms.**—Struma; Scrofulosis; King's evil; The evil; Tuberculosis.

**Definition.**—A constitutional dyscrasia, hereditary or acquired, characterized by glandular swellings and different grades of inflammation.

**Etiology.**—Probably the most important factor in the causation of this disease is heredity. Parents who are not, strictly speaking, scrofulous may transmit to their offspring a strumous condition. Scrofula may be acquired through the evil influences of bad hygienic surroundings, such as poor food, insufficient clothing, overwork, crowding together in small, low, damp rooms, etc. Again, this disease may be transmitted, especially if there be a predisposition to it, by means of milk from tuberculous cows. It

seems reasonable to suppose that carelessness in neglecting the destruction of discharges from glandular swellings may cause the disease. This would be especially true of tuberculous diseases of the lungs, or phthisis pulmonalis. In this disease, the sputa being deposited on sidewalks, floors, public conveyances, etc., is dried, converted into dust, and carried hither and thither by movements of the air. These particles containing the bacillus tuberculosis are inhaled, the person becomes infected, and if he is peculiarly susceptible the disease is thus developed. It is possible that tuberculosis may be communicated during dental operations when the bacilli in the mouth of a patient may infect the operator. In view of these possibilities the dentist should take warning.

The disease usually manifests itself in children about the time when the temporary teeth begin to appear, and the liability increases up to the seventh year. Certain diseases are supposed to be predisposing causes, as measles, whooping-cough, smallpox, typhoid fever, etc.

**Symptoms.**—Scrofulous subjects are usually susceptible to inflammation of the eye and ear, and also to enlargement of the faucial and pharyngeal tonsils accompanied by nasal catarrh. Slight wounds in the skin heal slowly, and eruptions often occur on the face and scalp. During the temporary dentition, the lymphatic glands are disposed to swell, and often break down by cheesy degeneration, discharging pus. The healing of these abscesses takes place with difficulty, often presenting deep excavations having thick and indurated margins. Sometimes the glands may enlarge without suppuration.

**Effects on the Teeth.**—Certain peculiarities of the teeth are closely associated with this disease; but the cases in which tooth symptoms appear are generally those in which the condition is inherited. In these cases the teeth present a perfect form and structure. Imperfections in development vary much in different individuals; sometimes presenting white spots on the surface of the teeth, which finally soften and decay; sometimes being notched or serrated in their cutting edges, or contracted in form, presenting a stunted appearance. In fact, no particular type of deformity can be described as being associated with this disease, for the disease itself presents many phases and is little understood. Its relation to syphilis has been suspected, and is held by many to be closely associated with it. It is impossible to designate certain typical

defects of the teeth as belonging to scrofula and another distinctive type as belonging to syphilis.

**Effect of a Scrofulous Diathesis on certain Dental Diseases.**—The existence of a scrofulous diathesis is sure to act unfavorably in the treatment of many pathological conditions of the mouth and teeth. For example, pulpitis is more likely to go on to suppuration and death of the pulp, and alveolar abscess is more difficult to cure. Gingivitis and the various forms of stomatitis are much slower in their response to treatment. Particularly is this the case in many of the antrum diseases, which may go on for years, yielding to treatment only when the scrofulous condition has been partially relieved or cured.

**Treatment.**—Prophylactic treatment should be given in all cases in which it is possible. Prophylaxis consists in good hygienic conditions, with the various factors which are comprised in the full meaning of this term. If possible, this should be carried to the point of leading an outdoor, country life, with physical training directed to the development of the entire body. The simple bitters are useful, and the following prescription, which the writer has used for many years, includes a nerve- tonic also, and is as follows:

R—Tinct. nucis vomicæ,                   ʒiv;  
           Tinct. gentianæ comp.,           ʒiv. M.

Sig.—A half-teaspoonful in a little water before meals.

Cod-liver oil is also a useful agent, and may be given in conjunction with the lacto-phosphate of lime. In some cases with anemia the syrup of the iodid of iron and manganese is efficient.

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## CHAPTER XVI.

### CHANCROID, OR SOFT CHANCRE.

**Synonyms.**—Non-infecting chancre; Chancre mou, Chancrelle (Fr.); Chancre (Germ.).

**Definition.**—A local contagious ulcer (usually of the genitals) of high inflammatory grade and very destructive. It is entirely distinct from syphilis as a disease. Its effects do not invade the entire system; it may be inoculated into many different parts of the body, and in each case a soft chancre would be the result; this is not the case with syphilis.

**Etiology.**—The usual mode of conveyance is by actual contact in the act of coition, by which means the pus is conveyed. The disease may also be transmitted by means of the fingers, towels, or instruments.

**Clinical History.**—These ulcers have but a short period of incubation, appearing in a few days after inoculation. The first appearance upon mucous membranes is as a minute yellow spot, surrounded by a bright red area. This yellow spot grows larger, forming a pustule, the superficial part of which comes away, leaving an ulcer of irregular shape. The edges are sharply cut and abrupt, being somewhat undermined. The bottom of the ulcer is uneven and covered with light yellow pus.

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## CHAPTER XVII.

### SYPHILIS.\*

**Definition.**—A chronic infectious disease, first manifested in a local lesion, afterward appearing in every part of the organism.

**Nature and Course of the Disease.**—A certain point in the body is infected with the syphilitic virus, and after a period of invasion lasting from ten days to two months a chancre is sure to appear at the exact point of infection. This so-called “hard chancre,” or primary sore, marks the beginning of the second period of incubation, during which time the entire system is becoming infected. Usually within ten days after the appearance of the chancre the lymphatic glands in the immediate neighborhood begin to enlarge, and become indurated, forming what is known as the syphilitic bubo.

At the end of the second period of incubation the entire system has become infected; this usually occurs within three months from the appearance of the chancre, and is manifested by general

\* Syphilis, in its history, evolution, and course, involving as it does every organ and tissue of the body, and expressed by such a variety of symptoms, would seem out of place in this work if discussed in detail, therefore only a general idea of the disease will be given, with especial consideration of its infectious nature and the importance of preventing the infection of dental operators and their patients.

malaise, headache, and pains in various parts of the body. There is also an eruption of papules or vesicles upon the skin, which upon breaking down form pustules; these become dry, but a progressive ulceration is going on beneath the scab.

The secondary stage of syphilis usually lasts from a year and a half to two years, when, if treatment has been neglected, the so-called tertiary symptoms appear, which simply mark a further stage in the progress of the disease. These lesions are, as a rule, more localized but of a deeper and more serious nature, affecting the internal organs and bones. It is slow in progress, usually, but often very destructive.

**Etiology.** *Modes of Infection.*—Infection may take place in three ways: 1st. By actual contact. 2d. By mediate infection. 3d. By hereditary transmission.

Infection by the first method is by far the most common, the syphilitic secretions being conveyed by personal contact to an abraded surface, by which they are absorbed.

By the second method infection is produced by means of instruments or other articles which have on them some of the syphilitic virus, which is thus brought in contact with some abraded surface of the body. As vehicles for transmitting syphilis in this way, we may mention dental and surgical instruments, and such articles as pipes, cigars, drinking-vessels, knives, spoons, razors, towels, sponges, children's toys, candies, etc.

The third method, by hereditary transmission, indicates a conveyance of the effects of syphilis from parents to offspring.

**Manifestations of Syphilis within the Oral Cavity.**—The initial lesion of syphilis often occurs on the lips, usually at the site of a fissure. In point of frequency the tongue is next attacked, then the gums and tonsils. A chancre on the lip (see Plate II.) has been mistaken for cancer, but cancer is painful, more irregular in outline, occurs nearly always on the lower lip, and lacks the ivory hardness of a syphilitic chancre. It also resists treatment, which is not usually the case in syphilis. A chancre on the tongue appears flat, slightly raised, smooth, and red; its indurated edges are sharply defined.

In the *secondary* stage, gummatous tumors may form on the lips and on nearly every part of the tongue, being common on its sides and base. The soft palate and nasal cavities may also be involved. Wherever these tumors exist the appearance is char-



PLATE III





acteristic; they begin as a small round tumor, which increases in size but may ulcerate at any time, causing great destruction of tissue. There is generally no pain connected with the development of these tumors, but there may be seen a surrounding redness and induration. If the induration be absent, or slight, it should be remembered that this deposit of tissue constituting the hard and firm condition surrounding these tumors is formed in a gradual manner, and that it may be in the first stages when the examination is made.

In the *tertiary* period the bones of the jaws may become necrosed, causing much destruction and inflammation, loosening and loss of teeth, etc.

**Diagnosis.**—Many of these syphilitic conditions may be confounded with various forms of pyorrhœa, but by attention to the description of the lesions, the history, and the results of treatment a diagnosis may be formed. It should be remembered that the soft chancre is rarely found in the mouth, and that it presents no indurated circumference. Epithelioma or other cancerous lesions are attended with more or less pain, and other skin lesions are not usually found.

Aphthous patches may resemble small ulcerated gummata, but the absence of induration and of other lesions, with the temporary character of aphthæ, should determine the diagnosis.

**Effect of Syphilis upon the Teeth.**—Syphilis, like other infectious diseases, interferes with nutrition, and in many cases may arrest development, which is later shown in pits, notches, and irregular formations of the teeth, but it does not appear that any type of defect in the teeth can at the present time be exclusively connected with a syphilitic cause. It is well known that the Hutchinson condition (a crescent-shaped notch in the permanent incisors) and other deformities may be seen in patients who have never had syphilis either primary or inherited. On the other hand, syphilitic patients often present a well-formed set of natural teeth.

**Treatment.**—The medical treatment consists mainly in the administration, during the earlier or secondary stage, of mercury in some form; while in the tertiary stage potassium iodid is more plainly indicated. These remedies are specific, and their effect, when intelligently used, is remarkable. Sometimes mercury and potassium iodid are combined with advantage. Cleanliness of the parts, with antiseptic washes and other hygienic means, are necessary.

## CHAPTER XVIII.

## RHEUMATISM.

## ACUTE RHEUMATISM.

**Synonyms.**—Rheumatic fever; Acute articular rheumatism.

**Definition.**—A disease affecting the entire human system, characterized by fever and inflammation of the joints, with a tendency to inflammation of the serous covering and lining of the heart.

**Etiology.**—This disease may occur at all seasons of the year, although it appears to be more prevalent in temperate climates than in the polar regions. It may also occur at any age, although the largest number of cases occur between fifteen and twenty-five years of age. A moist and damp condition of the atmosphere is supposed to invite an attack, and yet the disease has been very prevalent in climates which are remarkably dry. There is no doubt that a predisposition to rheumatism is inherited. Exposure to cold and dampness, especially when the body is heated and perspiring, will probably excite an attack in the predisposed.

**Symptoms.**—An acute attack begins usually with some muscular soreness, accompanied by darting pains of a neuralgic character; also pain on movement of certain joints. As the attack progresses the digestive organs indicate an inflammatory action, as seen in the coated tongue, thirst, lack of appetite, constipation, etc. Later the affected joints are swollen, accompanied by the other symptoms of inflammation.

The slightest movement of the joints causes extreme pain. The affection of the joint, or joints, may travel to other parts, thus appearing successively in different joints of the body. This tendency to change from one joint to another is characteristic of rheumatism. The temperature in these acute cases usually rises to 103° or 104° F., rising and falling with no regularity, during the disease. In very severe cases, of course, all these symptoms are exaggerated. It is also noticed that there is a free perspiration having a strong acid odor.

## CHRONIC RHEUMATISM.

**Definition.**—This term simply indicates a prolongation of the acute form of rheumatism with modified symptoms according to the severity of the disease.

**Symptoms and Diagnosis.**—In the chronic form of this disease the joints, principally, are affected; they are usually more or less swollen, and their movements are restricted. Atmospheric changes, especially those marked by a falling of the barometer indicative of an impending storm, always affect the predisposed. A stiffness and soreness of the joints is noticed, more particularly in the morning, as exercise renders them supple and less likely to give pain on motion. Often the disease is present when the symptoms are not sufficiently pronounced to indicate it at first sight. In fact, the patient may not know that he is affected with such a disease. In these cases, in which the ordinary rheumatic symptoms are absent, if the patient is asked if he has neuralgia the answer will usually be in the affirmative.

Erosion of the teeth, and some of the forms of pyorrhea alveolaris, are regarded by many as true expressions of a rheumatic diathesis. For many years the endeavor to trace the connection of these symptoms, as shown in the teeth and gums, with some form of rheumatism has resulted in finding, in every marked case of so-called pyorrhea, certain symptoms, more or less marked, of a rheumatic diathesis.

**Treatment.\***—Hygiene is of the first importance. The finest wool underclothing should be worn the year round. Avoid exposure to cold and dampness. Avoid all starchy and saccharine foods, as well as an excess of salt. Also avoid malt liquors, wines, and coffee. As suitable foods the following may be named: Beef, and nearly all kinds of fish. Green vegetables, beans, peas, etc. Brown breads. Black tea. Acid fruits. Milk with lime-water.

Exercise in the open air, sufficiently vigorous to cause profuse perspiration, and followed by shower-baths with brisk rubbing, is of excellent service. Pure water should be taken abundantly, from three to five glasses before breakfast as a rule, and at other times during the day. Good results may be obtained from Saratoga Vichy water, a pint taken with each meal. One of the oldest and most reliable remedies for this disease is the salicylate of sodium. It should be given persistently in full doses unless the stomach rebels. If this should occur the salicylate of quinin may be tried. Other remedies are potassium iodid, cod-liver oil,

\*The brief outline of treatment here indicated is given with the object of assisting in the treatment of pyorrhea alveolaris.

arsenic, iodid of iron, and quinin. The different preparations of lithium, according to Bartholow, are efficacious. Tablets of lithium bitartrate (tartarlitine), suggested by Dr. E. C. Kirk, have been advocated and have produced good results. One of these tablets dissolved in one-half glass of hot water should be taken half an hour before each meal; at night two tablets may be taken before retiring. The oil of wintergreen is an efficient remedy; from five to fifteen drops may be taken on sugar or in an emulsion. The following prescription containing this oil may be found useful:

R—Olei gaultheriæ,	ʒj;	
Acidi salicylici,	ʒiv;	
Sodii biboratis,	ʒj;	
Syrupi picis liquidæ,	ʒij;	
Aquæ anisi,	ʒij.	M.

*Sig.*—Two teaspoonfuls every four hours.

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## CHAPTER XIX.

### DYSPEPSIA.

DYSPEPSIA is a term in general use by the laity, which may indicate a simple disturbance in the function of digestion or any intermediate condition between this and the more severe cases of gastric disturbance. Furthermore, this term has been constantly applied to chronic inflammation of the stomach, or chronic gastritis.

Strictly speaking, acute gastritis is almost unknown, for an acute destructive inflammation of the stomach is limited nearly always to those cases resulting from toxic causes. But the object here is to consider those less severe forms of irritation of the stomach which are of frequent occurrence. It is in this broader sense, therefore, that this term will now be regarded.

### ACUTE GASTRITIS.

**Etiology.**—An acute gastritis, so called, is usually brought about by sudden atmospheric changes; errors in diet; excessive eating; or the abuse of ices, condiments, and alcoholic drinks. The occupation and habits of life have a predisposing influence.

A very important factor in the production of gastric irritation

is insufficient mastication, due to carious teeth or the absence of teeth. This cause alone may produce a mild form of gastritis, during which acute attacks may occur from time to time.

The nose, naso-pharynx, and mouth constitute a very citadel for the habitation and propagation of various forms of bacteria. Respiration and the act of swallowing serve to convey these organisms to distant parts of the body, and it is now believed that an unhygienic nasal and oral condition is often a prominent factor in the causation of diseases in other and remote parts.

The stomach, being the direct receptacle for all substances swallowed, is especially liable to inflammatory attacks, due to organisms which have been carried there by the act of swallowing. The nasal secretions, containing bacteria, pass into the pharynx and are swallowed. The crypts of the faucial tonsils often contain offensive secretions containing great numbers of bacteria, and these are also swallowed. Teeth that have large carious cavities serve to collect and propagate micro-organisms which get into the throat during mastication and go into the stomach.

Crevices between the teeth, unclean regulating appliances, improperly constructed bridges, the pockets of pyorrhea, and ulcerated parts of the mouth, all contribute to send down into the stomach such numbers of micro-organisms that it is no wonder that the stomach rebels,—indeed, the wonder is that it is not oftener affected.

**Symptoms.**—Appetite depraved or wanting, inability to sleep, headache, occasional dizziness, and pain over the stomach are among the symptoms. The tongue is covered with a white or yellowish-white coat, and often enlarged; the sense of taste is perverted, and in the morning the mouth is pasty and covered with a bitter-tasting mucus. Nausea exists in varying degrees, accompanied by vomiting, especially if the attack is caused by indigestion. The breath is fetid and there are also eructations of gas, the result of decomposition.

#### CHRONIC GASTRITIS.

**Etiology.**—This differs from the acute form in that heredity exercises an important influence; otherwise the causes are much the same. Indeed, the majority of cases of chronic gastritis are but a continuation of the acute form, showing, however, a marked abatement of all the symptoms.

**Symptoms.**—In this form, known as dyspepsia, the symptoms are much less severe. The patient suffers especially after taking food, although he is rarely free from some disagreeable sensation about his stomach. The gases which are formed as a result of indigestion distend the stomach, causing much distress. Other organs are often displaced by this means, and another set of symptoms appears.

**Effect upon the Teeth.**—It will be seen that a collection of sticky mucus about the teeth, which is readily decomposed, not only may act injuriously upon any defect in the teeth, but favors decay by interfering with the proper cleansing of them. Besides this, during the existence of these stomach diseases there are frequent eructations of acrid vapor, as well as the acid contents of the stomach and vomited matters, which cannot fail to act injuriously upon the teeth. Moreover, the dyspeptic is limited to soft liquid foods, requiring little or no mastication; this gives the teeth no exercise, while the lack of friction favors uncleanness and a gradual weakening of the teeth with their surrounding tissues. The dentist has often observed the superior condition of teeth upon the side of the mouth where mastication chiefly occurs. A still more important consideration is the fact that a person suffering from dyspepsia does not receive into his system the proper elements which go to support the nutrition of the teeth. Furthermore, the condition of the digestive apparatus is such that whatever is received as food does not really feed the system because the materials are not assimilated.

**Treatment.**—A very brief outline of the treatment of chronic gastritis may be indicated as follows: Regulate the diet by omitting the articles known to disagree, avoiding sweet and fatty substances, and instead of these taking vegetables, such as lettuce, spinach, celery, etc. The writer has had marked success in his own practice by adopting the "skimmed-milk cure" advised by Bartholow. This treatment consists in the use of skimmed milk alone as a diet for several weeks, or even months, if necessary, when some additions to the diet may be made, such as fresh milk with lime-water. The diet may be gradually varied by using stale bread, followed by rice, and so on, as the patient can bear it. Fowler's solution, one or two drops three times a day before meals, is an efficient remedy. The simple bitters should be used with caution, being more especially adapted to atonic dyspepsia and very



mild chronic cases. Marked results have followed the substitution of artificial teeth for those which had been lost, also the filling of carious teeth so that mastication could be properly performed. This is a matter of such importance that it should not be overlooked, as it has been in the past. Cases of dyspepsia require special attention to the hygiene of the mouth. Alkaline and antiseptic washes should be prescribed, and the dentist should take particular interest to see that his directions are faithfully and intelligently carried out.

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## CHAPTER XX.

### TETANUS.

**Definition.**—Tetanus comes from a Greek word ( $\tau\epsilon\tau\alpha\iota\omega$ ) meaning "I stretch." It is an acute disease in which the voluntary muscles contract in paroxysms, due to an excessive functional derangement of the spinal cord.

**Varieties.**—*Acute* and *Chronic*.—While tetanus is designated as an acute affection, it often assumes the chronic form, in which there is a longer time between the injury and the appearance of the symptoms, and which is marked by periods of rest, affording an opportunity for the patient to recuperate, thus giving hope of recovery.

*Tetanus Hydrophobicus.*—Chiefly confined to the head, and due to infected wounds in the mouth, face, or any other part of the head.

*Trismus Nascentium.*—Tetanus occurring in the infant within two weeks from birth, due probably to infection of the umbilical cord.

*Puerperal Tetanus.*—This variety occurs after abortion or premature labor, and while it has been observed to occur after adhesion of the placenta or the use of the forceps, there is no reason for believing that there is in these cases any special cause other than the bacillus at work.\*

**Etiology.**—Tetanus is a disease that interests the dentist because it affects the jaw, and because dental diseases, as alveolar

\* See "Diagnosis" for other varieties and simulated conditions.

abscess, also tooth-extraction, produce a solution of the continuity of tissue, which may become infected with the bacillus tetani.\*

Tetanus has been popularly supposed to be due to some wound in the body, especially a punctured one; to exposure to heat, or to cold and damp following vigorous exercise with perspiration; also that the cicatrix in forming may compress a nerve or nerves and thus bring on the paroxysm. The disease was also supposed to occur idiopathically, and to be found more frequently in the negro than in other races. All the above theories, however, have been overturned by the discovery of the *bacillus tetani* by Nicolaier of Göttingen, in 1885, followed by the experiments of Kitasato in 1889, who first made a pure culture of this microbe. Later experimentation upon animals has shown that the tetanus bacillus is the cause of so-called "traumatic" tetanus, and it is likely to prove true that all other varieties of genuine tetanus may be traced to the same germ origin; for instance, we may well suppose that in the so-called "idiopathic" forms there must have been some slight lesion of the skin or mucous membrane through which tetanus bacilli entered, and the abrasion or wound healed quickly (the tetanus bacillus having no pyogenic properties), thus removing all outward manifestation of the cause.

In cases of so-called "scar" tetanus the symptoms of tetanus were probably produced by reflex action due to the peripheral injury to the nerves caused by the impingement of the scar-tissue; in such cases, therefore, we must assume that the diagnosis was at fault.

The existence of the tetanus bacillus is widespread, the micro-organism being found in garden earth, in the dust of streets, in stables, and in putrid liquids, but it is markedly anaërobic, being destroyed by the action of oxygen; thus it is that many superficial wounds exposed to the oxygen of the air do not admit of the multiplication of bacilli and the production of toxins; and this accounts to a great extent for the rarity of tetanus as a disease. In punctured wounds it is quite different; the nail, splinter of wood, or bullet, carries the bacillus deep into the tissues, where it is unaffected by the oxygen of the air, and finds a better soil for its growth. The bacillus, however, does not directly cause the symptoms of tetanus, but indirectly by means of a poison which is gen-

\* See cases in "American System of Dentistry," vol. iii. p. 489.

erated at the seat of the wound. This may be shown by taking the filtrate of a tetanus bouillon culture which contains no bacilli, and injecting it into a white mouse, and the same symptoms may be produced as those which are the result of an injection of the bacillus itself.

**Symptoms.**—The disease begins with a feeling of lassitude and weakness, often followed by sore throat and stiffness of the neck, and an inability to open the mouth widely. This becomes noticeable at meal-times, when difficulty is experienced in masticating and food is not taken, more on account of this trouble than from want of appetite. The illness increases rapidly, and in twenty-four hours the symptoms may become alarming. The teeth are clenched, the countenance gives the appearance of age and exhaustion, and the voice is changed to a feeble, inarticulate sound. At this time, while the patient may have an appetite, it is almost impossible for him to swallow food, and every attempt brings on a spasm of the throat. The muscles of the neck and back become stiff and hard, and any slight shock, such as the slamming of a door, may bring on a spasm, the patient being in a state of opisthotonos. This spasm may last for several minutes; the skin becomes dusky and covered with perspiration, and the facial expression is horrible. The term “risus sardonicus” conveys an idea of the frightful appearance of the patient under these circumstances. At this stage of the disease, it is wellnigh impossible to take food, either by the mouth or by enemata. The tongue and cheeks are bitten, and frothy saliva tinged with blood comes from the mouth; the patient is unable to sleep, and the pains, when they come on, are most distressing.

As the spasms increase in frequency the pulse becomes quick, weak, and irregular, while nearly all the muscles of the body are in a state of rigidity. This condition directly affects the respiratory organs and interferes with breathing. During this time in which the patient is sinking, dying from pain, starvation, and inability to breathe, the mind remains perfectly clear.

**Course, Duration, etc.**—Tetanus may run an acute course, terminating in death in a few days, or it may assume a chronic type, in which the intervals between the spasms are longer and the pain is not so severe. Sleep and food may be taken during these intervals and the prognosis is largely governed by the length of time between the spasms as well as by their severity.

**Diagnosis.**—In the diagnosis of this disease, the symptoms should be kept well in mind, so as to distinguish it from other diseases having some of the symptoms in common.

*Stiffness of the jaw* due to inflammatory conditions within the mouth, such as alveolar abscess or inflammation about the temporo-maxillary articulation, may be distinguished from tetanus by the absence of spasm and by an examination which will reveal the cause of the existing condition.

The writer once had a case of supposed tetanus brought to him for diagnosis and treatment. The upper and lower teeth could be separated only half an inch; there was severe pain, some swelling of the face, and general bodily weakness. Tetanus was ruled out on account of the time which had elapsed during the development of the symptoms, the absence of spasm, muscular rigidity, etc., and a diagnosis of *actinomycosis* was made.

*Hysterical contraction* of the masseter muscles and cases of severe reflex irritation may usually be recognized by studying the history of the case.

"*Tetany*," a rare disease in America, is distinguished from tetanus by the fact that pressure on the nerve-trunk leading to the affected muscles always brings on a spasm, and by the knowledge that trismus never occurs in tetany.

In *strychnin poisoning* the symptoms come on and terminate suddenly, and there is not necessarily a wound or other similar cause for the attack.

There are tonic spasms of the muscles in *spinal meningitis*, but they are not paroxysmal and there are no periods of cessation of the morbid process. In tetanus the slightest causes produce reflex spasms; this is not the case in spinal meningitis.

*Hydrophobia* has some symptoms similar to those of tetanus, but the difficulty in swallowing water and the hawking noise made in the effort to expel the viscid mucus from the throat in hydrophobia are not found in tetanus.

**Prognosis.**—The prognosis depends mainly upon the rapidity with which the case develops, and the length of time for rest and sleep between the spasms; a favorable outlook being promised when the case is late in developing, and when there are long periods in which there is a cessation of marked symptoms.

**Treatment.**—On general principles, it is important that dirt and poisonous substances should be removed as thoroughly as

possible from all wounds; but it is especially so if the wound be a punctured one into which dirt containing the bacillus tetani has probably been carried. Under these circumstances it is important that a bacteriological examination be made, taking the material for examination from the agent making the wound or from the wound itself. If some of the suspected material be injected under the skin of a mouse, and the animal dies with the symptoms of tetanus, the patient should receive proper serum treatment at once.

Experiments upon animals have demonstrated that death may be prevented by the use of antitoxin when a toxic dose has been administered, but on account of the rarity of the disease and consequent lack of statistical evidence, definite conclusions have not yet been reached as to the effect in the treatment of tetanus in man when the symptoms have become established. There is every reason to believe, however, that the antitoxic serum (there are several preparations in the market) has a true antidotal power, and that its influence upon the disease in years to come will be marked.

To briefly summarize the important points to be remembered, we may say that it is fairly well established that the antitoxin treatment has a marked prophylactic influence; that the bacteria develop very rapidly, and that large doses must be administered in proportion as the disease has progressed.

It is possible that the antitoxin does not act upon the same tissues as the toxin. The moment this poison enters the blood it begins at once to enter into combination with the tissues, afterwards acting principally upon the central nervous system. It has been claimed that the antitoxin has no direct influence upon these tissues, and if this is true it explains the slight effect of the antitoxin when it has been administered after the symptoms were fully established.

The intracerebral injection of antitoxin, first performed by Quénu and Chauffard,\* has been recently practiced by Dr. Rambaud, of the New York Pasteur Institute. This was the eighth case on record, and the first in which the operation was performed in this country; it was followed by recovery. The operation consists in trephining the skull on each side opposite the fissure of Rolando, and injecting about three cubic centimeters of the antitoxic fluid into the brain.

This direct application of the remedy into the tissues where the

\* *La Presse Médicale*, June 18, 1898.

toxins of tetanus have become fixed seems to have a more potent effect than the injection of antitoxin into other parts of the body; but one case has recently come to the knowledge of the writer in which the symptoms of tetanus were far advanced, and the injection into a vein of a pint of serum daily was followed by recovery.

The general treatment should consist of remedies which reduce the reflex irritability of the spinal cord, as potassium bromid. Bartholow advises large doses of this remedy; one or two drams every four hours, to be diminished as the spasms are reduced. All noises and other causes of excitement and reflex irritation should be prohibited.

The disease is one of great depression, and the spasms and pain exhaust the patient rapidly; therefore warm nourishing drinks, and wine or some similar stimulant, should be administered.

Ether may be carefully used for the spasms and pain, or subcutaneous injections of morphin may accomplish the same result; the injections being used only in sufficient quantities to relieve the local irritation, and care being exercised not to depress the general system. Dr. Joseph Hartshorne many years ago called attention to the efficacy of vigorous counter-irritation over the spine. Rest, quiet, and warmth are indispensable.

LOCAL DISEASES AFFECTING THE SOFT TISSUES  
OF THE MOUTH.

## CHAPTER XXI.

## GINGIVITIS.

**Synonyms.**—Inflammation of the gums; Spongy gums; Periodontitis; Ulitis.

**Definition.**—An inflammation of the gums.

**Etiology.**—The most common local causes are the retention and decomposition of food particles and mucous cells at the gum margin; the careless use of wood toothpicks; ligatures accidentally left under the gum; various wounds to the gum during certain operations on the teeth; and the wearing of regulating appliances not admitting of thorough cleansing. Besides the above-named local causes, some diseases and certain drugs when taken into the system find local expression in the form of gingivitis. Salter has demonstrated the fact that when potassium iodid has been taken internally with resulting gingivitis, the cells taken from the gum margin and submitted to a chemical test show the presence of iodine. Mercury has a similar effect. Scurvy is a systemic disease having a local manifestation in the gums, and is often diagnosed as gingivitis.

**Pathology and Symptoms.**—Ordinarily the severity of the local disease is not sufficient to produce constitutional disturbances. The gums present varying degrees of redness, tumefaction, or swelling, according to the severity of the case. Fermenting and corroding substances coming in contact with the gum often cause it to be denuded of its epithelial covering and to present a "raw" surface, which bleeds upon the slightest touch, and is painful during mastication or upon contact with irritating substances in food or drink. In severe cases there is fetor of the breath.

**Prognosis.**—The prognosis depends upon the cause, which, if local, can often be easily eradicated; but if of constitutional origin it may present some difficulty.

**Diagnosis.**—The only question that may arise in regard to the diagnosis is this: Have we under consideration a simple case of gingivitis, or is the inflammation present merely an expression or

symptom of some other disease? If a symptom of some other disease, a study of the symptoms of those diseases which are characterized by gingivitis as a symptom will enable one to form a correct diagnosis.

**Treatment.**—Cleanliness is the first requisite, for retention of decomposing substances in contact with the gums is usually the only and sufficient cause for the continuance of the disease. After the parts are cleansed, an astringent, such as the undiluted tincture of catechu, applied with a camel's-hair brush, is sufficient in simple cases.

If the inflammation extends over a considerable surface, and the parts are sensitive to food and drink, the combination of the astringent with an anesthetic and antiseptic will be of value.

℞—Acidi carbolici (Calvert's No. 1) gtt. xx;  
 Olei gaultheriæ, gtt. ij;  
 Tinct. catechu, ʒiv. M.

*Sig.*—Apply to the gums by means of a camel's-hair brush.

The local irritation may be acting as the immediate or direct cause, while a constitutional taint or temporary condition of the system may be the underlying and original cause. The diagnosis and treatment of these constitutional conditions must then claim attention in the further treatment of the case.

## CHAPTER XXII.

### PYORRHEA ALVEOLARIS.\*

ONE form of this disease is characterized by large deposits of calcium phosphate and carbonate around the teeth at the gingival border.

**Synonyms (1).**—Riggs's disease; Tartar; Calcic inflammation; Salivary calculus; Ptyalogenic calcic pericementitis.

Another form is determined by a thin, hard, black deposit, often far up toward the apex of the root.

**Synonyms (2).**—Riggs's disease; Tartar; Serumal calculus; Sanguinary calculus; Hematogenic calcic pericementitis.

\* This term has been made to include a variety of pathological conditions of the gum and pericemental membrane.



**Etiology.**—Opinions regarding the etiology of this disease are divided between hereditary, constitutional, and local causes. In the consideration of causes, it is especially important to designate them accurately according to their particular relation to the disease. For instance, one observer speaks of this as a cause, and another of that, without designating the cause as immediate or remote, exciting or predisposing. In order to avoid the confusion which must result from this practice, let us insist that immediate, intermediate, and remote causes shall be designated as such.

Calcareous deposits are inseparably connected with nearly all forms of pyorrhea, and while these formations may be utilized as symptoms, and properly designated as such, they also have a causal relation, and should receive some consideration at this point.

While it is true that hard formations may occur in various parts of the human body, the immediate causes must vary with the location and character of the solution from which the deposit is formed. It is generally supposed that the deposits which are formed in cavities, or ducts, are simply deposited from the fluid which has held them in solution, while those which occur within the substance of an organ or tissue are regarded as products of some nutritive irritation.

The fluid which exists in the mouth comes mainly from three sets of glands. That from the parotid contains no mucin, but  $\text{CO}_2$  and calcium bicarbonate in solution. That from the submaxillary gland contains mucin and calcium carbonate, which may be precipitated. The secretion of the sublingual gland contains still more mucin and is markedly alkaline.

The manner in which the salivary calculus is formed has been the subject of speculation resulting in the promulgation of various theories. It has been held that the saliva, holding in solution calcium carbonates and phosphates, enters the mouth from the salivary ducts, and at this time the carbon dioxid, by which the solution is held, escapes, and the salts above mentioned are deposited. But it is not known what causes the escape in one instance and the retention and perfect solution in the other. The opinion has also been advanced that the calcium salts are merely suspended in the saliva, and that they are deposited when the conditions for it are favorable.

Prof. H. H. Burchard\* has called attention to the fact that

\**Dental Cosmos* for November 1895.

along the gingival border there is a line of accumulated material which is not removed by the tongue, and which, undergoing decomposition, affords nutriment to micro-organisms that may produce substances of an irritant nature. Besides this, there also exist in this locality numerous glands which secrete mucin and whose function may be changed by the influence of the above-named irritating substances, so that the secretion itself may become irritating and injurious in its effect, and it is further stated that the degree of irritation influences proportionately the character of the calculus thus formed.

The formation of calculi in general and the varieties of dental calculi are well described in the following quotations from Prof. Burchard's paper in the *Dental Cosmos* for January 1898:

Calculary deposits found in any part of the body are formed in consequence of a precipitation of calcium salts in some organic menstruum; the calculus consists of a combination of the calcium salts with the organic material. There must first be established conditions under which calcium salts previously held in solution are precipitated. These conditions vary in different situations in the body, as also does the chemical composition of the precipitated salts and of the menstruum in which they are deposited and cemented together. The most common of the cementing materials is mucin and allied substances. In calculi found in some situations in the body, notably in the bladder and gall-duct, the albuminous stroma in which calcic material is contained is of distinctive structure, the form of the calculus remaining after the calcium salts have been removed through the action of dilute acids. . . . There are certainly five distinct varieties, —distinct in that each is associated with distinctive pathological states and chemical conditions.

Three of these classes—two of them undoubtedly—are of salivary origin, the doubtful member of at least partial salivary origin, while two of them may be fitly termed serumal, or hematogenic.

The first class consists of the yellowish-white deposits found upon the buccal surfaces of upper molars. The second class includes the calculi found first upon the lower anterior teeth, opposite the ducts of the sub-maxillary and sublingual glands. The third class comprises those dark, flattened, hard, scale-like calculi found immediately beneath the gum margin. This variety is at times associated with the first and second classes. The fourth class consists of those small nodular calculi found deep in the pockets of pyorrhea cases and upon the apices of roots in cases of long-continued apical abscess. The fifth class includes those deposits which are found upon the sides of roots in cases of gouty necrosis of the pericementum, and which exhibit in some degree a reaction to the murexide test,—i.e. which contain urates. . . .

The first class of calculi—those found upon the buccal faces of upper posterior teeth—present these features: They are yellowish-white, and are

comparatively soft and friable. They dissolve readily in dilute hydrochloric acid with the evolution of carbon dioxide, and leave but little detritus and apparently no distinct evidences of an organic stroma,—*i.e.* they are largely composed of calcium carbonate, with a minimum admixture of organic material. The parotid secretion to which they owe their origin contains a much greater percentage of calcium carbonate than of the phosphate, and instead of mucin contains a globulin. . . .

The calculi of the second class—those formed first upon the lingual faces of the lower anterior teeth—are made up, in large part, of calcium phosphate combined with mucin. Like the previously described form they may contain dead epithelial cells, leptothrix, and foreign materials. A foreign substance which has found lodgment frequently acts as the nidus of a deposit. A rough or irregular surface will also determine a point of deposit. . . .

The next variety of calculus—the small, dark, scaly deposits found beneath the gum margin which excite the most common and most curable variety of pyorrhea alveolaris,—is intimately associated in its formation with a pre-existing marginal gingivitis. After having formed, these calculi act as persistent irritants to continue the gingivitis and excite degenerative changes in the pericementum. This is the variety of calculus usually described as serumal. Furthermore, all deposits upon tooth-roots other than those described have been included under this head,—an error of classification, as will be seen. . . .

When, however, gingivitis has been excited by the presence of calculi of the first and second classes, the hard, sparse calculus frequently forms beneath and about the edges of the first calculus at its point of contact with the gum.

The presence of these deposits excites progressive degenerative changes and destruction of the retentive apparatus of the tooth, the pericementum and alveolar process, in a distinctive manner. There is a recession of pericementum, which keeps pace with the atrophy of the alveolar wall. The walls of the pocket between the soft tissues and the tooth become infected early by pyogenic organisms, and pus-formation occurs, hastening the pericemental destruction. If the tooth be extracted at a comparatively early date, a dark, scaly calculus is seen to occupy the cervical portion of the root; beyond this is an area of tooth-denudation in which no deposits are found, and toward the apex the shreds of the thickened pericementum. There is always a space between the pericementum and calculus, showing that detachment or loss of the pericementum is in advance of the calculus. If the tooth be extracted or examined after pyorrhea (pus-flow) has persisted for a long time, it is common to find the areas of denudation lying beyond the primary calculus to be incrustated by numbers of small, hard, dark, nodular deposits, which lie in the area of necrosis as small islands. This is the fourth variety of calculus,—called a variety because its appearance has such an association with long-continued suppuration that it seems a consequence of such conditions. . . .

The next, or fifth, class of calculus is that regarding which there has been so much controversy during the past five years,—gouty calculi. These

deposits may be associated with the subgingival calculi and those of pyogenic origin, so that much confusion has arisen from the lack of discrimination.

A typical gouty incrustation presents these features: A tooth exhibits the symptoms of acute apical pericementitis; a bistoury passed into the apex of the swelling over the root may give vent to a glairy, mucus-like discharge, or, in some cases, pus flows. A further examination may reveal the loss of underlying alveolar wall; exposing the root, which is partially denuded of pericementum in this area of denudation, the presence of a calculus is detected. The pulp responds to tests for its vitality, and the gum margin and marginal pericemental attachment appear to be intact. A chemical test of the calculus shows it to respond in some degree to the murexid test,—*i.e.* it contains urates. These deposits in their typical form are irregular and more friable than either the subgingival deposits or the other root-deposits named. The bulk of the calculus is made up of calcium phosphate, a common associate of deposits of urates in other parts of the body.

It has been stated that pyorrhœa is a catarrhal process: but what is catarrh? It may be applied to various conditions of mucous membrane throughout the body, but in America the term is usually understood to indicate an inflammation of the mucous membrane of the air-passages. If, as has been stated, pyorrhœa alveolaris has its origin in the oral cavity and is a catarrhal process, being due, as is claimed, to the same influences that produce catarrh in other regions, then we should be likely to see the catarrhal process in surrounding parts. But this is not the case; many cases of catarrh exist with no sign of what is called pyorrhœa alveolaris. It is argued that particles of dust, shock from colds, and changes of temperature from breathing through the mouth, cause a catarrh of the oral cavity in much the same way as it is produced in the nose; but as a matter of fact we do not hold that nasal catarrh or rhinitis is produced in this way; and besides, the function and structure of the nasal mucous membrane and the turbinated bodies are altogether different from those of the gum tissue and mucous membrane of the mouth.

Pyorrhœa alveolaris and nasal catarrh are found in a large proportion of patients, and it is therefore not an uncommon occurrence to find these two diseases associated in the same person, as other distinct diseases often occur together; for example, hay asthma and ordinary rhinitis, or stomatitis catarrhalis and stomatitis herpetica.

If the disease is catarrhal, why does it attack the pericementum and contiguous tissues to the exclusion of the entire mucous mem-

brane of the mouth? This is a disease of adult life, but it is not infrequently observed in young people under fifteen years of age. It cannot be said to exist more commonly in those whose diet is luxurious than in those who live on plain food. In regard to the condition of health, many pass the dentist's observation as physically sound who are really not so; for many a strumous diathesis lurks beneath a fair skin and ruddy appearance. When the physical examination becomes more searching, thorough, and exact, the systemic conditions will be revealed and the cause found.

The successful treatment of diseases depends largely upon the detection and elimination of the first cause; for there are first, second, and third causes, much after the manner of a row of bricks in which one falls upon the other until those at a considerable distance feel the effects of the fall of the first. This is why a permanent cure of pyorrhea is not effected when the calculus, or the direct cause, has been removed, for, if previous causes continue to act, the deposit will be formed again.

Statements have been made to the effect that if the tartar deposit could be eliminated from the list of causes of pyorrhea the disease itself would practically disappear, to which answer may be made that the way to eliminate the tartar as a cause is by removing the constitutional condition which produces it; and the difficulty of doing this explains the inability which all practitioners have in curing disease.

It has been said by Dr. M. L. Rhein, of New York, that "Every known disease that afflicts the human organism often manifests itself as pyorrhea alveolaris, and in many it is the first marked symptom."

Pyorrhea has not been noted as being an accompaniment of tetanus, diphtheria, or psoriasis, and the same may be said of it in its relation to most other diseases. No one will deny the possibility of pyorrhea occurring incidentally during any of these diseases; but this is quite a different thing from noting it as being inseparably connected with one or all of them. In order to connect pyorrhea with any of these diseases it should occur during the disease and disappear with it also.

Dr. Cravens believes that the cause of so-called serumal calculus is in the pus itself, and that it should be called pyonal calculus. Dr. Geo. B. Clement, of Macon, Miss., holds that the lesion within the socket is a disease or the result of a disease of the

cementum; that there is an obstruction of the canaliculi and lacunæ which is the result of a deposit of lime salts, thus solidifying the cementum and cutting off the vital connection between it and the pericementum.

The late Dr. Thomas Evans, of Paris, reported that he had observed many cases of pyorrhea connected with affections of the kidneys, and predicted that pyorrhea will come to be recognized as a manifestation of kidney trouble. Others regard pyorrhea as one of the symptoms of gout.

Prof. C. N. Peirce has described two different pathological states included in the term pyorrhea alveolaris. He believes that the pericementitis is in each case associated with a calcic deposit; but that the origin of one is in the saliva, and that of the other is in the blood. Prof. Peirce presents two terms, original with himself, to designate these conditions. The form of so-called pyorrhea having its origin in the saliva is termed ptyalogenic calcic pericementitis, with the intention of conveying the idea that its origin is local, peripheral, and salivary. The form having its origin in the blood is termed hematogenic calcic pericementitis, expressing the idea that in its origin it is constitutional, central, and associated with some modification of the normal composition of the blood-plasma. Dr. Peirce found that upon the removal of the deposit from teeth which were lost in consequence of this form of pyorrhea, the chemical analysis showed in every case that the deposit was a combination of calcic urate and sodic urate with some calcic phosphate and carbonate. The existence of the urates, in which uric acid is the predominating element, shows that the deposit is a precipitate from blood-exudation, that the irritation is of constitutional origin, and that the disease pyorrhea alveolaris is but another phase of the uric acid or gouty diathesis. The explanation of the presence of uric acid has not been given, but the fact has been established of its presence in the blood, of its non-diffusibility and consequent retention, and the formation of the urates found in many portions of the body. In view of these facts Dr. Peirce states:

Inasmuch as all portions of the body have been shown by pathologists to be liable to uric acid deposits, it is not at all strange that the alveolo-cemental membrane, composed largely of connective tissue, should also become a depot for uric acid deposits. It is more than probable that as a predisposing cause there might coexist some impairment in the nutrition of this membrane dependent upon either local mechanical force or some

obscure faulty innervation. However this may be, the mere presence of these salts leads to the conclusion that here as elsewhere they are derived from the blood by or through the medium of the lymph-stream. With the absorption of the excess of lymph, the residual salts become precipitated upon the cemental surface. It is for this reason that I regard the deposition of uric acid as of blood origin, and the disease pyorrhœa alveolaris as one of the local manifestations of the constitutional state familiar to all pathologists as the uric acid or gouty diathesis. Assuming now that the deposition of uric acid salts is the primary cause of this form of pericementitis, what would naturally be the successive stages in its evolution? As the current of the lymph-stream is directed for the most part toward the cementum, through its borders or periphery into the lacunæ and canaliculi, and finally in the reverse direction, it is not difficult to see why the deposit should take place on the surface of the cementum as well as in the meshes of the alveolo-cemental membrane. The constant deposition and pressure of these insoluble salts will act as irritants, engendering the well-known inflammatory states, viz. congestion, exudation, impaired nutrition, tissue-disorganization, and formation of pus. These changes take place here as elsewhere in the immediate vicinity of the irritation—that is, on the cemental aspect of the membrane—leading to its detachment from the cementum and the development of a pus-pocket.

It is the writer's belief that the disease known as pyorrhœa alveolaris is in nearly every case the result of a constitutional diathesis; that the teeth are in these cases the victims of the local manifestation; that the diathesis, in whatever form it may be, manifests itself in other organs besides the teeth; and that to demonstrate the connection of a diathesis with the teeth it must be shown, not that its symptoms always coexist with pyorrhœal symptoms, but that the condition of the pyorrhœa varies in intensity with the condition of the diathesis; or, to put it another way, that curing the diathesis cures the pyorrhœa. If removing the teeth, followed by a cure of the local pyorrhœa, proves the disease to be local, it is still necessary to point out the local cause; for the teeth themselves cannot be held to be a cause, since in that case every one so unfortunate as to have teeth would pay the penalty with pyorrhœa. Moreover, constitutional symptoms may yet be found to be present. If it is held that poison, at first local, has infected the whole system, still we ask for the origin of the local manifestation, and may even expect that, when the teeth have been removed, tartar will not collect on artificial plates and the constitutional symptoms will disappear or at least improve in a reasonable degree, provided structural change and otherwise permanent injuries have not taken place.

It is of course acknowledged that the immediate or direct cause may be readily seen in the irritating foreign body known as tartar, or the deposit of whatever character; but in order to cope successfully with the disease, we must look for a cause back of this, and if possible find the first cause. It is possible not only that constitutional derangements and diatheses may be unperceived by the ordinary observer, but also that persons in whom they exist may be unaware of any abnormal or unhealthy condition; for instance, a patient of twenty-four years has an offensive ozena, and certainly has a constitutional diathesis underlying this condition; but this patient presents a healthy appearance, and there are no other symptoms of physical disturbance. It is to be supposed, therefore, that many conditions of the teeth and gums in persons otherwise in good health are due to an obscure constitutional taint, such as that of scrofula or rheumatism. The writer had a patient, a physician, the subject of diabetes, whose teeth had loosened to an alarming extent with so-called pyorrhea; after an exclusive anti-diabetic diet they began to tighten and the deposit ceased to accumulate, and this condition has been maintained for nearly two years.

**Pathology.**—On inspection, the ordinary and so-called pyorrhoeal cases present a pocket or space between the tooth and gums from which there is a flow of pus, which may be profuse or very slight. The gum shows varying shades of red to purple. To quote Prof. Miller, of Berlin: "Pyorrhoea alveolaris is a chronic suppurative inflammation of the periosteum with more or less severe inflammation of the gums and necrosis of the alveolar process of the diseased teeth."

Dr. W. C. Barrett thus describes further the pathology of this disease:

The pocket once formed and infected with septic organisms, an irritation and inflammation of the vascular tissues succeeds, perhaps due to the more direct action of the fungi, or possibly consequent upon the changes in the tissues beneath; with an osteitis and caries of the bone due to the secondary products of the growth of the organisms, and a suppurative condition of the pericementum dependent upon a pyogenic organism. All of these pathological changes are possible because of some predisposing diathesis, or a condition of atony.

It is well understood that accretions may form in any part of the body as a deposit from purulent matter in an inflamed area, and, although there are some differences of opinion, the following seems to be a rational explanation: Calcareous matter is normally



contained in the blood, being held in solution by carbon dioxid. When the circulation is impeded from any cause the diffusible carbon dioxid is absorbed by the tissues, or combines to form new compounds, thus leaving the calcareous matter to be deposited. In regard to the destruction of the alveolar process and the pericementum, while it is not denied that it is a necrosis, in some forms of this disease it appears as a process of absorption, governed by the laws which usually determine bone-softening. Prof. C. N. Peirce thus speaks regarding this subject:

If the periosteum of any bone becomes the seat of inflammation, an exudation is poured out from its inner surface, which is in close contact with the compact tissue. The exudation exerts pressure on the bone, interferes with its nutrition, and in consequence leads to softening and absorption. If the tension be not relieved by the removal of the exudation, the softening increases and necrosis results; but if the pressure be removed in sufficient time, the progressive pathological state never passes beyond the stage of softening and absorption. In pericementitis the effusion exerts a pressure in both directions, toward the cementum and toward the alveolar process. The constant pressure of the exudation would, by interference with the nutrition of the process, lead not only to softening and absorption, but to necrosis also, if it were not that, as the pus accumulates and the pressure rises, the fluid takes the line of least resistance and burrows toward the gum margins, and so relieves the pressure on the alveolar process before complete strangulation of the tissues takes place; but, as the pressure from pus-accumulation rises and falls from time to time, there will be periodical compressions with some pain, and gradual absorption. If necrosis of the process should, however, occur in any appreciable amount, we should have it demonstrated by exfoliation and sequestration.

**Symptoms.**—The apparent condition, or symptom, that appears in the cases of large deposits of salivary calculus is at first a slight reddening of the gum at its margin, caused by a deposit so slight that an instrument may be needed to detect it; but if it should be allowed to collect, its size might increase to a degree only limited by the space. As a rule the concretions are broken off by the patient, often after attaining a size much larger than the tooth itself. As the deposit increases, the inflammation of the gum augments and destruction of all the approximating tissues goes on as the deposit advances upon them, thereby loosening the teeth; but they are not as a rule painful or tender to the touch. This process may go on, accompanied by fetid breath and a disagreeable taste in the mouth, and followed by indigestion with all its symptoms and consequences, until the teeth are lost.

In the serumal form the advance of the disease is more stealth-

ily accomplished, there is less inflammation of the gums, less absorption, and consequently less loosening of the teeth; often the only diagnostic sign being the ability to pass an instrument under the gum beyond the health limit. When this deposit is unaccompanied by the salivary form, it may take years to produce serious or noticeable symptoms.

**Duration.**—The disease is unlimited in duration, with a tendency to increase with age. It may, however, subside or disappear with some physiological change in the patient's general condition.

**Prognosis.**—Unfavorable as to cure.

**Diagnosis.**—Attention to the pathology and symptoms will afford ample means for diagnosis. The salivary form is unmistakable. The only difficulty, if any, will be in making a differentiation between the serumal form and phagedenic pericementitis; or possibly the latter may be simulated by an alveolar abscess which discharges at the margin of the gum, in which case, however, the condition would be confined to the teeth thus affected.

**Treatment.**—The treatment has hitherto consisted almost wholly in local measures, and principally in the removal of the foreign body. In all the forms it is absolutely necessary to remove all irritating substances. If there is a physical disability in any part of the system, whether we are clear as to its direct causation of the pyorrhea or not, it would be well to treat this condition with a view to helping the body to resist the local influence. In the absence of definite constitutional causes it is evident that there can be no specific systemic treatment. There are many cases having large salivary deposits, and other forms of deposit, in which there is no apparent deviation from perfect health, but in which there exists nevertheless a diathesis, or some inherited constitutional taint, that finds local expression in many ways; in such cases we cannot advise experimenting with drugs, but can only remove the deposits and treat the resulting pocket and inflammation. The recent methods of doing this are as follows: By means of the various scalers the deposits are removed as thoroughly as possible (and this will apply to all the varieties), after which some acid solvent is applied to dissolve any remaining particles.

There are two acid solvents which have been commended, viz. a twenty-five per cent. solution of sulfuric acid, and a saturated solution of trichloroacetic acid. For the application of these remedies orange-wood sticks, shaped very thin like a chisel scaler and

scared by passing through the flame of an alcohol lamp, may be dipped in the acid, and passed down along the root much in the same way as a scaler would be used. In removing the deposits, by whatever method, care should be taken not to lacerate the soft tissues. The remaining deposits being thus dissolved, two things are to be done, viz.: 1st. To remove the softened and detached particles of deposit; 2d. To neutralize any remaining acid. The first may be accomplished by means of a hypodermic syringe with a needle having a smooth, rounded point, from which some antiseptic solution is thrown forcibly under the gum. Such solutions may contain mercuric bichlorid 1 to 2000, or three per cent. pyrozone.

Another method of removing débris from the pockets is that in which the above solutions are sprayed into the pockets by an atomizer connected with a tank of compressed air, which throws a warm spray with great force. And still another method consists in the use of a very fine and nearly smooth broach wrapped with cotton, which after being dipped in some antiseptic solution is passed around the root.

The second essential thing to be accomplished has been partly done in the effort to wash out the remaining particles of the deposit; but to make it certain that all acid is neutralized, a paste of sodium bicarbonate should be introduced into the pocket. Following this, Dr. James Truman advises the introduction into the pocket of a paste of quinin sulfate which remains until the next sitting, in two or three days. Dr. Truman advises the further use of quinin at subsequent sittings, and prescribes the following mouth-wash to be used indefinitely:

℞—Hydronaphthol,	gr. xx;
Alcoholis,	
Aquæ,	āā. ʒj. M.

*Sig.*—Half a teaspoonful of the above to a small tumbler of water, to be used twice a day, in the morning and before retiring at night.

In the subsequent treatment by the patient much care should be exercised in order not to reopen wounded surfaces, and to this end a syringe should be employed to direct a small stream of water against the parts for cleansing purposes.

As a safe astringent to place in the patient's hands, the writer has made use of the tincture of catechu, applied full strength with a camel's-hair brush. Much may be done by careful instruction of the patient in the use of the tooth-brush.

If the teeth are very loose, it is essential that some appliance be placed so that they may be held firmly, for it is obvious that while the teeth are moving to and fro, no attachment can form, and no union or healing take place. In cases having the deposit near the apex of the root it has been recommended that such teeth be extracted, the root cleansed, the canal filled, and the tooth replanted; all being done under antiseptic conditions. It would seem that the success of this operation would depend largely upon the amount of tissue destroyed; if there is much loss of membrane, it might be a better practice to replant a sound tooth obtained from some other source.

Nitrate of silver has considerable prominence as a remedial agent in pyorrhea, and good results have been obtained. The remedy is certainly efficacious and has a wide range of application, but it stains the teeth. The powdered crystals may be taken up on a thin, moistened orange-wood stick, or fused to the end of a platinum point, made very thin for this purpose.

During all methods of treatment, the fact should be kept steadily in mind that asepsis in the mouth always acts favorably on the disease.

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## CHAPTER XXIII.

### PHAGEDENIC PERICEMENTITIS.\*

**Definition.**—A destructive inflammation of the peridental membrane.

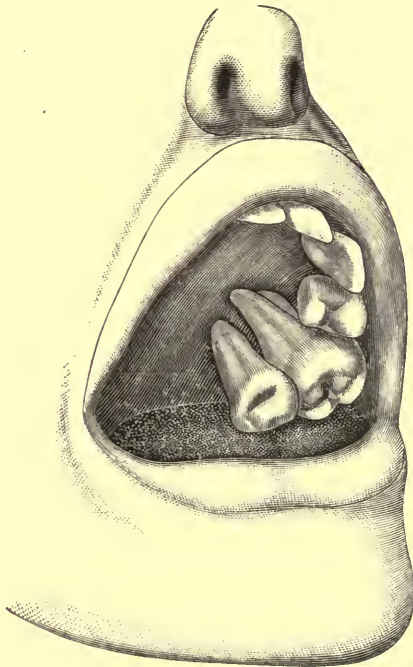
**Etiology.**—The etiology of this form of pyorrhea, by reason of its close relation to the other forms, is likewise obscure. In its beginning it may not be distinguished from an ordinary gingivitis, and during its course may be accompanied by some of the other forms, thus obscuring the diagnosis. The part which micro-organisms play in the causation of this disease has not yet been determined.† They are always present, and germicidal remedies have a beneficial effect.

\* This term, suggested by Dr. G. V. Black, indicates a condition nearly always classed as pyorrhea alveolaris, from which it is, however, essentially different in several particulars.

† See editorial in the *Dental Cosmos* for November 1898.

**Pathology.**—The prominent characteristics of phagedenic pericementitis are the destruction of the peridental membrane and absorption of the alveolar process. This may take place without calculus of any kind. The membrane is destroyed as it is separated from the root of the tooth. The gums may be inflamed, but not necessarily so. (Fig. 9.) As the destruction of the membrane goes on, a very slight space or pocket may be formed, which

FIG. 9.



Phagedenic pericementitis. (The illustration, taken from life, shows what the author believes to be the results of this disease, following its earlier and acute stages. The teeth are now quite firm, considering the small area of attachment; there is no inflammation, and the disease does not appear to be progressing at the present time.)

contains pus. This may occur upon any part of the root, or at several points at the same time.

As an example of an acute form of the disease, Dr. Black cites several cases, one of which is given here: A lady who had consulted her dentist only a month before calling on Dr. Black, was informed that no disease could be found. When she came to Dr. Black she showed him a tooth which she had removed two

days before with her thumb and finger. An examination revealed the disease in progress about the roots of several remaining teeth. In this case there were no deposits, and the other usual evidences of inflammation and disease were so slight as to be unnoticed by the dentist. Many cases, however, have been accompanied with pain and inflammation of the surrounding soft tissues. (See Plate III.)

It seems, therefore, that in this form of pyorrhea, while the cases are usually accompanied by deposits, these are not necessary to the destruction of the membrane, which apparently goes on just as rapidly when there are no deposits. Besides this, in cases having deposits an examination of the root and membrane will show that the destruction of the membrane has proceeded beyond the limit of the calculus.

**Symptoms.**—The expressions of this condition vary with the length of time it has been in progress. When it is uncomplicated we may say there are no deposits. After a time pockets are formed which are deep, but not broad, as in those cases accompanied by a calcareous deposit.

There is often looseness of the teeth, and in acute cases pain. The gum is not usually inflamed, but has receded in proportion to the time the disease has been in progress. The exposed dentin is sensitive, and the teeth are often sore on shutting them together. The writer has seen oral conditions which he believes to be symptomatic of this disease, in which there was swelling and redness of the gum, tenderness on percussion of the adjacent teeth, but no discharge of pus or abnormal separation of the gum at its margin; but these symptoms disappeared after a few weeks, during which time constitutional treatment was employed.

**Prognosis.**—The prognosis is generally discouraging, as relating to cure. The treatment is palliative and prophylactic, and sometimes the disease may thus be held in check or retarded for an indefinite period.

**Diagnosis.**—In forming the diagnosis a suitable exploring instrument is passed under the gum, for the purpose of ascertaining the amount of destruction of the pericementum, if any; and to examine for absorption of the alveolar process. The destruction of the pericementum and absorption of the alveolar process are the main features by which it is distinguished from other forms of pyorrhea.

PLATE III.







One should look for gouty and rheumatic symptoms, although they are not always markedly pronounced, and in some cases seem to be wanting altogether.

**Treatment.**—The difficulty in treatment consists in the inaccessibility of the parts affected. If foreign particles or calcareous deposits have formed near the apex of the root, in my opinion they cannot be thoroughly removed without turning aside a portion of the soft tissue, in the form of a flap, which will expose the surface to be operated upon; or extracting the tooth, which, after being treated, is replaced. It is important after every surgical procedure of this nature that all blood-clots be washed away, as they may decompose and thus hinder the process of repair. Zinc chlorid, twenty grains to the ounce of water, is an excellent astringent to apply to the pocket or parts operated upon, and a ten per cent. solution of nitrate of silver is also a remedy upon which great reliance is placed. This constricts the dilated vessels and is otherwise of benefit.

This should be followed by a stimulating treatment such as the application of carbolic acid one part and oil of cinnamon two parts; this is antiseptic as well as stimulant. Campho-phénique may be used in the same way with good effect.

Sponge-grafting is not to be commended, on account of the impossibility of maintaining an aseptic condition of the sponge after it has been placed in position.

Replantation has not shown successful results, for the reason that cases in which it has been practiced have been so far advanced, and as its reliability has not been fully tested the practitioner may well be reluctant to adopt such a radical measure in the early stages of the disease, hoping to stay its progress by a less risky method.

Systemic treatment in these cases should be directed toward the prevention and removal of urates, or other systemic disturbances; but cases have not yet been tabulated, nor have a sufficient number been treated in order to form a definite opinion in regard to it.

## CHAPTER XXIV.

## DIFFICULT DENTITION.

**Definition.**—Difficult or abnormal dentition is a departure from the normal and purely physiological process, attended with pain and various other symptoms.

**Etiology.**—That normal dentition frequently passes the borderline which marks the limit of a physiological process into a pathological one is well established. The eruption of the deciduous teeth occurs at a time of life when the organism is extremely delicate and susceptible, and at a time which is well known to be the period of greatest mortality. The organism, being thus in a state of physiological activity, is more easily influenced by causes which tend to produce a pathological condition; besides, the nervous and vascular excitability of teething must make an extra drain upon the vital forces at this time, thus rendering the organism less able to combat any injurious influence that may arise in any part of it.

This being true, we are justified in assuming that diarrhea, convulsions, irritating and painful conditions of the gums and associate parts, may be due to teething as an exciting cause, the action of which was made possible by the existence of a predisposition either inherited or brought about by improper food or clothing, indigestion, etc.

Dr. James W. White, in the *Dental Cosmos* for November, 1890, speaks as follows regarding the sympathetic and physiological relations of the mouth to other parts of the organism:

Anatomically considered, no other portion of the human organism offers such a complex association of tissues as those which compose the mouth: no other has such diversified physiological functions, and, from a pathological standpoint, no such significant systemic relations. Its various offices (those of the oral cavity) necessitate a no less varied organization and an equally varied relation with other structures. The wide circle of its anatomical and physiological sympathies suggests an equal circle of pathological complications, and indicates the diversity, as well as the gravity, of the disturbances dependent upon systemic relations to which its lesions may give rise. By means of its lining mucous membrane the mouth is related by continuity with the pharynx, esophagus, stomach, and intestinal tract, the larynx, trachea, and bronchia, and by contiguity as well as by continuity with the eyes, ears, nares, and antra. But it is to direct or sympathetic

nervous relations that the most formidable disturbances resulting from an interference with the erupted process are to be attributed. The terminal distribution in and about the mouth of the sensory and motor branches of the trigeminus, its extensive topographical connections and their relations to the heterogeneous tissues and manifold functions concerned, and its association with the great sympathetic,—thus connecting the teeth with the entire organism,—explain the liability to aberrations of sensation, nutrition, and motion, when its termini are the seat of disordered sensibility. . . .

The profound disturbance which may be excited in an infant by even a slight functional disorder is a matter of common observation. A little irritation of the larynx will produce spasmodic croup, a little indigestible food may cause convulsions, and almost any excitant may provoke vomiting. . . . The balance between health and disease in an infant is delicately adjusted, and a slight disturbance will incline it to one or the other side.

Cholera infantum is undoubtedly aggravated by the process of tooth-eruption, which many believe may be considered a concomitant cause; but we take into consideration also that at this age there is great functional activity and development of the intestinal follicles, and thus a greater liability to this disease.

Dr. C. N. Peirce says:

Purely normal dentition depends upon a complete correspondence between the development of tooth-germ and its calcification at its base, or growing extremity, and the absorption or otherwise removal of the overlying structures; so that, as the soft structures are solidified, the previously formed and dense part of the tooth will be lifted from its base, and thus prevent impingement upon the uncalcified germ, which produces constitutional disturbance. When this is indicated the lancet should be thoroughly used, that for the time the obstruction to the advancing crown may be entirely removed.

**Pathology.**—The pathology of teething involves nice points of distinction, for while this process is purely physiological, it is always active and excessive, and approaches so nearly the borderline between physiology and pathology that it has often been pronounced pathological when in reality it was only a physiological process in a high state of activity. Again, when the process has quite clearly passed into a distinct pathological condition, there are those who hold that tooth-eruption is still a normal process, and consequently needs no local treatment, systemic conditions being treated independently.

There are certain signs which should distinguish a pathological condition from a physiological one, and if the general condition is such that it produces a local disturbance in the mouth connected

with teething, it ought surely to be recognized and treated accordingly.

On inspection of the mouth, we must determine whether the redness of the gums is normal, taking into account the fact that pressure of an advancing tooth may cause a blanching of the overlying tissue. This condition, however, may be better understood when other symptoms and conditions are noted. We may then say that there is an abnormal redness to be expected in certain cases, and following this, tumefaction and ulceration.

The surrounding parts, such as the tongue, cheeks, and lips, may be similarly affected by acid secretions, which are usually present.

Pathological conditions of other and remote parts of the body are also said to be induced by the process of dentition. These conditions are indicated by various symptoms; for instance, obstinate vomiting, or convulsions, ceasing only when the teeth have perforated the gum.

**Symptoms.**—In looking for the local symptoms of difficult dentition we should make allowance for certain expressions or symptoms which accompany the eruption of the teeth, but which are physiological; for instance, the increased flow of saliva, which is normal; also a certain amount of discomfort which this occasions by overflowing the mouth and irritating the skin; and the general uneasiness depending upon the unusual but not abnormal amount of tissue-change necessary to the process of tooth-eruption. The discomfort of which we have just spoken causes the child to seek relief by carrying the fingers, or any hard substance, to the mouth and biting,—a symptom recognized in every household.

This normal process may pass into a pathological condition, the symptoms becoming more pronounced; the gums are now painful to the touch, swollen, and often of a glassy or glistening appearance. The color may vary from the redness of the earlier stages to a darker color, although the erupting tooth may cause anemia of the gum immediately over it. The extent to which the general system is affected depends upon the severity of the local irritation. Diarrhea is often present, but even this, in a limited degree, need not be considered pathological. If severe and protracted, it demands attention as being injurious and out of the range of physiological action. Through reflex irritation various systemic disturbances may occur, as eruptions of the skin, nervous

derangement, as shown by fretfulness, inability to sleep, loss of appetite, etc.

A continuance of these symptoms may lead to still further and more serious results. Many of the original symptoms continue, but are exaggerated; the little patient cries out, even in sleep, and becomes more fretful and uneasy, until the delicate nervous system can stand the strain no longer. There is then a lull from exhaustion, broken by convulsive sobs; the temperature and thirst increase; the eyes have a peculiar brightness; muscular twitchings are noticed, and the child closes the jaw tightly, or grinds the teeth; these latter symptoms give warning of approaching convulsions.

Although ordinary tooth-eruption should rarely be held responsible for the development of chorea, there is no doubt that any irritated condition of the teeth and surrounding parts may bring about an attack. Reports of cases show that impacted teeth, persistent temporary teeth, and non-erupted teeth have caused chorea, and in a majority of such cases extraction or other treatment has cut short the attack.

Infantile paralysis is also classed among the diseases incident to dentition; and in the *Lancet* for February 28th, 1860, Dr. Brown-Séguard speaks of a case of paraplegia in which the paralysis appeared at the very beginning of the second dentition, and increased and decreased alternately during and after the cutting of each of the three molars. Dr. Fleiss, in the *Journal for Sick Children*, says:

When a child during the first or second dentition is suddenly seized with paralysis in one arm, or of the whole side of the body, or is affected in only a part of the same without any obvious external cause, this is to be considered as a paralysis from dentition, and an accurate examination of the mouth will confirm this diagnosis, for the teeth will be found firmly compressed with the gums.

This article mentions other reflex disturbances, such as affections of the eye and ear, insanity, etc., and concludes with the following:

Here, then, we have on the highest authority a long list of the many ailments that may be consequent upon disordered dentition. Just how this occurs in some instances it is difficult to determine, but it has been thoroughly established that dental irritation may induce pathological conditions in other organs of the body, or in the nervous structures themselves, even without the existence of any subjective intimations of pain in the teeth; and it is therefore necessary for a practitioner to distinguish in each individual case whether the disorder is consequent upon some derangement

of the teething process, or upon an abnormal condition of some other organ or organs, of which the dental difficulty itself is but a symptom.

There are those [says Dr. Berg] who believe dentition cannot be productive of any serious pathological disturbances, but they are of right in the minority. When it shall have been proven that other physiological processes, like puberty and the cessation of the menstrual flow, are never productive of serious morbid states, then we shall give credence to such a view; for the present it is emphatically the opinion of the vast majority of authorities that teething is frequently the only assignable cause of some of the diseases occurring during the dentitional epoch.

**Diagnosis.**—There can be no reasonable difficulty as to the diagnosis of teething, for the age, the increased flow of saliva, the desire to bite something, the appearance and condition of the gums, should be sufficient to enable one to form a conclusion as to the character of the disturbance. The more serious difficulty arises when we are called upon to decide whether teething is an essential factor in producing other diseases or expressions of disease in remote parts of the body. In the consideration of this question, two things should be borne in mind, viz. that it is possible for other causes to co-operate with teething to produce convulsions and constitutional disturbances, and that another cause, such as an overloaded stomach, may be sufficient in itself to produce these expressions entirely aside from teething. In view of these facts it is well to eliminate other possible causes, so far as possible, before deciding that teething alone is responsible.

**Treatment.**—For the immediate relief of the congestion and possible pressure of an advancing tooth, lancing the gums not only assists in removing this condition, but relieves blood-pressure in the surrounding parts as well. Caution should be used in this as in other surgical procedures, to avoid operating when a hemorrhagic diathesis exists. The time-worn statement that teething is a normal process, and that on that account no surgical interference should be permitted, does not apply to the condition which we are considering.

Nothing could be wider of the mark than the supposition that we advocate gum-lancing at a time when all the parts involved are in a physiological condition. Dentition is physiological in many cases (it should be in all), while in others it begins and is for a time carried on within the physiological range, gradually merging, however, into the pathological. When it has reached this condition, it is then time to render any surgical or medical aid that may be within our command. Again, there may exist in

the mouth an excessive yet physiological action, which in a susceptible organism may be the exciting cause of remote disturbances, to be considered later. We have mentioned gum-lancing as one of the first indications in a severe case in which the gums are swollen, tender, hot, and painful, and when the eruption of teeth is otherwise shown by constitutional symptoms.

In the operation of lancing the gums the child should be held in the lap or against the breast, and the operator may then proceed as he would in operating upon the teeth. It does not seem necessary that the head should be held between the knees, as is often advocated.

The lancet should have only a small cutting surface, not over a quarter of an inch from the point, this being either straight or curved in the form of a bistoury. If the lancet used has a long cutting surface, it should be wrapped in linen or other protective, and as an additional precaution the finger should be placed against the blade at a short distance from the point to guard against accidental cutting.

The incisions should be made in accordance with the object in view, viz. to make the cut directly over the cusps of the advancing tooth, and of sufficient length and depth thoroughly to liberate them from any pressure of the gum over them. If one or more cusps protrude through the gum, it is not always proof that there is no necessity for lancing. An incision over an incisor or cuspid should be made to correspond with the cutting edge of the tooth; while over a molar there should be made a crucial incision, thus, X.

The following quotations show the opinions of authorities in regard to lancing the gums in difficult dentition.

Dr. J. W. White says:

If these views be correct, it is evident that there may be cases in which a train of morbid symptoms is presented, ending possibly in convulsions and death, without the existence of a single local indication. It is not, therefore, a sufficient reason to abstain from lancing the gums, that they exhibit neither tumefaction, redness, induration, nor the whiteness of the presenting tooth, though there is generally some external local manifestation. If, however, there be no obvious explanation for the occurrence of untoward symptoms during the period of dentition, it seems the part of wisdom to give the child the benefit of the doubt by free incisions over the tooth whose eruption is in accordance with the general laws to be anticipated, even though there be no hyperemia of the gums; especially as the operation causes only a trifling amount of pain, inflicts no injury, and is practically free from danger. Local indications demand the lancet;

constitutional symptoms of distress not otherwise accounted for suggest and justify it.

If the positions assumed as to the etiology of the morbid phenomena connected with dentition be correct, it follows that the lancing of the gums over the erupting tooth is the procedure which should be promptly resorted to, as that most essential and most likely to afford quick relief; unless, indeed, it can be shown that there are valid objections to the operation. The objection most frequently urged is that unless the tooth is erupted before there is time for the wound to heal, a cicatricial tissue is formed which offers increased resistance. This argument is in contravention of recognized facts as to the reparative process. Cicatricial tissue is always of a lower degree of organization than the original structure, and consequently easier of absorption. The uniting medium in the repair of a solution of continuity possesses less vitality, is less perfectly nourished, and is easier of disintegration than the original tissue. The tendency of scar tissue to break down is a matter of common observation even among the laity, and except in the case of gum-lancing is not disputed by any medical authority. Gum tissue offers no exception to the general rule.

In the proceedings of the Boston Society for Medical Observation the following opinions are expressed:

Dr. Rotch reported a case of a child nine months old who had had some difficulty in cutting the lower incisors at eight months. The child began to suffer from pain, was sleepless, cried persistently, and had fever. Potassium bromid and breast-milk were rejected; the temperature rose to 104° F., and there was retention of urine. After twenty-four hours the gums, which were swollen and tense, were lanced. Within two minutes after this the child fell asleep for twenty minutes. Its temperature was then 102° F. After another hour the temperature was normal; the child nursed, and had no further trouble.

Dr. F. C. Shattuck said that he had never performed the operation, never having seen a case, either in private practice or in a large dispensary and Massachusetts Hospital out-patient experience, in which it seemed to him indicated.

Dr. Porter recalled the case of a child who had been in apparent pain for forty-eight hours, was restless, and would not leave its mother's arms. The gums were swollen, so he lanced them in four places, and in a few minutes the child was asleep. So soundly did it sleep that the mother was alarmed, and feared it was dead. There was no further trouble at that time. He had always lanced the gums of his own children when there was swelling and irritation.

The subsequent treatment should depend entirely upon the



condition of the patient as indicated by the symptoms. If there is undue heat with tenderness of the gums, soothing local applications may be found in bits of ice placed in the mouth, or in bathing the gums with cold peppermint-water. Solutions of cocain for this purpose should be used with the greatest caution.

It would be quite impossible for such local irritation to exist without being recognized by the general system. Aside from special and well-defined disturbances that may arise reflexly, proceeding from the dental irritation, more or less general irritability may be expected, with a possible rise in temperature.

These conditions should be met, usually, by sedatives having a soothing effect on the entire nervous system; but all depends upon the condition of the patient. It is possible for local and general irritation and pain to occur while the system is in the extreme opposite condition from plethora; indeed, anemia, with adults, is a common predisposing cause of neuralgia, and under such circumstances tonics, not sedatives, are indicated. For the anemia some form of iron may be administered. If a scrofulous diathesis exists, syrup of iodid of iron, or cod-liver oil, is indicated. If there is a plethoric condition, sedatives, and possibly antiphlogistic remedies, as aconite, should be prescribed. The writer prefers sodium bromid to the potassium salt and would suggest the following as a general sedative in the milder cases:

R—Sodii bromidi,  
 Sodii bicarb.,                      āā. gr. xvj;  
 Aquæ menth. pip.,                      ʒj.    M.

*Sig.*—A teaspoonful in a wineglassful of water every two hours to a child from six months to two years old.

The condition of the bowels should be noted and treated, always keeping in mind the general strength and vigor of the patient. In a strong, vigorous child, a free movement of the bowels should be maintained rather than checked; and if constipation exists, a saline cathartic should be given. If the condition of irritability is beyond the control of ordinary sedatives, the camphorated tincture of opium is the best remedy for children. If convulsions should occur, one effective remedy is the immersing of the child in as warm water as can be borne, taking care not to have the water too hot for its delicate skin. As a medicine, potassium bromid is the antispasmodic remedy; two to five grains in water for a child six months to a year old.

Diarrhea often accompanies the teething process, and the

treatment of diarrhea should always be governed by its cause or causes, so far as they can be ascertained.

We quote the following from Dr. J. W. White's paper on "Diseases Incident to the First Dentition":

In all infants, especially in those artificially fed, there is a tendency to an acid fermentation of their food, due partly to the character of the food and partly to the peculiar activity of the mucous glands, either in response to a local irritant or to a reflex impression causing a modified secretion, or to an extension of a local irritation. Flatulence, pain, vomiting, and diarrhea are the natural results of this condition of the alimentary tract. Attention to the condition of the mouth; to the hygienic management of the infant; and especially to its diet as to quantity, quality, and frequency, should precede the employment of drugs. A flannel bandage around the abdomen will serve as a derivative, and if desired, may be made more effective by rubbing powdered spices or dry mustard on the surface, or by sprinkling it with turpentine mixed with sweet oil. A change or modification of diet is frequently advisable, and a change of air will often act like a charm. Under all circumstances it is well to limit the amount of food to the quantity just sufficient to sustain life, in order to afford the digestive organs physiological rest. The union of an alkali with an aromatic is indicated, and a grain of the bicarbonate of sodium or of potassium with anise, cinnamon, or caraway, will prove of advantage if given with each meal until the condition is corrected.

If undigested food or vitiated secretions in the alimentary tract are suspected, a dose of castor-oil and aromatic syrup of rhubarb in equal portions (a teaspoonful of the mixture) will be of great service. If torpidity of the liver is diagnosed, a few doses, at intervals of two hours, of  $\frac{1}{8}$  or  $\frac{1}{12}$  of a grain of calomel, with one or two grains of sodium bicarbonate, will be likely to correct the condition. If the diarrhea persists after the action of the purgative, the following prescription may be employed, first prohibiting the use of any farinaceous or milk food. Indeed, if all food be withheld for from two to six or eight hours, and be then given in very small quantities, the effect on the digestive tract will be very beneficial.

℞—Tinct. opii,	gtt. viij;
Bismuth. subnitrat.,	ʒj;
Mucilag. acaciæ,	ʒss;
Aquæ menth. pip.,	ʒjss. M.

*Sig.*—A teaspoonful every three hours to a child six months old.

Opium is indicated, however, only after all offending matters have been expelled from the alimentary canal. Its chief value then, is to lessen peristaltic action; but it is, at best, a choice of evils in the mal-digestion of infancy, because of its interference with the normal secretions of the digestive fluids. Opium is sometimes beneficial when combined with small doses of a purgative,—half a drop of laudanum to twenty or thirty drops of a mixture in equal proportions of castor-oil and spiced syrup of rhubarb, given three or four times daily.

Diarrhea may be the result, more or less directly, of reflex nervous irritation, and in such cases the object is to pacify the nervous system. This condition is often characterized by profuse watery stools, showing active fermentation; deranged stomach, headache, and restlessness. Treatment of this combination of symptoms is imperative, as it may lead to cerebral congestion and convulsions.

℞—Potassii bromidi,	ʒj;	
Syrupi simplicis,	ʒss;	
Aquæ menthæ pip.,	ʒjss.	M.

*Sig.*—A half-teaspoonful in water every hour or two.

If the stomach irritation is prominent, the above potassium salt may not be well borne, in which case minute doses of sodium bromid, one-half grain in a little water every fifteen minutes, should be substituted.

Chamomile is said to have a marked effect upon reflex excitability, and it may be administered in the form of an infusion of the flowers, one-half to one dram for a child less than one year old.

Constipation may coexist with teething, and when it does the treatment is quite as important a matter as in the opposite condition of diarrhea. Suppositories of cacao butter or molasses candy may be used with good effect when it is desirable to avoid the stomach; otherwise castor-oil and simple syrup in equal parts, with the addition of a drop or two of the oil of gaultheria, is a good remedy. If the constipation is persistent, cod-liver oil may be administered, beginning with the ten-drop doses and increasing. If, on the other hand, it is temporary, calomel, in doses of one-tenth of a grain, will be effectual.

## CHAPTER XXV.

### SALIVARY FISTULA.

**Definition.**—A salivary fistula consists of an opening or canal extending from the outside of the face to the excretory ducts within the mouth, usually the duct of Stensen.

**Etiology.**—The causes of salivary fistula are usually dependent upon some traumatic injury or an abscess, or upon the result of

certain imperfect surgical procedures. Any means whatsoever, be it surgical or the result of an insidious and slowly progressing disease, which establishes a communication of the ducts of the mouth with the outside of the face, is a cause of salivary fistula.

**Symptoms.**—An artificial opening in the face from which issues saliva, at once indicates salivary fistula. An inquiry into the history of the case will reveal its origin as indicated under the head of etiology. The symptoms, past and present, will be governed somewhat by the cause. Certainly the condition is an extremely uncomfortable one, some of the worst forms being those which are produced by sloughing due to ptyalism. The loss of saliva, at all times an important if not essential fluid in the human economy, is a positive drain upon the system, and may impair digestion and otherwise disturb the normal condition of the mouth. Therefore complications may arise, perhaps of an inflammatory nature, which will require treatment.

**Duration.**—Salivary fistula may continue an indefinite length of time unless treatment is employed to prevent it.

**Treatment.**—The principles of treatment consist mainly in changing the direction of the artificial orifice and in closing the opening upon the cheek. When the fistula is the result of a recent wound, all that is usually required for this purpose is the simple twisted suture and a compress with a bandage. If, however, considerable time has elapsed it may be necessary to pare the edges of the opening in order to place them in a condition favorable to healing. If the fistula is caused by abscess or ulceration, effective treatment may be found in the use of nitrate of silver, which may be applied by means of a glass or silver probe on which some of the crystals are fused; this forms an eschar in which granulation tissue springs up, and the saliva gradually finds its way into the natural channel.

In the more obstinate cases Dr. Homer suggests the following treatment: The head being properly supported, a broad wooden spatula is introduced into the mouth opposite the site of the fistula, and with a large punch the whole of the diseased structure is removed, and the opening in the integument is immediately closed with the twisted suture. In cases in which the inner orifice of the fistula is nearly obliterated, Prof. Gross suggested the use of a thick, well-waxed silk cord, passed through the fistula, brought out at the corner of the mouth and tied upon the cheek. When

the opening into the mouth has become re-established, the seton may be removed and the external wound closed.

Dr. J. L. Crouse has reported the following case of salivary fistula, stating that it was of interest on account of the operation being different from that usually mentioned in text-books, and on account of its favorable result:

The patient, a girl of five years, had injured herself four months before by falling upon a sharp piece of wood, which entered her cheek. The greater part of the foreign body was removed at the time of the injury, but subsequently several smaller pieces came away. The wound discharged all the time, and not seeming to get any better, the mother brought the patient to the clinic of the Medical College of Ohio. She presented, on the left cheek, midway between the angle of the mouth and the concha of the ear, a linear cicatrix, vertical in direction, of one and a half inches in length. At the upper border of the same there was a large vesicle filled with turbid fluid. This, the mother said, would burst every now and then, discharging the watery contents over the cheek. As long as there was a free outlet to the secretions the patient complained of no disagreeable symptom, but when the opening closed, then pain as well as swelling of the parotid region supervened.

On August 4th, three months after the injury, both ends of a silver wire were passed through the external opening into the buccal cavity; the free ends of the wire were then twisted in the mouth, and the external wound closed. The object of the wire was to maintain an opening between the injured duct and the buccal cavity.

On September 5th, thirty-two days after the operation, the wire was removed and the recovery was found to be complete.

Dr. Henry Morris reports the treatment of a case as follows:

A shoemaker came under my care in the Middlesex Hospital, on June 24, 1879, bleeding from several incised wounds, one of which was about two inches long, and vertical in direction, along the right cheek. On June 28th, saliva was seen trickling from the lower end of this wound, which was all but healed. The patient now stated that since the injury the right side of the mouth had felt very hot and dry, and that he had constantly to moisten it by carrying the fluid from the left over to the right side of his mouth. A fine catgut bougie was introduced at the oral aperture of the duct, and passed onward toward the parotid gland until it emerged on the cheek through the fistula. The newly healed wound was laid open, and the proximal end of the injured salivary duct searched for, and found by squeezing the parotid gland until a little saliva was forced out of the duct. Into this the point of the bougie was inserted and pushed onward for about half an inch. The edges of the wound were brought together with three hare-lip pins and twisted sutures, and the bougie cut short, so that the short end, not long enough to be caught between the molar teeth, was left protruding into the mouth from the slit-like orifice of the duct. The patient at once appreciated a marked differ-

ence in the feeling of the right side of the mouth, which was now in all respects like the other side, and he could distinctly feel saliva trickling into it. On July 4th the bougie came away accidentally. The wound on the cheek had been all but healed for four days, but a little discharge still escaped at its lower end. On July 9th a little saliva was still escaping; cotton wool and collodion were therefore applied over the wound until July 15th. By this date the wound was securely healed and all the saliva flowed freely into the mouth. The man was retained in the hospital for a few days longer, and was then discharged well.

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## CHAPTER XXVI.

### SALIVATION.

**Definition.**—An abnormally excessive secretion of saliva caused by some agent acting either locally or systemically.

**Synonyms.**—Ptyalism; Ptyalismus acutus sympatheticus; Mouth-watering.

**Etiology.**—One form of excessive secretion of saliva may be caused by the sight, smell, or thought of appetizing food. This is purely physiological; also the condition in which there is superabundant salivary secretion in young people and children, the result of hereditary tendencies or the normal teething process, has no pathological significance.

Salivation which is the result of some pathological action may be seen in connection with inflammations of the oral mucous membrane, as in ulcerative, aphthous, catarrhal, or mercurial stomatitis. Salivation also takes place during certain stages of such diseases as dengue, parotitis, smallpox, scurvy, hysteria, and hydrophobia; it may also take place during dentition and pregnancy.

Of medicines which increase the flow of saliva, mercury is the one which takes nearly all the blame. Other preparations have a similar action, such as copper, lead, gold, antimony, bismuth, potassium iodid, arsenic, castor-oil, pilocarpin, and iodin.

**Pathology.**—In severe cases there are always accompanying local changes from the normal to pathological conditions, as indicated by pericementitis or gingivitis with its various stages from

sponginess of the gums to ulceration and sloughing. The presence of stomatitis indicates a spreading of the effects to other parts, and a more general disturbance.

**Symptoms.**—The increased flow of saliva is naturally taken as the one characteristic symptom; there is also to be noted a coppery taste in the mouth, followed by swelling and tenderness of the gums. The breath soon becomes fetid, and the teeth become loose. The tongue, as the pathological condition advances, becomes large and flabby, covered with indentations at its sides corresponding to the spaces between the teeth. The teeth are hypersensitive to percussion, and the simple gingivitis which occurred at first may go on to extensive swelling and ulceration, and even gangrene. The face and neck may become swollen, and the glands in this vicinity inflamed, tense, and tender through septic absorption. The swelling and tenderness prevent opening of the mouth, deglutition, and speech. It should not be surprising to note that the entire system sympathizes with this condition, as indicated by heat of the skin, quickened pulse, thirst and loss of appetite.

The duration of this condition varies to a great extent, depending much upon the peculiarities of constitution in different individuals. With some patients it may last only a few days, while in others the time may be extended for months after the primary cause has been removed.

**Treatment.**—Mild cases may need no special treatment, as they get well in a few days after the mercury or other cause has been discontinued. In severe cases treatment is demanded, for there may be severe pain which must be relieved by some anodyne,—as, for instance, ten drops of deodorized tincture of opium in water every half-hour till relief is afforded, or until three doses have been taken; after which an interval of three or four hours should elapse before the administration is continued. As an internal corrective of salivation, potassium chlorate may be administered in doses of five to fifteen grains three times daily, dissolved in a liberal quantity of water or lemonade. This remedy may be useful also as a wash, locally; one or two drams being dissolved in a pint of water, and used every three hours. It may be noted here that potassium chlorate is not without poisonous effects, as well as the fact that many of its alleged therapeutic qualities have been seriously questioned in recent years.

If there is much inflammation, non-irritating warm douches should be used; later, when the severe symptoms have subsided, applications more decidedly astringent may be employed. For this purpose one of the best is Goulard's extract (liquor plumbi subacetatis).\* One dram of this may be added to eight ounces of water, and applied every two hours. The following prescription will be found useful:

℞—Aquæ,	℥xv;	
Tinct. catechu,	℥j;	
Aluminis,	℥ij.	M.

*Sig.*—Mouth-wash.

Also an excellent mouth-wash, possessing antiseptic qualities as well as a mild astringent effect, is the following prescription, formulated over fifteen years ago:

℞—Acid. carbolicæ (Calvert's No. 1),	gtt. xv;	
Olei gaultheriæ,	gtt. ij;	
Aquæ,	℥ijss;	
Tinct. cardamomi comp.,	℥iv.	M.

*Sig.*—Mouth-wash. Rinse the mouth four times daily.

Ulcerated spots may be touched with trichloroacetic acid, or nitrate of silver, using a finely pointed glass tube. It may be well to administer some cooling laxative, such as a Seidlitz powder or magnesium sulfate.

## CHAPTER XXVII.

### RANULA.

**Definition.**—Ranula is a peculiar form of tumor having its origin under the tongue and caused by obstruction to the flow of saliva, or mucus from the glands beneath the tongue. The term ranula may include several other forms of sublingual swelling.

**Etiology.**—Many cases of ranula occur in young people from fifteen to thirty years of age, yet, as congenital cases have been reported, and also instances occurring in older people, we are hardly justified in designating age as a causative agency. In tracing the steps by which a ranula is formed, we first notice the condition, which is essentially that of an encysted tumor. Now, in order that this tumor may be formed there must be an obstruc-

\* It discolors the teeth temporarily, but is without permanent injury.



tion in the canals or orifices of the excretory ducts leading from the glands. There may be an inflammatory adhesion, or gluing together of the walls; or some substance may obstruct the free flow of secretion, which accumulates, causing absorption by pressure, as well as dilatation of its walls, until a tumor is formed possessing properties as described.

This obstruction may occur in minute follicles or conglobate glands, or it may take place in the duct of Wharton or other larger ducts; or it may, according to Fox, depend upon an inflammation of the bursa which is placed between the genio-hyoglossi muscles. Again, cysts such as we have just described may form in the mucous membrane of the lips or cheeks, or in mucous surfaces in other parts of the body.

**Pathology.**—As a matter of observation, the sublingual gland is rarely the subject of calcareous formations. Prof. Gross met with only one such concretion, which he removed from a man fifty-four years of age. The concretion caused for several weeks severe local distress, attended with great difficulty in moving the tongue.

Paré describes a case of ranula in which there were five concretions, the largest of which was the size of an almond, causing a large abscess under the tongue. Whether the obstruction occurs from inflammatory adhesions or from adventitious substances within the canals, there is, in the course of time, enlargement of bloodvessels, absorption of the walls of ducts, and swelling. The contents which have accumulated may be of a thin consistence, very like the secretion itself, or they may be thick and cheesy.

**Symptoms.**—The symptom first attracting attention is a swelling in the vicinity of the lower jaw, which may show externally; indeed, in some cases the swelling may rapidly extend down the neck to the clavicle, and alarming symptoms, such as fever and obstructed breathing, may arise, which will require immediate and radical treatment. In ordinary cases the swelling seldom exceeds the size of a pigeon's egg, and may usually be found either on the side of the tongue or beneath it.

The onward progress of the condition called ranula is usually slow, and causes little or no suffering; therefore it does not usually affect the general health. In some cases a ranula may be years in developing, and in others a serious condition may arise in a few hours; all depending upon the cause, or upon the general condition of the patient.

**Prognosis.**—The prognosis is generally favorable, if correct treatment is employed.

**Diagnosis.**—Ranula may be distinguished from other tumors by its location, its grayish, translucent aspect, not unlike the belly of a frog (whence its name), its irregular oval shape, and the fact that its contents upon puncture are of a glairy, ropy consistence, like the white of egg; bearing in mind that in cases of long standing the contents may vary from the above-described consistence and color to a substance of a yellow, oily nature, often thick and cheesy. Sometimes gritty particles, concretions of the phosphate and carbonate of lime, are found.

**Treatment.**—There are varying circumstances which should govern the treatment of ranula; for instance, the age, size, and consistence of the tumor. In mild and recent cases the most satisfactory results are obtained by excision of a portion of the sac, in the form of an oval flap, and the brushing of the surfaces with tincture of iodine, full strength. The wound suppurates, and soon heals by the granulation process. In some cases the seton is effectual, and in others the injection of tincture of iodine is sufficient. The injection of two drops of deliquescent zinc chlorid into the sac has been recommended, but it has also met with objections on account of the very severe pain which it produces, as well as the frequent lack of success in its use.

A modified seton may be employed in the following way: Thread a curved needle with black iron-dyed silk, a double thread, and having passed the needle through the cyst, remove it and tie the ends of the thread so that a loop projects sufficiently to enable the operator to move the thread back and forth every other day, till there is no discharge. The thread may be then removed and the openings allowed to close by the granulation process.

When the tumor is large and its contents are hard, extirpation of the whole mass is necessary. An incision may be made along the side of the tongue, and the flaps of mucous membrane turned aside, when, with the handle of the scalpel, the mass may usually be turned out.

Dr. T. F. Prewitt described a case before the American Medical Association as follows:

G. M., aged fifteen, presented himself on May 6, 1882, having a swelling under the left lower maxilla, nearly as large as a goose-egg. It fluctuated freely, some portions of it seeming hard, however, and projected also into the mouth under the tongue, though the swelling here was not very great.

A diagnosis of ranula was made, and a portion of the cyst-wall in the floor of the mouth was excised. A quantity of clear, transparent mucoid fluid escaped, spurting out several feet as the cyst was excised. In the course of two or three weeks this had contracted, and threatened to close, when catheterization was resorted to.

In the meantime a ranula had appeared under the tongue upon the right side, with translucent, bluish, thin walls, but not projecting beneath the jaw; this also was treated by excision of a portion of the cyst-wall. In July the young man ceased to present himself; the orifice closed, the sacs rapidly filled, and Dr. L. again brought him to me in an alarming state from threatened suffocation. Both ranulæ were swollen and painful. Upon the left side the swelling extended well down toward the clavicle and sternum, and across the trachea in front. Upon the right side the ranula was greatly swollen, meeting that upon the left side under the chin in a continuous swelling. Both inspiration and expiration were obstructed; the young man was flushed and feverish. From the rapidity of the occurrence of the symptoms and their increasing gravity it seemed as though tracheotomy might be necessary. I incised the cysts freely, permitting the free escape of the accumulated fluids, and directed hot fomentations to be persistently applied. This gave speedy relief to all urgent symptoms. As contraction took place I again resorted to catheterization, with the view of preventing reclosure. This was persevered in for two or three months, and was more effectual upon the left side, for the reason that the bougie, a soft, conical rubber, about 15 French, could be passed down for two inches and could be felt below the margin of the jaw.

Upon the right side a probe only could be used, and when its use was intermitted for a few days the opening would close completely. I determined, therefore, to make a permanent opening by a plastic operation upon that side. Carefully dissecting off the mucous membrane of the mouth over the cyst, denuding a surface as large as a nickel, I then incised the cyst-wall, turned it over, and tacked its free edge to the border of the mucous membrane of the mouth with fine silk sutures, thus, as it were, binding the opening in the cyst with mucous membrane, and interposing an effectual safeguard against its closure. Union by first intention took place, the stitches were removed on the third day, and an orifice was secured that has remained patulous to this time.

Dr. C. Lovegrove recommends the following treatment in some cases of ranula: Pass a tenaculum through the base of the tumor and draw the part somewhat forward. After withdrawing the thicker part of the tenaculum a little, pass a plain gold ring, such as is used when the ears are first pierced, by the side of the tenaculum through both holes; then clasp it securely, and leave *in situ* for three or four weeks; then remove. A permanent exit for the mucus, etc., will then remain, and all trouble will cease.\*

\* A description of a large ranula, accompanied by a tumor of a different character, is described in the *Dental Cosmos* for July 1881, page 389.

LOCAL DISEASES AFFECTING THE DENTAL AND  
SURROUNDING BONY TISSUES.

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CHAPTER XXVIII.

DENTAL CARIES.

**Synonyms.**—Caries; Decay.

**Etiology.**—Prof. Miller notes the following causes to which, at different times, decay of the teeth has been ascribed: Depraved juices in contact with the teeth. Disturbances of nutrition. Inflammation. Worms. Putrefaction. Chemical dissolution. Parasites. Electrolytic decomposition. Chemico-parasitic influences. Diverse causes.

Hippocrates wrote of the first of the above-named causes as early as 456 B. C. Similar explanations of caries were given by Krautermann in 1732, Bourdet in 1757, Benj. Bell in 1787, and Kappis in 1794.

For further data in relation to these different causes, the reader is referred to Dr. Miller's work on "Micro-Organisms of the Human Mouth," page 120 *et seq.*

The essential factors concerned in decay of the teeth may be named under three heads, viz.: 1. A defect in the tooth-structure. 2. A decomposable substance. 3. Bacteria.

The defect in the tooth-structure may have its origin in a congenital condition or it may be due to some accident by which the tooth is scratched or broken, or to the corrosive action of ferment-producing organisms, favored by irregularity and crowding of the teeth. When once the smooth surface of the enamel is broken, the defective place affords lodgment for food and secretions of the mouth; this, aided by lactic-acid-producing bacteria,\* which are

\* Organisms which, in the presence of starches and sugars, cause a ferment and produce lactic acid, which decalcifies the enamel and dentin. Since Dr. Miller's investigations, Galippe and Vignal have succeeded in isolating six different kinds of acid-forming organisms from the decay of teeth. Prof. Jung, of the University of Berlin, has, by using solid media which permitted treatment at the temperature of the mouth-cavity, succeeded in isolating ten different kinds from dental decay. We may consider it settled that the decay of teeth is not due to a specific bacterium.

ever present in the mouth, makes the breach larger, and they feed upon the decomposing material.

Thus we have what might essentially be termed a chemico-parasitic process, although the starting-point may be the result of a mechanical action. The principal factor is the lactic acid, which is formed by the action of organisms upon starchy and saccharine substances, and which finds its way into crevices and spaces between the teeth. Other acids may be present in the mouth and assist in the decalcifying action on the teeth; for instance, acid fruits, as lemons and grape-fruit; the drink known as acid phosphate; the acid contained in medicines, or that in the saliva as the result of certain diseases, such as rheumatism, gout, various forms of dyspepsia, etc.

When the dentin is reached, on account of its canals the process of dissolution by bacteria goes on much more rapidly than the decalcification of the enamel, which is a solid substance. After decalcification by the acid, the albuminous basic substance of the dentin is dissolved by micro-organisms which, according to Miller, have the power of peptonizing or converting it into a soluble modification. Again, there are also bacteria which have both the powers above named; they may, by means of acid-production, act in the first stages of decay, and at the same time play a part in the dissolution of the dentin.\*

**PREDISPOSING CAUSES.**—The character of the "tooth-structure" has always been considered an important element in the action of dental caries. Although the subject is imperfectly understood at the present time, it is thought that the vital resistance to caries is alike important with density of tooth-structure. We may well believe that in vigorous health the organic structure of the dentin is supplied with a material endowed with increased vitality and power to resist decay. The oral fluids, etc., constituting the environment of the teeth, must, in a condition of health, be less favorable to the progress of decay. The position of the teeth, including the relation they bear to one another, is also an important element. A crowded condition of the teeth, affording lodgment for substances which are not easily removed, favors the carious process. Deep fissures, in the molars especially, promote

\* For a more extended reading in regard to the action of acids and for description of micro-organisms, see Dr. Miller's book on "Micro-organisms of the Human Mouth," pages 212-215.

decay by reason of their capacity for the retention of organisms and food particles which are forced into them by the power of mastication. A "pocket" in the gum at the neck of the tooth will hold organisms and fermentable substances, and furnish all the essentials of decay.

During pregnancy there is often increased acidity, as well as an extra demand upon nutrition. The teeth are frequently neglected at this time. Pregnancy, however, is followed by a far more important period, lactation, when the drain upon nutrition and all the vital forces is indeed great. Heredity undoubtedly influences the type of the tooth, its regularity, structure, etc., and is one of the important factors concerned in dental caries.

General diseases, by lowering the vitality and nutritive supply, with resulting vitiated secretions, must be considered as concomitant causes of decay.

**Pathology.**—It has been thought that there must be first some defect or fissure in the surface of the tooth, for the conditions upon which this process depends are not found on a perfectly clean surface, but Dr. J. Leon Williams, of London, has demonstrated that over certain surfaces of the enamel there is often a hardened film, filled with organisms. These, the caries fungi, excrete, in the presence of sugar and starches, lactic acid, which slowly decalcifies the enamel, dissolving first the cement substance around the enamel rods, and afterward the rods themselves. Before the enamel breaks away, the dentin within is deeply decalcified, and decay results.

The direction of the destructive process when once begun is that of the dentinal canals, although there are cases in which, by anastomosing canals, the carious process spreads laterally.

The color of these affected structures varies with the rapidity of the carious process. At first it is white, and in rapid decay remains so in a degree proportionate to the rapidity, but if the decay goes on slowly the superficial layer becomes stained by long exposure. This protects the deeper structures by preventing the entrance of those agents upon which caries depends, and not infrequently arrests decay. In the carious process, various grades of tooth-destruction may thus be seen at different points. A cavity which has been formed is evidence that complete destruction has taken place at that point, beyond which may be found different degrees of softening, and lastly, a zone of partially softened dentin lighter in color, which adjoins the normal structure.

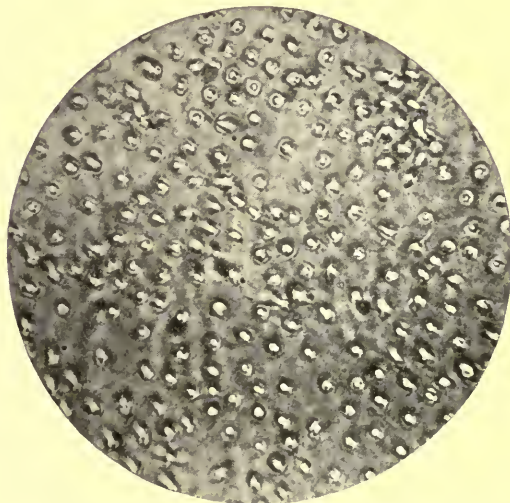
Dr. R. R. Andrews has kindly furnished the accompanying specimens illustrative of dental caries.

FIG. 10.



Normal dentin. Longitudinal section, showing canals. (DR. ANDREWS.)

FIG. 11.

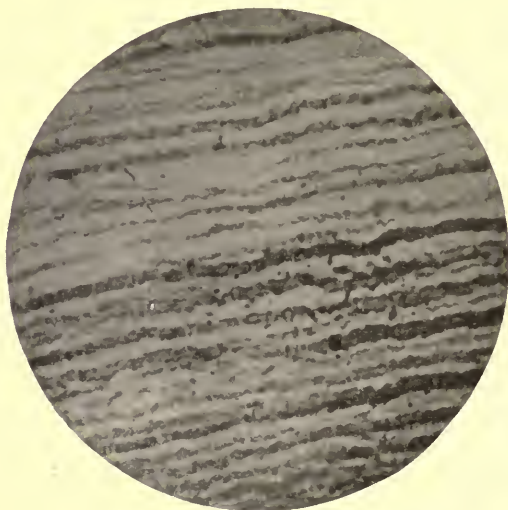


Normal dentin. Cross section, showing canals. (DR. ANDREWS.)

Dr. Black, in the "American System of Dentistry," says:

The penetration of enamel is distinctly different from the penetrating of dentin. This substance has not the natural openings that are characteristic

FIG. 12.



Natural decay of a human tooth. Longitudinal section, showing distended canals. (PROF. MILLER.)

FIG. 13.



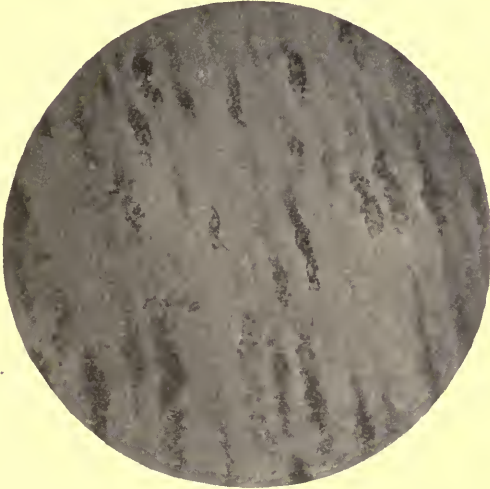
Dental caries. Showing a cavity formed. (DR. ANDREWS.)

of the dentin, and therefore does not present the same opportunities for growth of the fungus within its structure. It has been held by most of



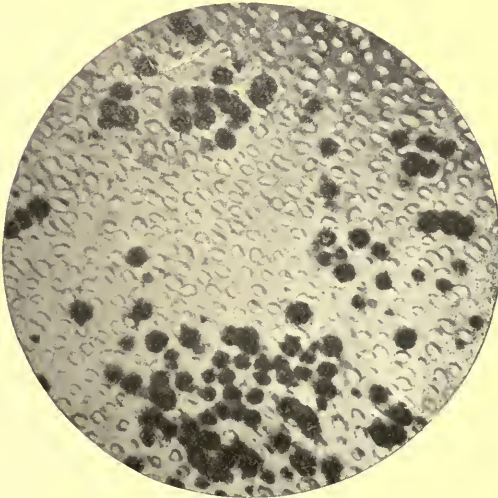
those who have written on this subject that the fungus is incapable of attacking enamel. If by the term "attack" is meant an invasion, or growth,

FIG. 14.



Human dentin. Showing organisms of decay. (PROF. MILLER.)

FIG. 15.

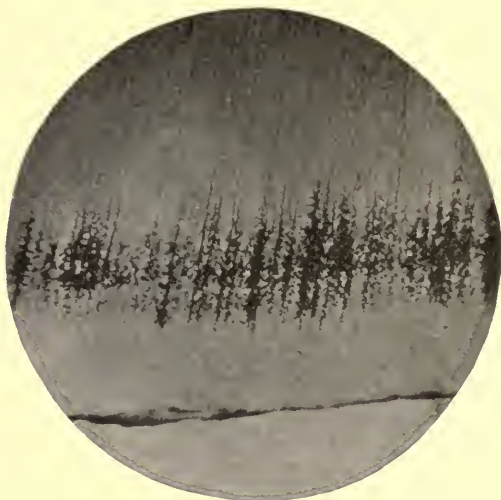


Cross section of infected human tooth. Natural decay. (PROF. MILLER.)

of the fungus into the substance of the enamel, this view is correct. No signs of the fungus are to be found in the enamel until after it has become

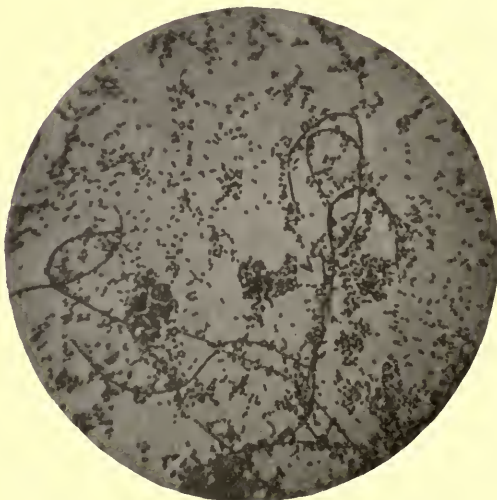
so far disorganized that its crystals are loosened and begin to fall apart. Except that of localization, and in some cases discoloration, the softening

FIG. 16.



Dental caries. Micro-organisms working through the "granular layer" of Tomes. (PROF. MILLER.)

FIG. 17.



Organisms of dental caries. (PROF. MILLER.)

of the enamel in the first stages of caries presents no other phenomena than those produced on that substance by acid action outside of the mouth. In

case this effect is rapid the enamel is seen to lose its transparency, and soon its prisms show a disposition to fall apart in such a way as to give the impression that they have been separated the one from the other. This disintegrated material is easily removed from the surface in the form of fine dust, and upon microscopic examination is found to be composed of short lengths of enamel rods. It seems that the acid [lactic] has the effect of dissolving the connecting substance which unites these into a compact mass, and that the rods themselves are dissolved more slowly. Thus the enamel fast becomes more porous, and finally some of the rods fall away, leaving minute openings through its substance by way of which the fungi of caries are admitted to the dentin beneath. On the proximal surfaces of the teeth, near the point of contact, a portion thus softened may frequently be found; this may be brushed away and the surface again polished, and show no opening exposing the dentin. Other cases may on careful investigation show one or several openings of minute size through which the dentin is exposed. After such exposure the enamel is undermined by the more rapid softening of the dentin which extends laterally under it. This disintegration presents precisely the same characteristics as that occurring on the outer surface. In this way the enamel is gradually destroyed through its entire thickness; or, more often, by the rapid disintegration of the dentin beneath is weakened and left unsupported, and breaks away, leaving the opening into the cavity jagged and irregular. In many instances of very rapid decay, however, especially if the enamel be very thick and strong, the carious process will extend to a considerable distance under it laterally before breakage occurs; and in this case the opening may be so small that the cavity might escape detection but for a slight discoloration which is seen through the enamel.

**Treatment.**—The treatment of dental caries may be classed under two heads,—medical and surgical; although very nearly all treatment at present is surgical. This does not deny that a great deal may be done with medical preparations, and with antiseptics together with proper food as a prophylactic measure, to which we may at this point give some attention.

It is generally conceded that the nutritive process extends into the structure of the teeth; and that hygiene thoroughly followed in all that the term includes will so improve assimilation that ordinary nutritious food will furnish materials to make good tooth-structure and vitality, and does do so. Such food consists mainly of fish, eggs, meats, Graham bread, oatmeal, milk, and butter. Dr. Miller emphasizes the need of food which is sufficiently hard to give the teeth exercise, and of that which does not readily undergo acid fermentation in the mouth.

Inasmuch as micro-organisms play so important a part in dental caries, it is evident that whatever restricts or destroys these

organisms will proportionately lessen the tendency to decay. Unfortunately this means is limited in its action to prevent decay, and much more so in its power to arrest it. For instance, an antiseptic mouth-wash cleanses the mouth, and undoubtedly lessens the activity of bacteria, but such liquids cannot be carried into cavities or between the teeth so as to reach all parts affected. Moreover, the strength of all antiseptics must be limited so that no injurious action may ensue, and with this limitation it is impossible to penetrate softened tooth-structure and destroy all bacteria. Nevertheless, antiseptic mouth-washes are to be strongly commended, not only for their germicidal power and cleansing properties but for their beneficial action on the soft tissues. Chewing-gum is to be commended in moderation for the cleansing and exercise it gives the teeth, the stimulation of the salivary glands and the aid thus given to digestion.

We have spoken of germicides and their effect on dental caries, but it is important to note also the good effect of alkaline washes which neutralize acids, thus preventing their action on the teeth. "Milk of magnesia" is an alkaline liquid which forms a coating on the teeth, and is one of the best alkaline washes for this purpose. It was introduced to the profession by Dr. E. C. Kirk, of Philadelphia.

As a means of arresting decay at any stage, no local treatment is so efficient as the application of silver nitrate to the decayed surface by means of a glass rod on which a few of the crystals have been fused, or that of dipping a suitably pointed orange-wood stick into the powdered crystals and applying in the same way. The excess of saliva should be wiped from the surface to which the application is to be made, and the soft tissues of the mouth protected by rubber dam or lintine.

Of internal treatment there is little to be said. The syrup of the hypophosphites of lime and soda may be indicated as a tonic and a tooth-builder; further than this, medicine can, with our present knowledge, be used only to remedy some special abnormal condition of the system which is believed to affect the teeth injuriously, as there are no medicinal "specifics" for dental caries.

## CHAPTER XXIX.

## HYPERSENSITIVE DENTIN.

**Definition.**—A condition in which the dentin is abnormally sensitive.

**Etiology.**—The causes of sensitive dentin are both local and general; this can be said with assurance, but we have very little knowledge of the *modus operandi* of either class of causes. We can only say that certain local conditions are associated with hyperesthesia of the dentin. For instance, a portion of dentin is exposed by fracture to the fluids of the mouth; after a day or two this exposed portion is excessively sensitive to the slightest touch, especially the contact of sweets. This is also the case when the dentin is exposed by erosion or decay, varying, in the case of decay, with the rapidity of the carious process and the density of the tooth-structure.

It is manifest that the softer and more porous the tissues involved and the greater the surface exposed, the more rapid and intense will be the action of irritating agents.

An acid may be formed in the mouth from decomposable substances, or the saliva and mucous secretion itself may be acid, due to the condition of the blood affected by gout or rheumatism. This acid is a direct local irritant, which, with general hyperesthesia of the nervous system, may cause excessive sensitiveness of the dentin.

A general irritability of the nervous system, from whatever cause, must necessarily magnify the result of any local irritant, and therefore should be reckoned as a predisposing cause of sensitive dentin.

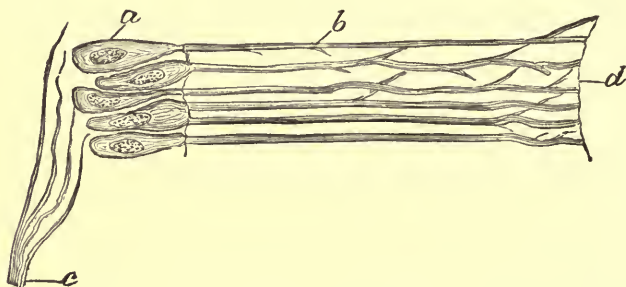
The mechanism by which the result of an irritant to the dentin is transmuted into pain is well explained by Dr. Black as follows:\*

Fig. 18 represents diagrammatically a group of odontoblasts with their processes, the dentinal fibrils, with a nerve-branch in close conjunction with the odontoblasts. In case of the irritation of the distal ends of the processes

\* "American System of Dentistry," vol. i. p. 1009. The reader is also referred to an article by the author in the *International Dental Journal* for March 1891.

of these cells pain is produced, yet no nerve or nerve-ending is touched, there being no nerves in the dentin. Everywhere, in the periphery of the pulp, fine nerve-filaments may be demonstrated in close conjunction with the odontoblasts, and it seems evident that they communicate to the sensorium the impression made on the protoplasm of these cells through the injury to the fibrils. . . . The striped or voluntary muscles furnish an example of the propagation of impulse along protoplasmic bodies which is like that I have suggested in the case of the dentinal fibrils, except that it is an efferent instead of an afferent impulse. There is but one motor nerve-ending in conjunction with a single muscular fiber, no matter what its length (Krause, Kölliker); this is sufficient to communicate the impulse to contraction to the whole fiber, though it may be much longer than the dentinal fibril. Here it will be seen that the passage of an impulse along a protoplasmic body from a nerve-ending seems demonstrated. In the explanation offered of the sensitiveness of dentin the impulse passes along a protoplasmic body to a nerve-ending. The conduction in the two instances is the same, but the impulse travels in the opposite direction.

FIG. 18.



Group of odontoblasts with their processes (dentinal fibrils). *a.* Odontoblasts. *b.* Fibrils. *c.* Nerve-supply. Irritation at the point *d* produces pain.

**Treatment.**—The vain search which has been made, and the long list of remedies that have been tried, indicate the great importance of this subject. In the first place there is no question that the manner of the operator has an effect on the patient, and this may be carried on to suggestion, and even hypnotism; but at present the only object is to suggest the good influence of an assuring manner, an earnest but quiet sympathy, showing a desire to do all that may be possible to prevent pain in any operation; a firm yet light touch; and the use of sharp instruments.

The patient's confidence may be won by operating upon the easier and less sensitive cavities first. The manner of using the excavator, as well as its form, has much to do with lessening the pain; for instance, hatchets of either right or obtuse angle, of the

smallest and most delicate pattern, finely tempered, and sharp, will enable the operator to excavate with the least amount of force or friction, and therefore with the minimum amount of pain. It is well also to bear in mind that in the removal of tooth-substance, the cutting should be, as far as possible, in a direction from the pulp toward the periphery of the cavity.

Warm air, or, indeed, heat in any form, is one of the best obtunders of sensitive dentin. Warm air may be conveniently applied in the following way: From a tank of compressed air, or a foot-bellows, a stream of air the temperature of which is raised to 125° F.,\* is directed into the cavity and maintained for a minute or two.

In many sensitive teeth, pain follows the first application of the air, and in order to avoid this it is necessary to raise the temperature of the tooth very gradually, which may be done by regulating the distance of the delivery tube from the tooth. If a finger is placed on the tooth to which the air is applied, it will be found that the whole tooth gets warm, which may serve as a guide in regulating the amount of heat. It will be found also that the tooth cools in a very short time, and sensitiveness returns, but the air may be applied by an assistant while the excavating is going on.†

Formerly the writer used a thermometer within the nozzle of the glass tube conveying the air, but after a considerable use of it he was enabled to judge very well by applying the finger to the tooth and noting the heat.

Of the innumerable remedies to be applied to the cavity, only a few will be mentioned. Carbolic acid in full strength sometimes has a good effect when applied to the cavity, but it is not readily absorbed, and cannot therefore be made effective to any satisfactory extent. Zinc chlorid is certainly an effective agent and has been in use for a long time. Its proper application is thus described by Dr. Jack:

To secure the proper action of chlorid of zinc, it is essential perfectly to protect the cavity from the ingress of water, whether by the inflowing of saliva or by the insensible entrance of any fluids by capillary approach. It

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\* It is necessary that the heat be applied within twelve inches of the delivery tube, as the air soon cools in being conveyed from the source of heat. The heat may be generated either by means of gas or electricity.

† In his experiments with warm air, the author is much indebted to Prof. E. T. Darby, of Philadelphia.

is also important to exclude the vapors of the mouth. To make sure of the exclusion of all moisture it is necessary to envelop the tooth—and frequently, also, its neighbors—with rubber-dam, securing it with a thread at the gum. If the cavity be a simple one, it should have placed in it, after being dried, a pledget of cotton filled with the saturated deliquescent solution of the chemical. It is necessary that the agent should be chemically pure and liquefied, and to secure full saturation it is important to observe that the vessel should always contain some of the undissolved crystals.

The remedy generally causes pain at first, and in some cases this pain is extreme. This can be modified by air-drying the cavity and applying for a moment carbolic acid, the carbolization of the cavity appearing not to interfere with the action of the chlorid.

In deep cases the part of the cavity nearest the pulp should in the beginning be perfectly protected from the action of the agent, and, as the sensibility of the dentin is considerable only at the periphery, the usual objection to the remedy is removable.

The remedy should be permitted to remain until all the pain it causes has passed away. It will be frequently observed that the pain diminishes very much after a little while, and then recurs. It is not until the secondary pain has subsided that the excavation should be performed.

There are several reasons why chlorid of zinc has not had the general repute to which its properties entitle it. It has by many practitioners been regarded as a very painful and uncertain remedy. This has not agreed with the writer's experience, who has made it his chief reliance in severe cases for many years, and he regards it as the only certain and reliable escharotic for this purpose when warmed air and carbolic acid prove inefficient. The uncertain results from its use may have arisen from disregard of the means necessary to secure its efficiency, combined with an indisposition to tolerate the delay which attends its use. This delay, however, is more apparent than real, as what time is lost in futile attempts to manipulate very sensitive cavities, in misdirected and inefficient efforts, is more than compensated for by the freedom and rapidity with which the case may be proceeded with after the treatment is over. An excellent method to obviate the loss of time is to apply the rubber-dam, make the application as above described, pass a ligature around the free portion of the rubber, at a short distance from the tooth, so tightly that water cannot enter, and then cut off the extruding portion of the rubber. Operations can then be carried on in connection with some other tooth in another part of the mouth until the sensibility is believed to be subdued. The cavity, after being thoroughly washed and permitted to remain open for a short time to allow the excess of zinc chlorid that has not combined to be dissolved away, may be filled temporarily if impracticable to complete the operation at that sitting. The postponement of such cases when treated in this way is frequently advantageous. Sensibility treated in this manner, when the remedy under consideration is indicated, is usually followed by the most satisfactory results.

There remain to be considered the general principles guiding the selection of this remedy. Although, when its administration is continued for no longer time than is required to subdue dentinal sensibility, it cannot pene-



trate deeply the tubular structure because its combination with the albumin limits the depth of its action, still it has energetic properties and is inadmissible under several conditions.

As it can do harm only by an extension of action upon the organic elements of the dentin, it will at once be observed that in all cases its danger is in proportion to the softness of the structures and the near proximity of the dental pulp. It is therefore manifest that in teeth of hard structure not near the pulp, danger would be less marked than in softer teeth at the same distance from that organ. In the harder teeth, also, where usually the caries is less rapid and the consolidation over the pulp more nearly complete, the safety must be greater than where the opposite conditions exist. In all cases, however, the extreme sensibility is always found at the peripheral limits of the tubules, and as before pointed out, it is not at all difficult to limit the action of the zinc to that part alone; and in practical experience it is found necessary to protect the central parts of the cavity, only in teeth of soft character and in the incomplete teeth of young subjects.

The following prescription containing veratria has been recommended by Dr. Bogue of New York:

℞—Veratrinæ,	gr. iv;
Acidi tannici,	gr. j;
Alcoholis,	gtt. xx;
Glycerini,	ʒj;
Acidi carbolici,	ʒij. M.

In applying this remedy, dryness of the tooth should be maintained, the drug applied, and allowed to remain for a time, while attention is given to some other tooth. After removing the remedy the cavity should be cleansed with alcohol and dried with warm air.

The "Robinson remedy" consists of equal parts of carbolic acid and caustic potash triturated in a mortar until a paste is formed. This agent is certainly entitled to a place in the list of reliable remedies. Cocain is largely used as a local anesthetic and has been known as such for nearly fifteen years; it is a valuable remedy when its absorption can be secured. In some cases, if the cavity be thoroughly dried, a solution of cocain placed within it will be absorbed sufficiently to obtund in a moderate degree. It is my opinion that if the solution be made in chloroform or ether, it will be absorbed more readily than will the aqueous solution.

A solution of cocain on cotton has been placed in the nostrils for its obtunding effect on the incisor teeth, and some have reported good results from this method. The author failed to get sufficiently good results to make this a rule of practice, and he would add a word of caution to those trying this method,—that in

placing the cotton an excess of the solution may run back to the throat, producing disagreeable and possibly dangerous symptoms.

Recently, the absorption of cocain and other remedies in solution has been accomplished by means of *cataphoresis*. Much care is necessary in conducting the cataphoresis generally, and especially in applying the electric current, as pain may be caused thereby. The time consumed in the application of this method has caused some to abandon it entirely, as the exceptional cases may be treated as effectually and more quickly by other means, such as the inhalation of ether. The application of cocain alone or with guaiacol, by cataphoresis, is not a new method in point of origin, yet it has only recently come into prominence and been reduced to practical use for the profession at large. By this method the medicinal agent is supposed to be driven into the substance of the tissue to which it is applied, and thus made effectual. As solutions applied to the dentin in the ordinary way are absorbed with difficulty, if at all, the value of this process must be apparent. In order to produce cataphoresis, it is necessary to have a steady current of galvanic electricity conveyed by electrodes; the negative is similar to the sponge electrodes of any battery, with the exception that it should be interchangeable, so that it may be taken out and another put in its place for the next patient. Spunk may be more readily used for this purpose on account of its being adapted to the holder; blotting paper or lintine may also be used.

The positive electrode should be of platinum, of such shape as to be introduced into cavities of the teeth. The electric current should be steady, and for this purpose the dry chlorid of silver cell is best. Another essential is the beginning with a small amount of current and increasing gradually, which, for example, may be accomplished by the Wheeler fractional volt selector, or Willms current-controller attached to the battery.\* Also, a milliampèremeter for measuring the current is, though not essential, extremely useful. In the majority of cases ten volts will be sufficient, although fifteen to twenty volts are often used. The usual steps in the application of this method are as follows: The electrode containing the sponge (negative) is held either in the hand or against the cheek; or, as Dr. Jack suggests, it may be inserted through an opening in the band which supports the rubber-dam, and thus held. It should first be thoroughly moistened, and the

\* Various current controllers are now in the market.

writer advises also the application of a very little salt. With the rubber-dam in position, the precaution is taken to insulate adjoining metal fillings by coating with wax, gutta-percha, or varnish.

A pledget of cotton is now saturated with a twenty per cent. solution of cocain and placed in the cavity. The positive electrode of platinum, of a suitable shape, is placed in firm contact with the cotton and either held by the operator or affixed to the end of a flexible wire, which is soldered to a clamp over a tooth; this may be bent so as to press against the cotton in the cavity.

The electrodes being thus placed, the current is let on in the smallest possible degree, and increased as the patient is able to bear it. As sensation is lessened, the current may be increased more rapidly, until, when considerable current is turned on and no irritation results, the indication is that sensitiveness is controlled sufficiently for the excavation of the dentin. The time usually needed for the accomplishment of this end varies between seven and twenty-five minutes.

Sulfuric ether, ethyl chlorid, and similar agents have been used successfully as a spray for the painless excavation of superficial cavities. These agents are certainly effective, take but little time for their application, and if used with due caution may not cause injurious results from the intense cold which is produced; but there are other and safer means for obtunding sensitive dentin.

The sensitive cavity may be made dry, medicated, and filled with a temporary stopping for a few days, or weeks, as the case may be, with benefit to the sensitive condition; also a paste of bicarbonate of sodium may be inserted into the dry cavity from time to time while operating.

*Constitutional Treatment of Hypersensitive Dentin.*—"Rapid breathing," as demonstrated by Dr. G. A. Bonwill, is effectual in some cases, and should be kept in mind, so that it may be employed when the case to which it is best adapted presents itself.

One of the most reliable and effective agents to be employed in hypersensitive dentin is sulfuric ether by inhalation. It is sometimes the case that half a dozen inhalations will suffice, but, in all cases, the operator may excavate very soon after the first effects of the ether are manifested. The patient is not unconscious, yet there is entire freedom from the pain of excavating; nor is sufficient ether given to produce nausea, or other unpleasant after-effects.

Nitrous oxid gas, with various proportions of oxygen, has given good results, but it does not in all cases render the operation painless, unless the patient is carried nearly or quite to the point of unconsciousness; if this occurs, the dentist loses the co-operation of the patient in facilitating the work, while there is often the rigidity of muscles characteristic of this agent, which is a decided hindrance.

Although, in many cases, chloroform, like nitrous oxid, has given most satisfactory results, it is open to the same criticism. This is to be regretted, as there can be no objection to the odor, as in the use of ether. In thus administering chloroform, the precaution should be taken to tip the operating chair well back; to administer a stimulant, and to cause the patient to inhale oxygen with the chloroform.

During the time from 1880 to 1883, frequent use was made of the inhalation of ethyl bromid for sensitive dentin, but it was found to be an unstable fluid, and it has no special advantages over chloroform.

In general irritability of the nervous system, sodium bromid may be administered with benefit. To secure the best results it should be taken during the day previous to the operation, in ten-grain doses, every three hours, and a dose of twenty grains half an hour before the operation. This remedy should be well diluted with water, at least half a glass for each dose. In other cases it may be necessary that the patient should receive treatment for weeks, either by the dentist or the physician, in order not only that the dentin may thereby be rendered less sensitive, but that the patient may be better able to bear the operation.

In making appointments for such patients, morning hours are usually preferable. Notwithstanding this, a time should be selected when the patient is in his best physical condition. Patients themselves ought to know that during or immediately preceding or following the menstrual period is not the best time for undergoing dental operations.

Prof. Thomas Fillebrown, of Boston, has kindly furnished the following description of his method of employing "suggestion" as a remedy in operating on hypersensitive dentin:

Suggestion has now become one of the well-acknowledged remedies for sensitive dentin, and I learn from reports and conferences with my fellow practitioners that it is becoming more common every day. For years I

have used it constantly and have found it efficient in more than three-fourths of my cases. At first I thought it necessary to induce hypnosis before using the suggestion, but a little later I found the formal hypnosis entirely unnecessary, and that relaxation and deep breathing induced the same receptive state as before obtained, hence the use of suggestion has become very simple and easy, and within the reach of every one interested to try it. The process is as follows:

1st. The operator shall induce a feeling of relaxation and repose in himself.

2d. By request and example, induce in the patient a complete relaxation of all the muscles of the body, including those of the face and jaws.

3d. By request and example induce deep, full, steady breathing by the patient.

4th. Make a statement that this will obtund the pain and lessen the fear, and prevent shock from the operation. One or two minutes will prepare the patient.

5th. Use a sharp instrument lightly and skillfully, avoiding any sudden plunge or cut. If a spot is found to be sensitive, wait a moment, repeat the suggestion, and the remedial effect will be renewed.

The previous suggestion of the absence of shock will prevent the occasional hurt from arousing any condition of dread of the next cut. Laving the hands upon the head and exerting a little pressure upon the middle of the forehead between the eyebrows will, I think, be found a decided aid in the process. A little practice will enable any one of ordinary intelligence and tact to practice this method successfully.

It will also be found a powerful adjunct in connection with any other agents that may be used for this purpose, some of which should be at the immediate command of every operator.

## CHAPTER XXX.

### HYPEREMIA OF THE DENTAL PULP.

**Definition.**—Hyperemia of the dental pulp may be defined as a condition in which there is an excessive amount of blood within the vessels of this tissue.

**Etiology.**—Hyperemia of the pulp may occur as the result of a deep-seated cavity of a tooth the pulp of which is not necessarily exposed thereby. The cavity may, or may not, have a filling; but if it does contain a filling, the character of the filling material will have an influence in producing hyperemia.

Sudden changes of heat and cold may not only act as causes of hyperemia, but a hyperemic pulp is extremely sensitive to thermal changes.

**Pathology.**—From our definition of hyperemia we know that there is, in this condition, an excess of blood in the vessels of the part affected. The vessels are distended, but they may return to their normal caliber and present no sign of physiological disturbance. This can hardly be called a pathological process; but this process may be repeated until the vessels lose their elasticity and become permanently enlarged, which is a pathological condition. By reason of this abnormal state, the affected tissue is thereby rendered more susceptible to future inflammatory attacks—if, indeed, inflammation does not immediately follow the hyperemic state. The degree to which the bloodvessels may be stretched varies greatly; in some cases they become enlarged to an enormous extent.

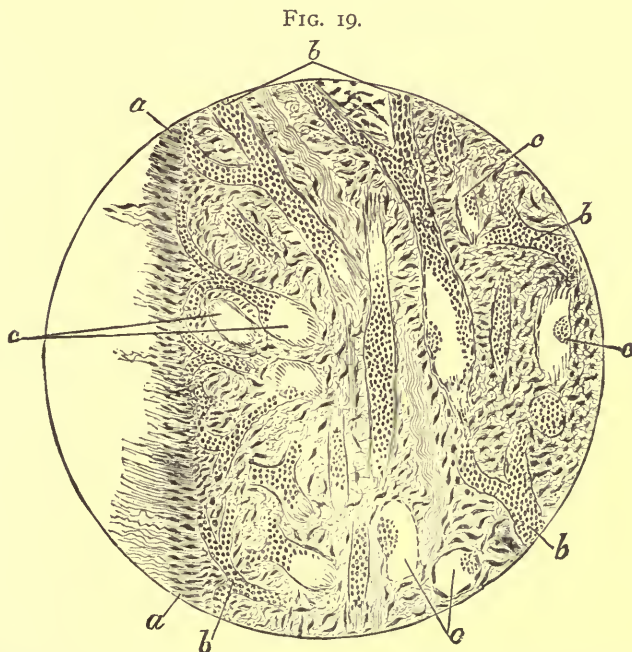
Dr. Black says that the vessels are distended to a greater extent in the coronal portion of the pulp, but that there is no symmetry in the enlargement, as this condition prevails in a very irregular way throughout the pulp-tissue.

The following from Dr. Black, in the "American System of Dentistry," is instructive:

Fig. 19 represents a field from the margin of a section of the pulp of a tooth extracted during a severe paroxysm of pain, the vessels containing the natural injection except at some points. This was a case of extreme sensitiveness to thermal changes, in which severe paroxysms of pain, lasting for an hour or more, were occasionally occurring, seemingly excited by very trivial changes of temperature. This condition had continued for several weeks. The tooth was much decayed, but the pulp was not actually exposed. The examination reveals no signs of inflammatory changes whatever. This I find common in those cases in which a pulp has become abnormally sensitive to thermal changes without exposure or irritation from external sources other than changes of temperature. This forms an important feature of the pathology of the dental pulp, for the reason that its causes are so constantly present and their action augmented in every case of filling with metal. It is liable to occur in the pulp of any tooth, however sound or otherwise healthy.

Sensitiveness to thermal changes in a certain degree is, as has been explained above, the normal sensory function of the pulp. In each instance of the exercise of this function there is an unusual amount of blood sent to the organ. This, when in a reasonable degree, is healthful,—a temporary physiological hyperemia which

calls out a simple warning in the form of an unpleasant sensation, and immediately passes away. It is evident in this case that no injury results, but when this is repeated frequently with a degree of thermal change that is inordinate, the vessels finally fail to contract and remain overfilled with blood, at the same time acquiring an unusual degree of susceptibility to thermal influences so that very slight changes produce pain.



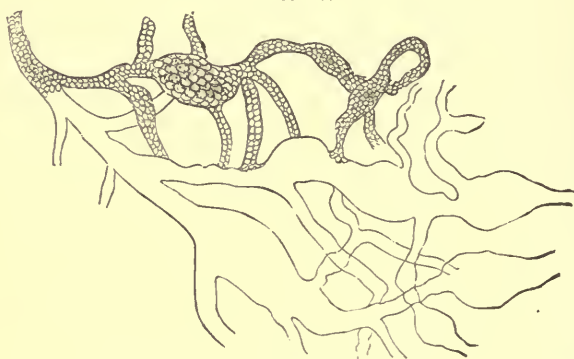
Hyperemia of the dental pulp: showing the natural injection of the vessels. *a a*. Membrana eboris, or layer of odontoblasts. *b b b b*. Vessels distended with blood. *c c c c*. Points from which the blood has fallen in handling the section.

There is now a question of how much this fullness of the vessels is due to the mechanical stretching which the pressure of the blood has exerted, and how much is due to nervous control through the vasomotor system. The fact that the vasomotor system of nerves controls the caliber of the bloodvessels to a certain extent is well known, but it seems reasonable to suppose that the permanent enlargement is due in some degree to stretching and loss of elasticity of the vessel walls.

The distension may also be due in part to a partial paralysis of

the vasomotor nerves which supply the parts affected, in which case, if in the early stages, recovery, partial or complete, may take place. The degree of distension is well shown in Fig. 20, from Black, who remarks that the distension is only shown when the tooth has been extracted during a paroxysm of pain, while in sections prepared from pulps of teeth which were extracted during an interval of quiet, nothing unusual is shown. The distension, as will be noticed, is enormous at certain points, being in some places increased to several times the normal caliber. When this process is carried further, and there is migration of the blood-corpuscles, the inflammatory process has begun, hyperemia being a process which, if continued, leads to inflammation.

FIG. 20.



Dilated bloodvessels from the dental pulp in hyperemia: from tooth extracted during a paroxysm of intense pain.

**Symptoms.**—These sudden changes in temperature occasion paroxysms of pain of an unusually violent character, with intervals of quiet which grow less and less as the case approaches inflammation. Extreme sensitiveness to heat and cold, and especially heat, is a marked and early symptom, manifest by pain as above described. The pain is not always easily located in the tooth affected, but is usually referred to some of the approximate teeth, though at times there is a pain in the ear, and more rarely in the face, extending to the eye.

**Course, Duration, etc.**—Hyperemia may exist for only a week after a metal filling has been introduced, and cease without treatment, or it may continue for several months. The writer has observed a case lasting four months, the trouble ceasing without



special treatment and remaining absent up to the present time, about twenty years.

**Prognosis.**—The prognosis is often favorable, but on the whole uncertain, depending upon the degree of irritation to the pulp, the general state of the patient, and the length of time the condition has existed.

**Diagnosis.**—For the purpose of forming a diagnosis, attention is directed to the pain, which is usually due to thermal changes; the period of rest occurring between the times of thermal irritation; the absence of tenderness of the tooth to percussion; the paroxysmal character of the pain, and the history of the case.

**Treatment.**—Instruct the patient to shield the affected tooth or teeth from heat or cold, not only to avoid the pain which they produce, but to give the parts an opportunity to recuperate. See that there is sufficient non-conducting material covering the pulp. Perhaps a change may be necessary in the filling material; for instance, from cement to gutta-percha. It may be necessary to place a gutta-percha cap over the entire tooth to shield it more perfectly from thermal changes. A capsicum plaster may often be placed on the gum with benefit. Attention to the lower digestive tract is important, and a laxative or even a cathartic may be beneficial.

## CHAPTER XXXI.

### PULPITIS—ACUTE; CHRONIC.

#### ACUTE PULPITIS.

**Etiology.**—The fact that the dental pulp is peculiarly susceptible to thermal changes, and thereby often the subject of hyperemia, makes it easy to see how this condition, when the cause is not removed, may gradually pass into an inflammatory state.

When caries approaches the pulp so that food and other substances irritate it, pulpitis results. It is often the case that the pulp is slightly exposed before any irritation of it occurs. Erosion, abrasion, fracture, the application of extremes of heat or cold for obtunding hypersensitive dentin, etc., all act as causes. Caries

is the most common cause, but it rarely produces inflammation of the pulp until that is exposed.

**Pathology.**—An interesting feature of the pathology of inflammation of the dental pulp is that the inflammatory process may occupy only a small portion of the pulp tissue. Dr. Black says that this is very common; that cases in which the inflammation is diffused through the entire portion of the pulp are the exception and not the rule, and that when the pulp is totally destroyed by the inflammatory process it is done gradually, beginning at a certain point and extending little by little throughout its entire extent by the process of suppuration.

The following illustrations after Black show the various tissue changes in inflammation of the pulp. Fig. 21 shows a section of the inflamed pulp with normal tissue cells at *a*, and at *c* may be seen the migrated white blood-cell under the process of development and self-division. These normal cells disappear as the inflammation goes on, and other cells belonging to the white blood-cell type make their appearance; this is well shown in Fig. 22.

**Symptoms.**—Inflammation of the dental pulp presents the same general characteristics that may be seen in any other inflamed tissue. The well-known cardinal symptoms are present, although modified by environment, so that the redness may be seen after extraction only, and the swelling is limited by the bony walls of the pulp-cavity.

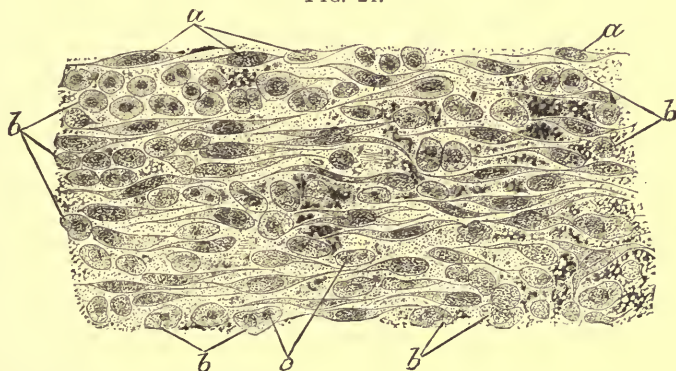
We have hyperemia still present, and we have severe pain in hyperemia, but, as new features are developed, the character of the pain is changed from the paroxysmal and spasmodic, with periods of rest, to a steadier pain which is inclined more and more to be continuous. As the inflammation progresses, the pain is more likely to be brought on by lying down, and the patient therefore gives a history of pain during the night.

In fully established inflammation of the pulp an actual exposure is nearly always found; also in a number of cases inflammation and destruction of the pulp have occurred with no symptoms whatever.

The pain which is located in the affected tooth may continue for hours at a time, with periods of abatement, according to the stage of the inflammatory process. The affected tooth is not sensitive to percussion, nor is it protruded, and there is no swelling of the gum.

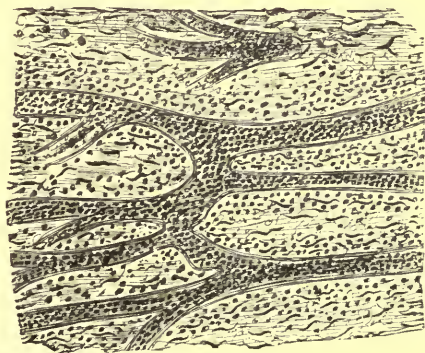
**Diagnosis.**—The diagnosis is based on the fact that the pain is more nearly continuous than in hyperemia, and increases on lying down; also upon a history of decay and exposure with previous symptoms of hyperemia. The tooth may or may not have been filled. There is sensitiveness to heat and cold as in hyperemia, and in neither condition is there any tenderness on percussion.

FIG. 21.



Inflammation of dental pulp. *a a*. Normal cells. *b b b b*. Inflammatory elements. *c*. Cells in process of division. ( $\frac{1}{10}$  in.)

FIG. 22.



Section of dental pulp: showing the invasion of the inflammatory process along the course of the veins—the diapedesis of the white blood-corpuscles.

**Treatment.**—The inflamed pulp is the seat of severe pain. Obviously, the first thing to do is to quiet this pain; and indeed, all subsequent treatment with the view of cure and preservation of the pulp depends upon our ability to relieve the pain.

This we may try to do in various ways, according to the condition which causes the trouble. If there is a filling which presses

unduly upon the pulp, or if the condition be due to the size of the filling, and the pulp has been repeatedly irritated, thus inducing inflammation, the filling must be removed. If, after the filling has been removed, it is impossible to subdue the pain, it then becomes a question whether the pulp may be preserved alive, and this will depend in large measure upon the length of time the patient has been suffering. In the writer's experience, if there is an actual exposure with a history of three to five days in which there has been severe pain nearly all the time (a pain may be said to be severe when it is sufficient to render the night a sleepless one), there is little hope of maintaining a permanent comfortable condition with the pulp alive.

While many cases of this kind may be carefully capped and the pulp preserved alive for two and perhaps three years, sooner or later the majority will present with a dying or dead pulp for treatment. After the removal of the filling or if there is an open cavity, a selection may be made from the many local obtundents; for instance, if the case be one of beginning acute inflammation of the pulp, one which has just passed the border line of hyperemia, carbolic acid or oil of cloves is applicable; if however, the case be advanced in inflammation, chloroform or tincture of aconite-root would be best suited to the condition.

If there is general fever and excitement and the local measures fail, the following internal treatment may be found of advantage:

R—Tinct. aconit. rad.,	gtt. vj;
Tinct. opii deod.,	ʒij;
Aquæ,	ʒvj. M.

*Sig.*—A teaspoonful in water every half-hour till three doses have been taken or until the pain is relieved.

As tinctures of aconite-root vary greatly in strength, it is always best to have an understanding with the druggist as to the strength of the tincture which is to be used, and modify the dose accordingly.

It is absolutely necessary that free movements of the bowels be maintained throughout the treatment.

After the pain is under control, the pulp may then, and only then, be devitalized, if this is deemed necessary. It may, however, be advisable to remove the pulp immediately by the application, either cataphorically or by injection, of cocain, or by means of general anesthesia.

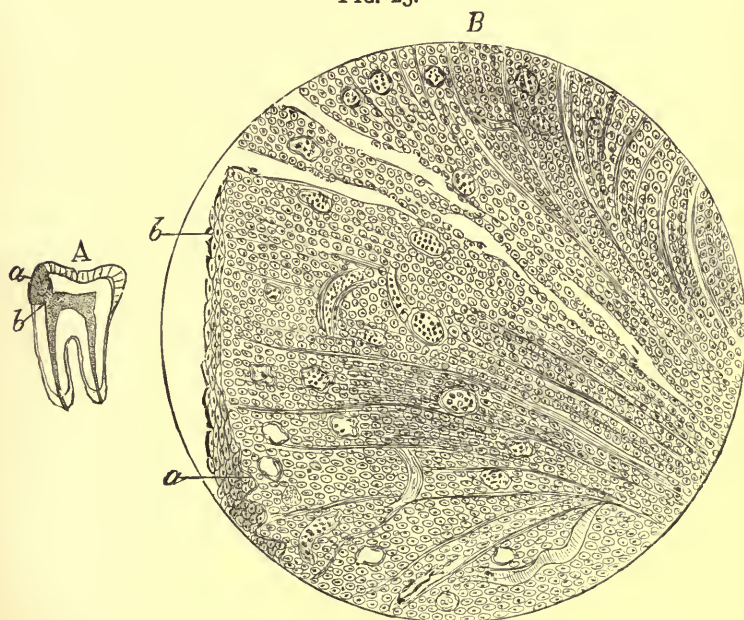
The question of capping, and preserving the pulp alive, depends

upon the length of time the pain has continued and the readiness with which it may be controlled.

### CHRONIC PULPITIS.

The varying conditions under this head may be classed as follows: Those of a chronic form, with exudations of pus; those in which hypertrophy is a prominent feature; and those in which there is breaking down or degeneration. In the chronic form of

FIG. 23.



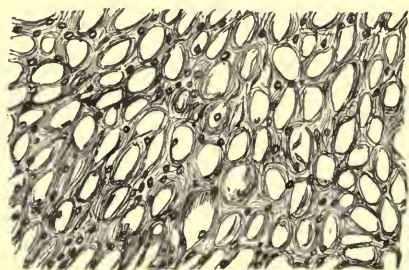
*A.* Diagram of a lower first molar, with a cavity at *a* completely filled by an hypertrophy of the pulp, which has grown out through the orifice, exposing the pulp at *b*.

*B.* Field illustrating the tissue of the growth, which is composed almost entirely of granulation tissue of a very primitive type. *a.* A covering of epithelium presenting papillae. *b.* Epithelium apparently without papillae.

inflammation the pulp is prone to throw out additional elements, and if this takes place it may cause absorption of the walls of the pulp chamber to an appreciable extent. If there is an opening into a cavity of decay the growing pathological tissue escapes through that, and may not only continue to increase in size until the cavity of decay is completely filled, but the development may still go on until it projects from the cavity, protruding as a reddish

fleshy mass, tender to the touch and bleeding easily. This growth of pulp tissue is often found to be continuous with the gum tissue, and therefore it may appear as if the gum had grown into the cavity, but upon inspection it will be found that the mass extends into the pulp chamber, and that we must account for its attachment to the gum in some other way. It has been suggested that abrasions of the gum occur, and while presenting a fresh surface thus made, the hypertrophied pulp becomes engrafted to the gum

FIG. 24.



Chronic inflammation of the pulp, areolation, and degeneration.

tissue. Black describes the hypertrophied pulp as “granulation tissue of low type” and gives the accompanying figure as a good illustration of this condition. (Fig. 23.)

The other variety of low-grade inflammation takes the form of degeneration, in which the original cells disappear. Areolæ develop in the matrix, which may or may not extend through the entire pulp tissue. This condition may be seen in Fig. 24.

## CHAPTER XXXII.

### SUPPURATION AND ABSCESS OF THE DENTAL PULP.

**Definition.**—While the term abscess includes the process of suppuration, a distinction is usually made between the condition which begins in a destruction, and consequent formation of pus, in a portion of the surface of the pulp, and progressing in area and depth, and that in which a circumscribed area is similarly affected,

usually within the substance of the pulp. The former condition is termed suppuration, or ulceration, and the latter, abscess.

**Etiology.**—A suppurative condition of the dental pulp indicates a certain stage of the inflammatory process (see etiology of Pulpitis) dependent directly upon the entrance of pyogenic organisms into the pulp tissue. In order that this infection may be accomplished, it is not necessary that the pulp be actually exposed, but in ordinary cases the carious cavity approaches sufficiently near the pulp to cause an inflammation of this tissue, and the thin layer of intervening dentin, usually in a state of decalcification, affords an easy entrance to bacteria. The possibility of the dental pulp becoming infected through a layer of hard dentin, or indirectly, through the general circulation,\* is admitted, but such cases, it seems to the writer, must be rare.

**Pathology.**—The peripheral cells of the pulp are usually first affected, losing their vitality, and finally breaking down. This process may extend little by little until the entire pulp has yielded to the destructive process. The presence of pus may be demonstrated by an exploratory puncture through an existing layer of dentin, or it may be seen rhythmically welling through a small opening into the carious cavity; or, minute abscesses may be demonstrated within the substance of the pulp by means of a microscopic examination. Bacteria are, of course, present in different forms, cocci and diplococci being constantly present. The variety of forms depends somewhat upon the size of the pulp-exposure, and the distance of the suppurative process from it.† The following quotation from Black‡ is of value in this connection:

In Fig. 25, *A*, I have represented in diagram a first molar with a proximal decay exposing the pulp. The darkened portion of the pulp at *b* shows the extent of the invasion of the pulp tissue by the inflammatory process. In *B* is given an illustration of the tissue which I have taken from a central section, and which includes most of the inflamed area. In this I have left the bloodvessels blank that they may be more apparent, though in the section they are filled with clotted blood. It will be noted that in the greater part of the field the normal cells of the part have disappeared and have given place to inflammatory elements, and that at the immediate point of exposure the odontoblasts are wanting and the tissue has been invaded by the suppurative process, forming a deep pocket in its

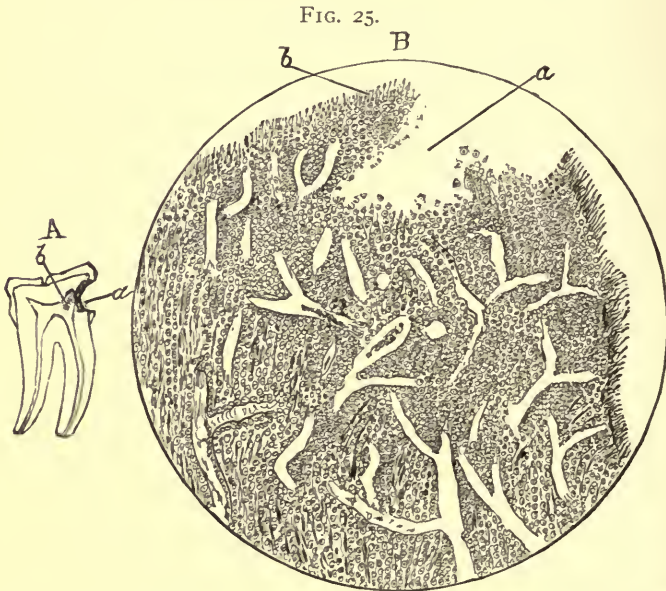
\* Miller, *Dental Cosmos* for July 1894.

† For an exhaustive and interesting article by Miller upon this subject, see *Dental Cosmos* for July 1894.

‡ "American System of Dentistry," vol. i. p. 853.

substance. The undermining of the layer of odontoblasts at the point *b*'s worthy of especial note. This undermining of the odontoblasts occurs so often that I may say that it is the general rule in what may be called progressive suppuration of the pulp, which is the form that I have generally found. Occasionally I have found suppuration—or, more properly, perhaps, ulceration—following a very superficial inflammation, in which the tissue was apparently melting down into a sanious pus thickly inhabited by micro-organisms. . . .

Abscess of the pulp is of frequent occurrence, and it seems to me probable that the suppurative process very often makes its beginnings in the form of a minute abscess just within the layer of the odontoblasts.



*A.* Diagram of lower molar, with caries at *a* which exposes the pulp. The darkened portion at *b* shows the extent of the inflammation. The rest of the organ was free from inflammatory change.

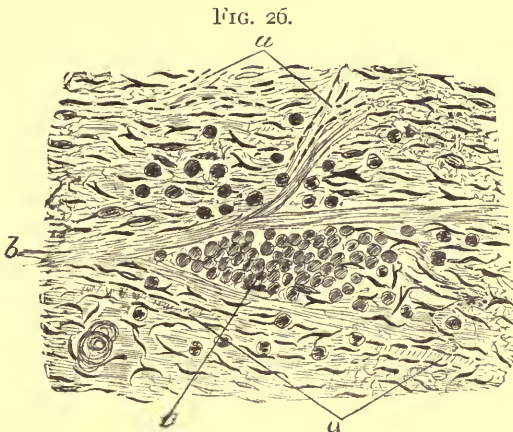
*B.* Illustration of the inflamed tissue, showing a part destroyed by suppuration at *a*. The odontoblasts are undermined at *b*. The bloodvessels which were filled with blood-clot in the section are left blank here, that they may be more apparent.

These cells exhibit less disposition to change under the influence of inflammation than do the other cells of the pulp, and I have often found them retaining their form and position when the tissue in immediate juxtaposition with them had been destroyed. Therefore it seems probable that the first formations of pus would be retained behind them for a time in the form of a tiny abscess; at least, this is suggested by the facts observed.

Abscesses lying deeper in the tissue of the organ are seen to form by the aggregation of the inflammatory elements into a compact mass, or little masses that lie near each other and run together in the process of



increasing. These cells, on account of the unfavorable conditions of their environment, degenerate into pus-cells, and the result is the formation of an abscess. Fig. 26 represents very fairly a beginning of the collection of



Minute inflammatory focus within the tissue of the pulp. *a a.* Arterial twigs. *b.* A nerve-bundle. *c.* Collection of leucocytes.

FIG. 27.



Abscess within the tissues of the pulp. The field includes about one-half of the little pocket of pus. ( $\times 250$ .)

inflammatory elements that might well serve as the nidus of an abscess if the conditions were unfavorable to their continued vitality. In Fig. 27 is given an illustration including about half of a minute abscess that I discovered in the sections of the pulp of a central incisor about midway of its

length. The coronal portion was suppurating, and the inflammation was rather more extended in its tissue than is common.

**Symptoms.**—The symptoms are those which pertain to the various stages of pulpitis. Although extensive suppuration of the dental pulp is properly associated with an advanced stage of inflammation, Miller\* states that a microscopic examination will reveal the presence of pus, even when pulpitis seems to be in its initial stage. In brief, the symptoms are: The response to the application of cold is subnormal, while there is an increased reaction to the heat test. There is an intense, throbbing pain, which rapidly becomes continuous; and these symptoms may, in twenty-four hours, merge into those of septic pericementitis (inflammation of the alveolo-dental periosteum).

**Prognosis.**—Unfavorable as to the vitality of the pulp, but favorable as to the salvation of the tooth.

**Treatment.**—As in other cases of pus-retention, so in a case of confined pus in the pulp chamber, the pus should be evacuated at the earliest possible moment; for this not only gives great relief from pain, but prevents further destruction of tissue and the spread of infection. After the flow of pus has ceased, an application of a solution of formalin three per cent. or carbolic acid full strength may be applied to the pulp exposure, and the cavity sealed until the next day, when, if there is no pain about the tooth, and the pulp requires further devitalization, a very minute quantity of an arsenical preparation may be applied, the cavity securely closed, and the patient dismissed for a week or more, as the case may be.

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## CHAPTER XXXIII.

### PERICEMENTITIS.

**Synonyms.**—Periodontitis; Periostitis; Alveolo-dental periostitis.

**Etiology.**—Foremost among the causes of pericementitis is death of the pulp, the resulting gases of decomposition from which

\* *Dental Cosmos*, July 1894.

are forced through the apical foramen, and by their irritating nature, mechanical force, and septic action set up an inflammation at the end of the root which travels along its membrane throughout its entire extent.

We believe that considerable pressure is often exerted by the forming gases when there is no opening through the tooth or any aperture from a fistula. Indeed it would be difficult to account in any other way for the manner in which certain fillings have been forced out of the cavity, following death of the pulp, or for the splitting of teeth, sometimes with an audible report.

Pericementitis may also result from an injury, as a blow upon the tooth; or, as in one case within the writer's knowledge, from the accidental heating of a metal clamp around a tooth upon which a jet of steam was directed for the purpose of obtunding hypersensitive dentin. Deposits of calculus or other foreign substances beneath the gum may induce a chronic pericementitis by impinging upon the cementum.

The loss of an antagonizing tooth, mal-occlusion, filling material projecting far beneath the gum or through the apical foramen, excess of filling material on the crown surfaces of teeth, are all etiological factors in producing pericementitis.

**Pathology.**—The increase in the force of the circulation tending to engorgement gradually distends the vessels of the pericementum, and after a time swelling of the membrane is evidenced by the protrusion and loosening of the tooth.

As the inflammatory process advances, the vessels become engorged with blood, leucocytes escape into the surrounding tissues, and there is considerable pressure from the blood as well as from the infiltration of cells and other products of inflammation, confined as they are between bony walls. The migrated cells collect in small areas and pus is formed. Many of these small aggregations of cells may coalesce and form one large pus-cavity, not deep, but covering a large area. Pus is often formed very quickly, usually within three days; on the other hand, the process of pus-formation may extend over a week.

**Symptoms.**—The symptoms of advanced pericementitis are unmistakable. The slightly loose, protruding tooth, sensitive to the slightest touch, but not painful in response to the application of heat or cold, at once indicates inflammation of the pericementum.

In the beginning of acute pericementitis the patient may com-

plain of a dull pain which can usually be located in some tooth; this increases, followed by greater redness of the gum opposite its root. As the pain increases in severity it also becomes more continuous; cold water held in the mouth affords comfort temporarily. While, at first, pressure on the tooth relieved the pain, it is now painful to the slightest touch, and being slightly protruded it receives pressure and slight blows which would not otherwise come to it.

There are usually no constitutional symptoms as a result of the local inflammation; it is not that the severity of the pain and local derangement is not sufficient to call upon the sympathy of the whole system, but the time is usually so short that alveolar abscess is developed before the symptoms occur.

In the chronic form of pericemental inflammation the symptoms have much the same character, but are milder in all respects. This chronic condition may last for weeks.

**Diagnosis.**—Sensitiveness to percussion, in all degrees of severity, is a constant symptomatic aid to diagnosis. It does not occur in hyperemia or inflammation of the pulp. The pain can always be located in the tooth affected. It is even more continuous than in pulpitis; in fact, the pain is constant, although it is made worse by lying down. Another decisive diagnostic point is that pain does not follow the application of heat or cold to the tooth. The facts in the history of the case, the death of the pulp, etc., will furnish conclusive evidence as to the character of the disease in question.

**Treatment.**—Remembering the causes of the condition that now calls for treatment, attention is at once directed to the source of the poisonous material and gases—the putrescent pulp; and if there is no outlet for these through the crown of the tooth, one should be made which will be sufficient.

This done, counter-irritation may be effected by means of capsicum plasters, or a blister formed by the application of some vesicant to the gum opposite the affected root.

Further depletion may be made by means of local bloodletting, passing a lancet around the tooth and under the border of the gum, or by leeches. (The foreign leeches are more efficacious than the American.) In order to get the leech to take hold, the gum should be clean and free from medicaments; a scratch should be made at the point where it is desired to apply the leech, and the

slight amount of blood will entice him on, or a little sugar placed on the part will generally accomplish the desired result. The leech ought to take a dram of blood; after it is removed, bleeding may be encouraged by wiping away the clot as fast as it forms and rinsing the mouth with warm water.

In severe cases it often gives relief to make an artificial sinus through the gum and alveolar process to the apical space. The writer has used carbolic acid for this purpose, in the manner described by Dr. Black. It is applied to the dried membrane by means of a plugger-point with prominent and sharp serrations, dipped in a ninety-five per cent. solution of carbolic acid, and touched with the point at the spot where it is desired to puncture the gum. This produces a white eschar, which is removed with the plugger-point by means of a slight scratching motion. This process is repeated until the bone is reached, when the periosteum is carefully raised and with a sharp drill an opening to the apical space is made.

In the milder forms of inflammation, local applications may be made to the gum, as tincture of aconite-root and tincture of iodine, either singly or combined.

To still further deplete, if the case demands it, the feet may be put in water as hot as can be borne, adding hot water from time to time as the temperature may be increased much above that which is bearable at first.

A free evacuation of the bowels will still further deplete, and this may be accomplished by administering calomel one-tenth of a grain every hour for four or six hours, according to the needs of the case. If on the following morning the desired action has not been accomplished, a dessertspoonful of magnesium sulphate may be given in a large glass of water at least half an hour before breakfast.

If the pain is not very severe sodium bromid may be a sufficient sedative. It may be administered in twenty-grain doses every two hours until three doses have been given. If the bromid is not sufficient to quiet the pain, resort may be had to opium in some form, and the deodorized tincture is well suited to the ordinary case. Fifteen drops in a little water may be administered, to be repeated in half an hour if the pain is not relieved.

If there is any reason against the use of opium, from three to ten grains of antikamnia may be used as a substitute. The pow-

der should be placed on the tongue and washed down with a little water.

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## CHAPTER XXXIV.

### DENTO-ALVEOLAR ABSCESS.

**Definition.**—An alveolar abscess is an abnormal circumscribed cavity containing pus, located within the alveolar walls, usually in the apical space.

**Etiology.**—The majority of the causes are traced back to those which we found to be the origin of pericementitis, and back of that, to those which caused pulpitis; and finally, to those which caused hyperemia of the pulp. But an abscess may be formed which is commonly termed “alveolar” from other causes than those included in the above-named processes; for instance, a deposit of tartar, some injury, or a foreign body may cause an abscess at the side of the root of a tooth.

**Pathology.**—By the terms of our definition we expect to find pus in the apical space; this, as it is formed, presses upon the tissues in all directions, and as this pressure increases, absorption takes place; in this way the space is enlarged, and not only is this so, but absorption may go on from this cause, following the weakest or least resistant structure until the pus makes its escape.

In the above process of pressure and absorption the fibers of the pericementum are swollen and separated, being infiltrated with inflammatory products, as may be seen in the fleshy mass usually found at the end of the root after extraction.

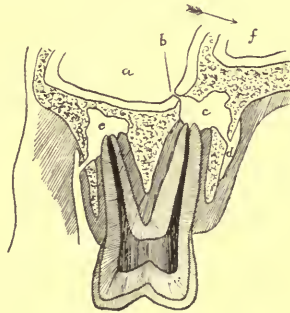
We have stated that the pus makes its way of escape in the direction which offers the least resistance to its progress. The direction is not the same in all cases, owing to the differences in structure and in the circumstances under which the abscess develops. For instance, if there be a large crown cavity with an opening into the pulp chamber the pus may escape through the canal and crown of the tooth into the mouth, or it may penetrate directly through the alveolar plate, either buccally or palatally, through the soft tissues into the mouth (Fig. 28, *e*), or it may not make its way through the alveolar plate, escaping instead at the margin of the

gum. Or it may go through the process but not through the periosteum, pushing it off and forming a pus-sac of greater or less extent. (Fig. 28, *d*.) The bone in some cases thus loses its periosteum over a considerable area, which of course predisposes it to necrosis.

The pus may also find its way from the apical space into the maxillary sinus and thence into the nose (Fig. 28, *b*), or it may escape by way of the palate or extend into the pharynx; and finally, it may penetrate the soft tissues, forming an opening on the face.

The amount of pus formed varies with the condition of the individual and the severity of the case. It is often very profuse, gradually lessening in amount until, after a period of four or five days,

FIG. 28.



*a*. Maxillary sinus. *b*. Sinus from an abscess-cavity discharging into the antrum. *c*. Abscess-cavity. *d*. Pus-cavity showing periosteum pushed away. *e*. Pus-cavity whose sinus extends through pericementum, alveolar plate, periosteum, and gum tissue. *f*. Inferior meatus of the nose.

it has for the most part ceased and the gum and surrounding tissues resume in a considerable degree their normal appearance. Following this there is usually a slight discharge of pus, which may be kept up indefinitely, or in other words it assumes a chronic condition unless treatment is instituted to correct it.

The fistula usually remains open; sometimes it heals and then reopens; and again it heals permanently, forming what is known as a blind abscess. (Fig. 29.)

These conditions are kept up by the slow discharge of the products of putrefaction from the pulp chamber into the apical space; furthermore, these products are absorbed into the dentin and give rise to more or less discoloration of the tooth.

**Symptoms.**—The local signs and symptoms of acute alveolar

abscess include many of those connected with the pericemental inflammation which has preceded it; in fact, we have abscess and its symptoms added to pericementitis and its symptoms. These additional symptoms are indicated by the violent throbbing character of the pain, which is now continuous and which increases until it is wellnigh unbearable. The adjacent gum tissue becomes deeply congested, and afterward swollen, increasing in fullness until there is distinct fluctuation, showing the accumulation of pus at this point; this, if left to itself, may be discharged at the point of greatest fluctuation.

The looseness of the tooth in its socket increases up to the time when the pent-up pus escapes; after that time it gradually gets firmer, the pain lessens, and all symptoms are abated.

FIG. 29.



a. Abscess-cavity.

In the chronic form the same features obtain, although they are modified to a great extent as the symptoms become acute from time to time. In severe cases the general system shows its sympathy with the local disturbance by fever, as indicated by the quickened pulse, flushed face, hot, dry skin, thirst, coated tongue, constipation, loss of appetite, etc.

**Prognosis.**—This depends upon the advancement of the inflammation before the beginning of treatment; the temperament; condition of health, etc. It must be said that when the process is fairly begun it is likely to run a certain definite course, limited by the time when the pus makes its escape. This is hastened by treatment.

**Diagnosis.**—In those rare cases in which it may be possible to



confound alveolar abscess with erysipelas, actinomycosis, subperiosteal inflammation, impacted teeth, etc., attention to the vitality of the pulp, the soreness of the tooth in proportion to the acuteness of the attack, the condition of the gum, exploration of existing sinuses, etc., ought to furnish conclusive evidence as to the existence or not of alveolar abscess.

**Treatment.**—While the treatment is to be modified according to the symptoms and stage of the morbid process, there are certain general principles to be observed, viz. the discharge of pus and the relief of pain, and depletion by local and general means.

In the evacuation of the pus, the usual procedure is to lance freely the soft and most prominent point of the swelling, and at the same time, if possible, to favor drainage by making the opening at the most dependent part.

The tooth is usually so painful to the touch that it is with great difficulty that an opening can be made into the pulp chamber, although it may be desirable to make such an opening. It may be helpful in such cases to tie a ligature around the affected tooth, and make traction upon it in the opposite direction to that in which the drill is being pushed. There is often such pressure in the apical space that when the opening is made into the pulp chamber the pus comes out profusely, and rapidly fills the opening, giving relief from pain at once.

In worthless roots and in rare cases of general weakness it is best to extract the offending organ.

After the discharge of pus and the consequent relief from pain, the patient may usually be discharged until soreness of the tooth has ceased, when the tooth may be treated. The treatment of the pain, and depletion by leeches and cathartics in the early stages, is precisely the same as in pericementitis.

The majority of cases will need no further treatment. In the early stages quinin in six-grain doses every four hours may be indicated in order to limit pus-formation.

After the active symptoms subside, certain cases should receive treatment calculated to strengthen the nervous system and enrich the blood. Strychnin or nux vomica may be relied upon as a nerve tonic, while the arsenate of iron in pill form may be administered in anemic conditions.

This treatment is also applicable to many conditions found in the chronic form of alveolar abscess.

## CHAPTER XXXV.

## DENTAL EROSION.

**Definition.**—A gradual wasting away of certain portions of the teeth, probably due to chemical action.

**Etiology.**—From the time of Hunter until the present day, various etiological factors have been entertained, some of which may be briefly stated as follows: An inherited condition of the teeth, not dependent upon local influences or accidental causes; an imperfect formation of the enamel; and mechanical action, principally that of the tooth-brush. Many writers have expressed their belief in the causal relation of hyperacidity of the saliva to dental erosion, and especially has Dr. James Truman\* given much attention to this subject, maintaining for many years that erosion of the teeth was caused by the acid resulting from fermentation in the mouth.

His experiments were made with the object of testing the oral fluids at different times during the day and night, and he found that the greatest acidity was attained after a prolonged period of rest, this time being in the early morning hours.

Working in the same direction, Dr. E. C. Kirk† not only confirmed the tests made by Dr. Truman, but suggested the source of the acid, showing by tests with litmus paper that the mucous glands of the lip, or cheek, opposite the eroded surface, secreted an abnormal product which exerted a solvent action on the teeth. The writer may add that he has applied the test as suggested above for several years, and his experience leads him to concur in the statements made by Dr. Kirk. The conclusions as to cause, resulting from these demonstrations are maintained at the present time; indeed, it would be difficult to account for many eroded surfaces located in odd situations where mechanical influences cannot act, were it not for the supposed abnormal action of certain isolated glands which are affected. Among the causes which probably act both locally and systemically are the excessive use of acid fruits and drinks. Several cases illustrating the injurious action of these

\* *International Dental Journal*, vol. xiv. No. 4.

† *Dental Cosmos*, 1886.

agents have been reported, and the writer has seen two or three cases in which they were prominent factors in producing dental erosion. Dr. Michaels of Paris has made some experiments\* which were described by Dr. Bogue at a meeting of the New York Odontological Society in June, 1894. Dr. Michaels asserted that potassium sulphocyanid would produce an erosion of the teeth having the same appearance as that found in the mouth. In a similar experiment performed by Dr. Bogue the teeth thus acted upon showed distinct marks of erosion after four days. Dr. Bogue said that potassium sulphocyanid gave a slightly acid reaction to litmus paper after it had been lying wet all night. These experiments are appropriate, inasmuch as potassium sulphocyanid is found in the saliva, but in no other part of the body.

*Constitutional conditions*, inherited usually, but often acquired, certainly play an important part in the causation of dental erosion. This statement is made, however, knowing that it is at present impossible to exactly define either the constitutional condition or the manner in which it produces the special lesion in the mouth; but clinically, for the past ten years, there has been observed a condition of the general system loosely termed a gouty diathesis which has been constantly associated with erosions of the teeth, often involving both the gum tissue and the alveolo-dental periosteum. It is also the writer's belief, based on clinical observations including an examination of oral secretions and renal excretions, that what is termed phagedenic pericementitis is but an acute stage of the condition in which there is loss of tooth substance (erosion), gum tissue, and alveolo-dental periosteum, without pus, calculus, or inflammatory conditions.

That erosions of the teeth have been observed to exist independently of any symptoms of a gouty diathesis is probably due to the fact that such a diathesis may exist for years without producing marked symptoms, and that certain symptoms, as neuralgia, are often overlooked, as far as the relation to a gouty condition is concerned.

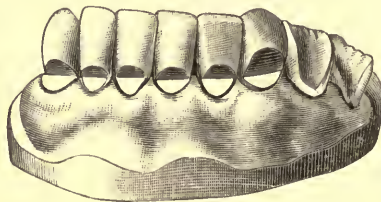
**Prognosis.**—The prognosis is discouraging, yet it is not always hopeless, depending upon the general condition of the body, which

\* The experiments consisted in dropping upon a tooth a solution of potassium sulphocyanid 1 part, to water 1000 parts. It was effected by means of two capillary siphons, one drawing the solution and the other carrying it away.

in some cases is such that the disease is arrested or mitigated, while in others it is so rapidly progressive that the destruction of the involved teeth is threatened.

**Symptoms and Diagnosis.**—Erosion is to be distinguished from abrasion by the shape of the eroded surface (Fig. 30) and its polish, and by its location in territory which is not acted upon by opposing teeth or necessarily by the tooth-brush. It is usually located on the labial and buccal surfaces of the incisors, cuspids and bicuspids, and sometimes on the molars, at the junction of the gum margin with the enamel. The erosion of grinding surfaces may be distinguished from abrasion by the peculiar cup-shaped depressions, not conforming to the flat surface or the point of contact with the opposing tooth. A careful examination of the secretion from the mucous follicles of the lips opposite the eroded surfaces will usually

FIG. 30.



Eroded teeth.

show a decided acid reaction. This examination may be made by drying the mucous surface and applying litmus paper thereon, pressing the tissue to cause an outflow of the secretion. The test should be made in the morning, on rising, and at other times during the day.

While erosion may exist without the patient's being conscious of any systemic disturbance, a careful physical examination will usually reveal a gouty or rheumatic condition.

**Treatment.**—The treatment of erosion may be classified under three heads: 1st. Filling the eroded cavities. 2d. Local applications as a preventive. 3d. Constitutional treatment, both preventive and curative.

Filling the eroded cavities or depressions is to be commended in cases sufficiently advanced, but, as one may readily perceive, it only prevents further action in that particular direction; it does not eradicate the cause, and erosion may still go on in other parts of the tooth surrounding the filling.

Regarding local applications, the main object is to neutralize the acid secretions and form a protective coating over the surfaces exposed to their action. One of the most recent and effective means of accomplishing this was suggested by Dr. E. C. Kirk.\* It consists in taking into the mouth about a teaspoonful of an un-official preparation known as "milk of magnesia" (magnesium hydrate) and letting it flow over the teeth. This forms a thin coating over them, protecting their surfaces and rendering the saliva alkaline for some hours. It should be done more especially after brushing the teeth at bedtime, and immediately after brushing the teeth in the morning.

A preparation which has been used with good effect is one composed of precipitated chalk, sodium bicarbonate, and gum tragacanth, these forming a sticky paste which adheres to the tooth.

The constitutional treatment must of necessity vary with the constitutional need, as far as this can be ascertained. Examination of the blood, urine, and oral secretions, essential in many other diseases, is especially so in this. If erosion be due to gout, it may not be simple gout, and if not, complications must be taken into consideration. If the assertions of recent writers are true, that erosion of the teeth is due to a gouty diathesis, and that this condition depends upon an accumulation in the blood-serum of the salts of uric acid, then treatment must consist in removing, if possible, the conditions which bring about this accumulation. Although the reasonable and principal basis of treatment would seem to be the proper arrangement of the diet, yet the different chemical changes which the food undergoes are so complex and inaccessible that many of them are unknown at the present time. It is generally advised that subjects of a gouty diathesis should avoid an albuminous diet, and partake largely of farinaceous and vegetable foods; but Dr. H. W. Draper, in Pepper's "System of Medicine," says that it is his experience that this theory is not supported by the clinical history of cases, although it may be a legitimate deduction, in view of the uric acid theory of gout. Dr. Draper has noticed that gouty subjects do not easily digest the carbohydrates, sugars and starches, and that these foods are more likely to produce digestive disturbances than the albuminous foods. In the absence of positive knowledge in regard to chemical changes in-

\* *Dental Cosmos* for July 1893, p. 585.

volved in the conversion of food into the various tissues and in the formation of excrementitious matters, it is not surprising that authors differ as to what should constitute the diet of the gouty subject, although there is general agreement that saccharine substances and malt liquors should be avoided. In the matter of meats, it should depend upon the condition and habits of the individual. If considerable exercise is taken, and much water drunk, the amount of meat could manifestly be increased. As a rule, fresh meat may be taken once a day, preference being given to fowl, game, and white meats, while salted meats, such as pork and ham, are to be avoided.

Bartholow says that eggs should be avoided, as well as cake, pastry, and all saccharine foods. Some writers allow fruits, while others restrict or forbid them; but this should probably depend upon the kind of fruit, and its previous effect upon the patient. Oranges and grape-fruit often contain much acid, and may do harm locally and constitutionally. Vegetables, milk, fish, and oysters may be allowed, but potatoes and other starchy foods should be restricted.

The objective points toward which the medicinal treatment of the gouty dyscrasia is aimed are classified as follows by Dr. Draper: 1st. The improvement of the primary digestion. 2d. The relief of the gastro-intestinal catarrh, which is the cause of the direct and reflex dyspeptic symptoms which belong to this diathesis. 3d. The augmentation of food-oxidation, so as to secure its thorough combustion. 4th. The promotion of the elimination of the waste products of nutrition.

In regard to the first—viz. the improvement of the primary digestion—attention to the diet and exercise as before mentioned, the judicious use of pepsin fifteen minutes before meals, and pancreatin, which aids in the digestion of the fatty amylaceous and ozotized foods, are mainly to be relied upon.

In regard to the second proposition, we refer to the remarks on diet and exercise, and in addition commend the mineral waters, such as Carlsbad, Friederichshall, and Hunyadi. Their use should not be continued over a long period of time, especially in weak, anemic persons.

The third objective point may be approached, as with the others, by the suggestion of sufficient outdoor air and exercise, with a regulated diet. If the patient be anemic, the blood may be enriched by the use of iron in the form of Blaud's pills.

Fourthly, in the elimination of the waste products of nutrition, remedies which will increase the action of the kidneys, and if possible act as solvents of uric acid, are indicated. The granular effervescent citrate of lithium may be used to effect this object and to produce an alkaline condition of the blood. Tartarlitine (lithium bitartrate), is also an excellent remedy for this purpose. The time for administering these or other remedies depends upon the object to be accomplished. To neutralize acidity in the stomach the remedy should be given immediately after meals, but for the purpose of exercising a solvent action it should be administered three or four hours after meals.

Large quantities of water, especially hot water—for its solvent action, as a diluent, and to assist in elimination—are to be recommended, and should be taken immediately after rising and at other times during the day.

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## CHAPTER XXXVI.

### ABRASION.

**Definition.**—A wearing away of the teeth due to mechanical causes.

**Etiology.**—It is easy to see how, by a disarrangement of the articulating surfaces, the prominences or cusps which normally fit into corresponding depressions in the opposite teeth are made to antagonize the cusps instead, and how, these being worn, still greater freedom is given to the sliding movement of the jaws by which the articulation is constantly changed. These changes in the articulation may also be the result of defective development, or the arrest of development consequent upon the extraction of several teeth before the growth of the jaw is complete. For instance, when teeth are removed from the upper jaw only, and the lower one goes on developing, the incisors and cuspids of both jaws may occlude, and are thus worn or abraded, sometimes in a marked degree, being occasionally worn down to the gum. Perhaps one of the most frequent causes of abrasion is the loss of the molars, or the molars and bicuspid, from each jaw, by which the remain-

ing anterior teeth are abraded from excessive use. Smokers have their teeth abraded corresponding to the position in which the pipe is habitually held. Those addicted to chewing tobacco often have all their teeth more or less abraded on account of gritty substances contained in the tobacco.

A certain amount of wear is unavoidable, and is therefore not to be considered as an abnormal condition; for it is a matter of everyday observation that recently erupted incisor teeth, in nearly all cases, present a serrated cutting edge, while those which have been subjected to wear for several years do not show these little prominences.

**Pathology.**—The pathological changes resulting from mechanical abrasion are slight, and very little has been said or written on this branch of the subject.

The supposition that abraded dentin is much harder than normal dentin is untrue, for any polished surface may present the appearance of greater density and hardness. This is well illustrated in a polished marble slab, which resists the penetration of a sharp instrument to a remarkable degree, but which, as every one knows, is neither denser nor harder in structure than before it was polished.

The sensitiveness of these abraded surfaces, from constant irritation, may well provoke changes in the pulp itself.

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## CHAPTER XXXVII.

### HYPERCEMENTOSIS.

**Synonyms.**—Hyperostosis; Exostosis; Dental osteoma; Hypertrophy of the cementum; Excementosis.

**Definition.**—Hypercementosis is an excessive development of the dental cementum.

**Etiology.**—It is generally understood that increase of the cemental tissue is due to some form of irritation, but as to the exact forms of irritation, and their origin, opinions are either silent or divided.



Caries has, for a long time, been mentioned as a cause, but it has not yet been demonstrated as such.

Various forms of irritation commonly seen in the mouth may cause hypercementosis, such as mal-occlusion of teeth, protrusion of fillings into the gum tissue, large metallic fillings near the pulp, deposits of tartar, etc., but as none of these can be verified by statistical tabulation or demonstration the matter is still unsettled, although these propositions may all be correct.

In regard to the increase of the cemental tissue in connection with alveolar abscess, Dr. Barrett\* says: "In the case of roots that have long been in an abscessed condition it will be found that where the pericementum has been destroyed there will be no hypertrophy, but upon those parts of the root which still retain their attachment a considerable growth will not unfrequently be seen. The abnormal deposition of cementum is not dependent upon the vitality of the tooth pulp, in fact it seems most excessive in teeth that have long been devitalized."

The opposite opinion is expressed by the late Prof. Abbott,† as follows: "Only an irritation of the pericementum while the pulp is living can, in my judgment, result in an increased cementum."

Dr. Guilford well says, in this connection: "While hypertrophy of the cementum is found in connection with teeth that have long been devitalized, or are partially invested with an abscess-sac, we do not know that these conditions in any way influence the increase of tissue. So, too, the fact that teeth that have long been unantagonized are upon extraction found to be largely exostosed, does not prove that their abnormality is due either to lack of antagonism or to gravitation, for they may have been hypertrophied before the latter conditions existed."

**Pathology.**—The teeth most frequently affected are the molars and bicuspid, and it is said that the upper teeth are more likely to be attacked than the lower.

The disease has no preference for any particular part of the root, and the additional growth may present itself in different forms. It may vary in size from a microscopic speck to a growth which entirely covers the root itself.

\* *Independent Practitioner*, vol. vii. p. 412.

† "American System of Dentistry," vol. iii. p. 431.

The following description of the manner of the formation of this growth is given by Dr. S. H. Guilford:\*

Secondary or hyperplastic cementum, like the normal cementum formed earlier, is the product of the peridental membrane or pericementum. This membrane comprises that tissue which intervenes between the root of the tooth and the bony walls of the alveolar process, and is the agent by which both these hard tissues are produced. That portion of it lying next to the alveolus produces bone, while the opposite margin, next to the root, is directly instrumental in the upbuilding of the cementum. The fact that the same tissue is capable of producing two hard tissues in most respects similar, and yet dissimilar enough to prevent their union, has led many to infer that the peridental membrane is in reality two membranes lying in close proximity and measurably connected, yet differing the one from the other in certain functional peculiarities. Later investigation, however (notably that of Prof. Black), goes to show that the membrane is single, and so constituted as to be able to produce either bone or cementum according to location and required needs.

Both surfaces of this membrane are covered with specialized cells which are the immediate instruments in the formation of bony tissue. Those on one surface, which are to produce bone, are termed osteoblasts, while those next to the tooth are known as cementoblasts. When either hard tissue is to be formed these special cells become active in throwing out calcareous salts, which shortly surround them with spherules of lime. These spherules, lying in close proximity, become coalesced and gradually filled up by further calcareous elimination, so as to form a layer of osseous tissue. Another row of cells similar to the first is then produced on the surface of the membrane, which in turn become converted into an osseous layer overlying the first. In this way, layer by layer, the hard tissue is produced until the normal limit is reached.

In the formation of the primary cementum the first layer is attached to the peripheral surface of the dentin. On this the second layer is formed, and so on until the normal quantity is formed, after which the pericementum becomes functionally inactive, and so remains unless again called into use through pathological influences.

In the production of hyperplastic cement the peridental membrane resumes its former activity, and new tissue similar to the first is added to that already formed. This action may be localized or general, according to the conditions operative in bringing it about. In the one case the new growth is circumscribed [Fig. 31], and in the other diffused [Fig. 32]. In either case it may assume considerable proportions, in many instances resulting in the coalescence of the different roots of the molar teeth [Fig. 33], and sometimes in uniting the roots of adjacent teeth. When this takes place one or more of the roots is increased in size by the hyperplastic growth, the pericementum is distended, the adjoining alveolar septum is absorbed, and finally, through compression, the membrane itself is dissolved and the roots united.

\* "American System of Dentistry," vol. iii. p. 429.

One of the most remarkable characteristics of this peridental membrane is the power it possesses of being the agent of either the upbuilding or resorption of the adjacent bony tissue. At times it assumes the one function, at other times the other. In many cases the normal cementum has been absorbed at certain points, and this resorption has again been followed by new cemental formation in the same place.

This resorption of bone or cementum is directly brought about by special cells on the surface of the pericementum, known as osteoclasts.

FIG. 31.



FIG. 32.



FIG. 33.



These appear to excrete a liquid capable of dissolving away the hard tissue. Whether these cells are the original cementoblasts pathologically modified, or an entirely new formation, has not yet been definitely determined.

This hypertrophic formation, when magnified, presents grooves and pits with portions of the periosteum attached. Its color is usually lighter than the original formation and often is nearly white. The excessive growth often encroaches upon the canal at the apex of the root, and thus interferes with the function of the nerves and arteries entering at this point; indeed, severe neuralgia may be the result of this encroachment and consequent irritation.

Cemental hypertrophy is uncommon in the incisors and cuspids; occasionally, however, this increase of tissue may be observed on the upper incisors or cuspids. More frequently are the bicuspids affected, and these more frequently show what is termed the cap-shaped variety.

In the molars the roots are often united by the overgrowth, and especially may this be seen in the third molar.

## CHAPTER XXXVIII.

## SECONDARY DENTIN.

**Definition.**—Secondary dentin is the product of a continued development of dentin beyond the usual limit, at the expense of the pulp cavity.

The causes of this growth are similar in character to those which produce the pulp nodule; for example, the presence of large metallic fillings too near the pulp; the irritation resulting from slowly progressing caries; also that from abraded and eroded teeth. These or other similar causes irritate the pulp through the dentinal canals, and if this irritation is long continued it results in the development of dentin as above defined.

**Pathology.**—The pulp chamber diminishes in size as the walls of the dentin increase in thickness; but this is the case as the dentin is normally developed from childhood, when, as we know, the pulp chamber is comparatively large. It is not known when or upon what physiological conditions this growth is limited, but it is known that when some abnormal condition obtains which induces a further growth of dentin there is a line of demarcation between the normally developed dentin and that which is the result of some abnormal condition. There is usually a general disturbance in the formation of the dentinal canals, and in their direction, but this varies greatly in different cases. Generally, in secondary dentin which is due to abrasion or caries the new canals correspond in a considerable degree with the old; but in the concentrically laminated and the nodulated varieties the canals do not have this similarity in direction. The color of the new growth is easily distinguished from that of the original dentin.

That secondary dentin may continue to be formed until the pulp chamber is entirely occluded has been demonstrated by observing patients whose teeth had been worn to the gum margin, yet showing no trace of the pulp cavity; this is not always the case, however, the amount of secondary formation being governed by the amount of irritation and the time during which it has been in operation.

It is also to be noted that the location of the secondary deposit

is related closely to the site of the external lesion; for example, if the dentinal deposit is due to abrasion long continued, the resulting growth is symmetrical, while that due to caries is found in that portion of the pulp chamber nearest the carious cavity.

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## CHAPTER XXXIX.

### PULP NODULES.

**Synonyms.**—Pulp nodules; Pulp-stones; Odontomes; Denticles; Odontheles.

**Definition.**—A very hard formation of bone, dentin, or both, within the pulp tissue, or attached to the walls of the pulp chamber.

**Etiology.**—We have a record of observations regarding the above-named formation which extends as far back as 1780, or possibly earlier, also writings by Tomes in 1846, since which time much has been written on this subject; yet the etiology is still obscure as to the precise manner of the formation of the pulp nodule.

The observations of the early writers led them to believe that so-called "pulp-stones" were a form of secondary dentin produced from the odontoblastic layer, and connected with the wall of the pulp chamber by a pedicle which was subsequently absorbed. These views, however, have been disproved through the later researches of Miller, Black, Bödecker, Baume, and others, showing that these formations occur within the connective tissue of the pulp by means of the calcification of the bundles of fibers and spindle-shaped cells of which it is composed, and that they have no connection with the odontoblasts.\*

It is not certain whether the spindle-cell itself becomes calcified, or the material is deposited around the cell, which thus becomes enlarged by accretions. Dr. Black says that these deposits are "not calcifications of the tissue of the pulp, but are found in the midst of the tissue, making room for themselves by pushing the tissue aside," but Dr. R. R. Andrews is certain that these nodules are calcified from the connective-tissue cells of the

\* See paper by Dr. E. C. Kirk, *International Dental Journal*, December 1893.

pulp. We know that the normal deposit of bone, dentin, and enamel is self-limited, and in health remains within this limitation, but different forms of irritation induce a renewal and possibly a perversion of this function, resulting in the various hard formations within the pulp chamber. The forms of irritation which cause this disturbance are much the same in some cases as those which induce deposits about the joints, in the coats of the arteries, in the brain and other parts of the body. The casual irritation may be general or local. It is possible that syphilis, gout, or rheumatism may act as a general irritating cause of the deposits, although this has not been proved. Among the probable local causes are caries, excessive abrasion, lack of occluding teeth, recession of gums and absorption of the alveolar process, large metallic fillings, etc.

Dr. Wm. P. Cooke of Boston, in an examination of five thousand teeth, found the largest pulp-stones in those molar teeth which seemed to have stood a severe test in mastication for many years.

**Pathology.**—Pulp nodules are harder than normal dentin, although they are composed of the same material; their outward appearance varies from a minute speck hardly discernible by the unaided eye to those which nearly fill the pulp chamber; they are found in all parts of the chamber, sometimes in the midst of the pulp tissue, and again near or at a point of exposure, and often at the bifurcation of the roots, or within the root-canal.

The pulp tissue itself under these conditions presents a normal appearance.

**Symptoms and Diagnosis.**—Dr. Black says that in studying the pulps of teeth of known history he has been unable to find that those with pulp nodules have given any peculiar symptoms or have given more pain than those without these bodies.\* It is, however, quite possible that these may occur of such size near the junction of the coronal and root portion of the pulp, or in the root portion, as to cause degeneration of the organ; or they may by their volume interfere with its functions.

The few symptoms, if any, that belong distinctively to "pulp-stones" make the diagnosis comparatively difficult. The expres-

\* Dr. R. R. Andrews says that the growths are liable at any time to give pain, or cause irritation from encroaching on nerve fibers of the pulp by growth.

sions of pain vary from a slight uneasiness to intense suffering, the teeth being especially sensitive to heat or cold. There is usually severe pain, often intermittent, with soreness on pressure in the advanced stages. As is commonly observed, often when too late for a more speedy and satisfactory treatment, the pulp in this condition resists the usual action of arsenic; this, if recognized early, may lead to a correct diagnosis and improved treatment.

**Treatment.**—When treatment is required, the tone of the request for it is not an uncertain one. There is but little choice in methods; indeed, there is only one treatment, and that is the removal of the pulp, with the hard bodies contained within its chamber. The methods of doing this may vary. It may be accomplished, probably, by the slow and painful one of repeated applications to destroy the pulp, but the pain may be so violent as to preclude this method. Cocain, or carbolic acid injected or pumped into the pulp cavity, has been effectual, also the employment of general anesthesia by nitrous oxid gas or ether.

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## CHAPTER XL.

### NECROSIS.

**Definition.**—Death of a tissue, in bulk.

**Etiology.**—The vitality of any part of the human body is dependent upon the blood as a circulating medium. If the general circulation ceases, death of the whole organism takes place. If the circulation is interrupted in part, death is the result, but it is limited to the part involved. As the term necrosis is usually applied to death of the bony tissues, so the term gangrene is applied to the same pathological condition of the soft tissues; for example, death of the dental pulp is gangrene, or mortification. Death, or mortification, of the pulp occasionally takes place without apparent cause, but it is probably due in such cases to changes which interfere with the circulation of the blood as above described. There are cases in which death of the pulp has followed typhoid fever by which the patient had been brought to a very low condi-

tion, in which it may be supposed that the circulation within the pulp may have ceased, and that this, with the impoverished condition of the blood, caused death of the part.

Degenerative changes, the action of medicines, and deposits of secondary dentin, may all produce the results mentioned, but in the further consideration of this subject we shall limit our discussion to bony tissue. The superficial bones are most frequently attacked, as the tibia, ulna, lower jaw, etc. The long bones are affected more frequently than the short, and the short rather than the flat, while in caries the reverse is true. Necrosis occurs frequently in those children under fifteen years of age who are the subjects of a strumous diathesis or who have a syphilitic taint; also in adults who have been subjected to long courses of mercury. Local irritation in many forms has undoubtedly a causative influence; some of these forms of irritation are the result of contusions, fractures, or abscesses. Frequently, death of the bone results from its being denuded of its periosteum, especially if this be considerable; it is also true that if the bloodvessels in any portion of the periosteum and in the medulla of the bone are destroyed, that portion of the bone tissue which fails to receive its necessary blood-supply becomes necrotic.

*Phosphorus* has in former years been quite frequently the cause of necrosis of the lower jaw. In several cases seen at the clinics at the Pennsylvania Hospital the necrosis was extensive in the lower jaw, while the upper remained unaffected. This phosphor-necrosis is somewhat remarkable, in that it shows such a decided preference for the lower jaw; but the anatomy of the jaws, and the manner in which the circulation is carried on, seem to offer a sufficient explanation. The lower jaw is a bone of considerable length, being bent upon itself. The blood and nerve supply, entering at the posterior end, passes along the inferior dental canal with little inosculation between the bloodvessels, so that any obstruction to the circulation in this part is not compensated for, by reason of the lack of collateral circulation.

The upper jaw, on the other hand, receives its blood and nerve supply from different directions, and its anatomical structure is different, being largely composed of thin plates and supplied with periosteum on each side. If the circulation on one side is obstructed, that on the other is sufficient to supply the bone-nutrient.



This form of necrosis was first noticed, in this country, by Dr. James R. Wood, who gave an account of it in the *New York Journal of Medicine* for May, 1856, with the history of a case in which he removed the entire lower jaw. In order to produce this particular form of necrosis it seems to be necessary that the vapor of phosphorus should come in actual contact with the periosteum. It has also been said that only those persons having carious teeth are liable to this affection. However this may be, it is a fact that since strict regulations have been carried out in the match-factories the disease has been of less frequent occurrence. These regulations include an improvement in ventilation and rigid enforcement of the rules that all carious teeth of the employes be filled; that

FIG. 34.



X-ray illustration, showing an unerupted bicuspid.

employes practice breathing through the nose instead of the mouth, and that each shall wear over the nose a sponge saturated with dilute sulfuric acid.

When *impacted teeth* are the cause of necrosis, the X rays may be used to locate the offending tooth. The following case is of interest in this connection:

The patient, Mrs. L. G. S., having suffered from dento-alveolar abscess of the lower first molar of the right side, this tooth was removed; but the pain and discharge continuing, in December 1896, ether was administered and an attempt was made to remove what was supposed to be an impacted tooth at the site of the second bicuspid, but the attempt was ineffectual. The parts being less painful, the condition was allowed to remain until December 1897, when there was swelling on the outside of the face, and the patient was referred to the writer.

The Roentgen rays showed the position of the impacted tooth. (See Fig. 34.)

An incision two inches long was made at the lower border of the body of the jaw; pus escaped, and necrosed bone was removed, which

revealed the end of the impacted tooth. By the use of chisels and elevators the tooth was finally removed through the mouth. The periosteum was sewed up and the external wound closed with the kangaroo-tendon suture and covered with iodoform collodion. In ten days the wound had healed, and the patient is making a good recovery.

The following case, from notes kindly supplied by Dr. Henry O. Marcy of Boston, is of interest as showing the possible injurious effect of the use of *hydrogen peroxid*:

W. A. J., aged fifty-seven, merchant; general health excellent. For some days he had pain about the right lower third molar. A large amalgam filling had been placed in this tooth a number of years previously, but it had never given trouble until the present time. Although decay was not present, he was advised to consult his dentist, who drilled out the filling with much difficulty, on account of the extreme sensitiveness of the parts.

His suffering increased, and after a few days the tooth was extracted. After extraction the dentist injected hydrogen peroxid into the socket; it was immediately followed by a most acute lancing pain which shot around the jaw quite to the opposite side. For some days the patient was confined to his room, and the pain was controlled only by large opiates. Tumefaction of the entire lower jaw followed, attended with great difficulty in swallowing. This was accompanied by a general septic fever which continued for a number of weeks, during which period a fatal issue seemed imminent. Suppuration occurred at various points around the entire jaw, opening exteriorly on the right side. Later, under an anesthetic, I removed nearly an entire set of sound teeth, which were held in place almost only by their attachment to the inflamed soft parts. These I reflected from either side, and with bone-forceps cut away the necrosed alveolar process quite to the ramus of the jaw. The exterior opening on the right side was found to connect with one of the pockets about the alveolar process, and necrosis of a part of the outer portion of the ramus of the jaw was found to exist. This was carefully chiseled away.

Following the operation, improvement slowly supervened, but months dragged wearily away, and quite two years elapsed before the last bit of necrosed bone was exfoliated. The parts would heal, but every little while a tender place made its appearance, to mark the site from which a spicule of bone would escape. The last piece to be detached was from the angle of the jaw posterior to the third molar, where the trouble began. Many months more

followed before artificial teeth could be fairly well tolerated, and the genius and skill of quite a number of our best dentists have been called into exercise in order to construct plates that may be made serviceable. The success in this direction, however, is such as to prevent any disfigurement, and permits of easy articulation without impairment of speech, and mastication of carefully prepared food. The general health is restored to the old-time vigor.

It is believed that the injection of the peroxid penetrated the inferior dental canal, and, instead of destroying septic elements, the pressure of the gas generated disseminated them through the entire length of the canal, and caused this most distressing and dangerous of accidents possible to the lower jaw. It is, indeed, not improbable that the forceful injection of pocketed wounds in any part of the body with peroxid may defeat the very end sought, and endanger the contiguous tissues by the transplanting of undestroyed micro-organisms. It is a frequently observed fact that wounds of this class, faithfully treated in this way, have been a source of vexation and disappointment to the surgeon, who too often charges the result to the lack of the antiseptic property rather than to its probable true cause,—the rapidly generated gases, which from pressure disseminate infection; and it is for this reason that the above clinical case is inserted.

**Pathology.**—The manner in which this pathological condition is first manifested depends much upon the cause. The soft parts over the seat of the disease are always affected, soon becoming tender to the touch, swollen, and discolored. Following this, pitting under pressure indicates the infiltration of the subcutaneous cellular tissue. The local conditions are often sufficient to command the sympathy of the entire system, and general symptoms are accordingly present. We are not surprised at this when we take into account the presence of pus, often deep-seated and located between the affected bone and its periosteum, as well as on the outside of this membrane, and in the connective tissue of the muscles and aponeuroses, which it often extensively permeates, detaching the one from the other, and forming pouches from which its removal is often difficult. The quantity of pus is often large, being derived mostly from the soft tissue surrounding the bone. The first stage of the disease being over, which means that the excess of pus has been discharged, the inflammatory symptoms subside in a measure, although the soft parts are still swollen,

tender, and painful. The periosteum is always destroyed to a greater or less extent and the surface of the bone is more or less rough, presenting, when seen, a grayish-white appearance. This condition may be determined by means of digital exploration, the use of the probe, or actual inspection of the part. As a general rule, at this stage of the disease the work of elimination and repair begins, but it is often very slowly and imperfectly accomplished, depending upon the recuperative powers of the system. This is quite different from death of the soft tissues, in which the separation of the sphacelus is easy compared with that of bone, which requires weeks and perhaps months for the entire separation of the dead from the living parts. Necrosis may involve only the outer layer of a bone or it may include its entire thickness and a considerable measure of its length. If only a small portion of the outer layer is thus affected, the portion detached is called an exfoliation; but if the whole body of the bone is involved, the part thrown off is called the sequestrum.

In the lower jaw, the outer surface of bone is usually first affected; in the upper jaw it may attack the hard palate, or the disease may include an indefinite amount of either jaw. A sequestrum is formed in the lower jaw only. Often many of the teeth are affected, becoming loose and discolored until their removal is necessary. The inflammation which precedes and accompanies necrosis, involving as it does the soft parts and the periosteum, may extend into the articulation and thus seriously affect the motility of the lower jaw. Many teeth may escape destruction while the surrounding alveolar process may be destroyed to a great extent. Dr. G. V. Black\* reports a case in which the buccal plates of the alveolar process, together with more than half the septum between two of the teeth, were destroyed by abscess, yet the teeth were found in very good condition eight years after the occurrence.

**Symptoms.**—The symptoms giving expression to death of bony tissue are often much the same as those which indicate acute inflammation. The pain is often excruciating, suppuration rapidly intervenes, and much damage is done even in a few days; but the progress of the disease is not always so swift and overwhelming; indeed, it may be quite the opposite, with very little pain, and otherwise pursuing what may be justly termed a chronic course.

\* "American System of Dentistry," vol. i. p. 932, fig. 488.

Following these earlier symptoms, those which indicate the separation of the dead bone and the formation of the new are quite characteristic. The foreign and poisonous material which is constantly being formed gives rise to an accumulation of pus, and ulcerations may be seen, surrounded by large unhealthy granulations, with sinuses leading from these ulcers down to the dead bone. There is a discharge, more or less constant, of thin, fetid matter, or of thick, white, inodorous pus. This is accompanied by more or less swelling and some induration, pain and tenderness on pressure, and wasting of the soft parts adjacent to the seat of the disease. There is also impaired function, according to the degree to which the joints in the immediate vicinity are affected.

In necrosis of bone, the disease is often sufficiently prolonged to produce a marked effect upon the general health, as indicated by anemia and emaciation. Hectic fever may occur when the disease is extensive. In cases of phosphor-necrosis the symptoms assume the acute form which we have just described.

It should be noticed in this connection that alveolar abscess followed by necrosis may present the ordinary symptoms of alveolar abscess, which after treatment of the abscess by incision or by extraction of the tooth may disappear altogether, only to reappear some weeks or months later. It would seem in such cases as though the cause had not been entirely removed, yet it would be difficult for any one to know that any irritating substance had been left behind which should ultimately cause necrosis. It would be well, therefore, after extracting a tooth in such a condition, to gently cleanse the socket and insert a light antiseptic dressing, changing it daily until this is found to be unnecessary.

**Prognosis.**—The prognosis is uncertain, depending much upon the cause, or causes, which produce the disease. In a general way it may be considered favorable when the disease is due to external or local causes; when it is confined to the outer portion of the bone, and the bone is exfoliated; also when the disease is uncomplicated, and of small extent; and, again, it is favorable when the patient is young and in good health. On the other hand, the outcome is more doubtful when the disease is extensive and has serious complications. In extensive necrosis of the superior maxillary bones the disease may extend to other bones, even affecting the brain and causing death thereby. Its progress is also unfavorable when it extends into joints of large size, or when the cause is a constitu-

tional one, as scrofula or syphilis. Finally, if the patient is of advanced age, or reduced in health by long suffering and disease, we anticipate an unfavorable issue.

**Diagnosis.**—As a general thing, necrosis is easily distinguished by the denuded state and whitish appearance of the affected bone, by the existence of a purulent discharge, and by an extremely fetid breath when it occurs within the oral cavity. The use of the probe is essential, and may tell much that cannot be readily ascertained upon inspection, or exploration with the finger. Dead bone when struck with the probe produces a peculiar, ringing sound, and has a very different feel from that of healthy bone. In necrosis the bone transmits a dry, rough sensation when the probe is passed over it, not at all like that produced by the smooth, velvety surface of a healthy bone.

It is sometimes difficult to know whether a separation of the dead bone from the living has been effected. In such a case two probes may be used to advantage, being introduced at different points and moved along in different directions. It may thus be possible to ascertain whether the separation or detachment is complete. The following comparison between necrosis and caries is given in the *Dental Cosmos* for August 1893:

#### NECROSIS.

#### CARIES.

- |   |   |
|---|---|
| <p>1. Parts affected in compact tissue. Bloodvessels are better supported in compact bone, and so less liable to passive congestion, but from the narrowness of the canals are quickly strangulated by the pressure of the exudation, and so the bone is rapidly and completely deprived of vitality.</p> | <p>1. Most common in cancellous tissue. Here is room for dilatation and exudation without causing a sudden stasis in the vessels.</p> |
| <p>2. Result of probing. Probe is suddenly arrested by striking against hard bone, without giving rise to pain.</p>   | <p>2. Probe is felt to pass through soft inflamed bone, and this is quite sensitive.</p>  |
| <p>3. The discharge is mostly purulent.</p>   | <p>3. Discharge is more watery or serous, and has a greater amount of lactic acid.</p>  |
| <p>4. Granulations along the sinus and at its orifice are comparatively healthy, often fungous and florid.</p>  | <p>4. Granulations are small or large, pale and edematous.</p>  |

5. Cause. The more acute, local injury or constitutional, as acute specific fever, more likely is inflammation to end in necrosis.

6. In syphilis both are frequent.

**Treatment.**—The essentials of treatment are included under three heads: first, to control the inflammation, which is the direct cause of the trouble; second, a waiting treatment which consists of antiseptic and acidulous injections, and keeping a watch over the operations of nature in the separation of the old bone and the formation of new; third, to promote the removal of the sequestrum.

1. The first of these objects, namely, the control of the inflammation, is to be attained by the proper employment of antiphlogistic remedies, such as aconite, laxatives, and a light diet; the lancet may often be used locally with satisfaction, and opiates, to allay pain and induce sleep, may serve a good purpose. As soon as fluctuation is perceived, or there is much pain and tension, or deep-seated pus, a large incision should be made at one or more points. This incision should be made in such a way that drainage may be facilitated and the wound kept open.

2. In the second place, a watch is to be kept up during the sloughing process and the stage of reparation, in order that these processes may be facilitated to the greatest degree. Great care must be exercised that the disease does not spread, and that the patient shall not become exhausted from the drainage and irritation which are its constant accompaniments. A certain amount of inflammation is a necessary accompaniment of this disease, as it aids not only in the separation of the dead bone, but in the formation of the new. A highly nutritious diet is required, such as animal food, milk punch, ale or porter; also the use of iron or quinin. Aromatic sulfuric acid should be given if there be hectic fever and night-sweats; also outdoor exercise should be taken according to the patient's ability, and, in fact, every means used to build up the general health.

Cleanliness must be maintained by the use of antiseptic washes, of which there is a great variety. The following are among the best: Solutions of carbolic acid, corrosive sublimate, and peroxid of hydrogen. Much has been said regarding the use of acid solvents as an aid in separating the sequestrum from the living bone, and in dissolving the sequestrum itself. In using such acid

injections, if the solution be strong enough to exercise any solvent action upon the sequestrum, it will also act upon the living bone and soft tissues injuriously; therefore, if acid solvents be employed at all, it would seem to be better practice to use them in very weak solutions, with a view to their cleansing effects rather than to any solvent action which they might be expected to exert.

After the inflammatory stage has passed it would be well to inquire if there be any special diathesis which should be combated. For example, if the patient be of a strumous diathesis, special remedies need to be employed, for it must be evident that no satisfactory progress can be made toward a cure so long as the system is handicapped by a depraved state of the solids and fluids of the body.

3. The third object to be fulfilled is to get rid of the sequestrum, for as long as this remains it acts as a foreign body and irritant which must necessarily keep up inflammation and discharge. If this be the case it would seem that the sooner it is removed the better; but here a mistake may be easily made. No removal of the dead bone should be attempted until the practitioner is satisfied that it has become completely detached, and the new bone sufficiently advanced in formation to enable it to retain its form after the sequestrum is removed.

The removal of the sequestrum may be accomplished either by use of the fingers, aided by forceps, or by the forceps alone. In any case considerable care should be exercised, in handling the forceps, not to injure the surrounding healthy tissues. If the piece be very large, it is possible that an incision into the soft tissues must be made, or the sequestrum itself divided with a saw or cutting pliers. When the whole of the lower jaw is necrosed, it is nearly always necessary to divide it at the chin, and extract each half separately. In doing this, care should be taken to remove the bone only, the periosteum being left *in situ*, for the formation of the new bone.

The dead bone having been removed, the partially organized granulations on the inner surface of the new bone should be scraped away, and washed out by free injections with the syringe. If the hemorrhage be profuse, as will often be the case in consequence of the great vascularity of the parts, plug the cavity with antiseptic gauze which has been dipped in alum or tannic acid.

An interesting question has been raised in regard to the



removal of teeth with alveolar abscesses, and with a probable necrosis of the surrounding bone. It has been said that in such a case attended with severe inflammation the teeth should not be removed during the inflammatory period; that the wound produced by the extraction never closes while there is necrotic bone beneath, and that infection is likely to spread to the other teeth. It is a fact that in such cases one tooth after another has been extracted and that the disease has spread; whether by reason of the extraction, or whether it would have advanced had the teeth been allowed to remain, is a question which has caused much discussion.

The opinion has even been advocated that teeth in this condition if allowed to remain will cause the spread of the disease. It would seem to the writer that in the condition described we have carious teeth with abscesses, which are surrounded by necrosed bone; there is acute inflammation, and the body temperature sympathizes with it in proportion; the teeth with foul pulps and abscessed roots can be considered as nothing less than foreign, irritating bodies, acting as the cause of the abscess and surrounding swelling, and as such they should be removed. It would seem that this is the best way to reduce the local inflammation and the general temperature.

The wound may possibly be kept open by the necrotic tissues underlying it, but after the removal of a portion of the infectious and irritant material, vital resistance to disease, or phagocytic action, is assisted by so much, and there is now a greater probability of the disease being arrested at this point.

With abscessed teeth in the jaw, and with the rapid destruction that is going on during acute inflammation, it would seem far more probable that infection would take place more readily at points where there is broken-down tissue than it would if the source of the inflammation were removed and the ends of the vessels sealed by cauterization, followed by antiseptic washes.

It has been thought best by some to treat the inflammation first, and remove the teeth afterward. What better treatment of inflammation can there be than the immediate removal of the offending body, and the release of pus and other irritating matter?

## CHAPTER XLI.

## ANKYLOSIS OF THE JAW.

**Definition.**—Ankylosis is loss of motility in a joint.

**Etiology.**—“Ankylosis of the jaw” is a condition of the articulating surface of the maxilla which hinders its normal movement. An inflammatory condition of the synovial membrane is accompanied by an effusion which, if not absorbed, undergoes certain changes which render the lower jaw more or less immobile. This condition may be the result either of traumatism or of certain pathologic conditions. The common traumatic injuries include blows, contusions, fractures, and dislocations. Among the diseased conditions are tumors, calcic deposits which are the result of a uric acid diathesis, mumps, quinsy, etc. Difficult eruption of the wisdom teeth may cause inflammation and swelling which hinder mobility of the mandible. The after-effects of surgical operations about these parts, such as cicatrices and adhesions, tend to contraction and fixation of the jaws. When tuberculosis affects the bones and the synovial surfaces of joints, the destruction of these surfaces is followed by granulation tissue, connective tissue, and bone, which interferes with the normal movement of the lower jaw, although bony ankylosis is not usually complete until a year or two after the acute process has taken place.

Recent experiments upon animals throw some doubt upon the idea that if the jaws are maintained in one position for a long time ankylosis results. A healthy joint which has been placed in a splint for six months may be found mobile. From these experiments and other studies in this direction it is known that ankylosis is a result of some inflammatory condition.

**Treatment.**—Inflammation, when it is present, must be subdued, first, by removing the cause. If an erupting third molar is the cause of the trouble, and there is much swelling with inability to open the mouth, treatment must be instituted, and as soon as the mouth can be sufficiently opened, the tissue about the offending tooth should be properly treated, or the tooth itself removed. If the inflammation consequent upon the original irritant has subsided, and we have to deal with cicatrices or adhesions of long standing, the treatment consists in passive motion of the jaw, brought about in some way which the operator shall devise.

## DISEASES AFFECTING THE ADNEXA OF THE MOUTH.

## CHAPTER XLII.

## EMPYEMA AND OTHER PATHOLOGICAL CONDITIONS OF THE MAXILLARY SINUS.

**Definition.**—Empyema of the maxillary sinus is a collection of pus in this cavity.

**Etiology.**—The maxillary sinus may occasionally share in the acute inflammation which accompanies a “cold in the head;” inflammation of the sinus, however, more commonly occurs by reason of the extension of disease from other parts, or as the result of a physical injury to its walls. Recent anatomical studies\* have demonstrated the possibility of empyema of the frontal sinus and disease of the ethmoidal cells extending by way of the infundibulum to the maxillary sinus, thus accounting for many obstinate cases of antral disease which have resisted treatment.

The roots of the first and second molars frequently extend nearly through the floor of the antrum, thereby making it possible for the pus from an alveolar abscess around such roots to find its way into the antral chamber, irritating its lining membrane and setting up an inflammation; or, on the other hand, antral disease may so interfere with the nutrition of the above-named teeth that it results in death of their pulps followed by alveolar abscess, which in turn discharges into the antrum. Thus antral disease may be due to alveolar abscess, or alveolar abscess may be due to antral disease.

As to the relative frequency with which empyema of the antrum is due to nasal or dental diseases, opinions are divided. It has been said that dentists claim that this disease is more frequently due to diseased teeth, while rhinologists insist that nasal disease is more frequently a cause. Dr. M. R. Brown, of Chicago, attributes a large number of cases to “catching cold;” the mucosa of the maxillary sinus becoming inflamed, and the congestion serving

\* Dr. M. H. Cryer, in the *Dental Cosmos* for January 1896; Dr. T. Fillebrown, *ibid.*, November 1896.

to close the natural opening to the nose, secretions are retained and degenerate into pus. Dr. Brown cites the following case from his own practice:

Mr. X. after exposure on a cold and windy day was confined to the house with a severe pain in the left cheek simulating neuralgia. In a few days a discharge of fetid pus set in from the nasal cavity of the affected side. This was followed by nasal obstruction, which was not present at the beginning of the case. The inference to be drawn is that the inflammation of the antrum was primary, and existed independently of any nasal trouble.

Intra-nasal tumors may act as a cause of empyema of the antrum by occluding the opening into the nose. The frequency with which tumors are found in the nasal cavities is well shown by P. Heymann of Berlin, who examined five hundred specimens of antra and found thirty-one tumors. Only when the tumors are very large and empyemic are they discovered during life. Other causes may be found in traumatism, dentigerous cysts, polypoid degenerations within the antral cavity, and influenza.

Dr. M. H. Fletcher, in a paper read before the section of Dental and Oral Surgery of the American Medical Association in June, 1893, gives reasons for believing that the majority of antral cases are due to intra-nasal disorders. The substance of the testimony is as follows: There is no intimate nervous connection between the teeth and the antrum, so there could be no disease by reason of reflex action from one to the other.

Out of two hundred examinations, Dr. Fletcher found fifty-seven ulcerated teeth, only four of which had perforated the antrum; the other fifty-three had discharged through the alveolus into the mouth. From two hundred and twenty-four cases of pulpless teeth in superior molars in his own practice, Dr. Fletcher knew of only one which penetrated the antrum; he has, however, treated a case in which the teeth were made pulpless, and some of them lost in consequence of disease of the antrum, and he believes that this condition is of more frequent occurrence than the reverse.

On the other hand, Dr. I. P. Wilson, in a paper read before the Dental Congress at Chicago, 1893, claims that antral disease is frequently of dental origin. He thinks that pus from a pulpless tooth may find its way readily through the thin layer of bone which forms the floor of the antral cavity, and that it does so frequently, instead of perforating the alveolar plate and going into the mouth. He gives no record of a large number of cases

or data to support his conclusions, but cites a case illustrating the subject of which the substance is as follows:

Mrs. C. complained of a diseased condition of her teeth, with symptoms of a dead, heavy pain in her cheek-bone and "under the bridge of her nose," also in the frontal region. Her eyes had a languid appearance, and were continually discharging a water-like substance. She complained also of "nasal catarrh," with offensive breath, nervousness, no appetite, loss of the sense of smell, and resonance of the voice. Examination showed that the upper second bicuspid and first molar had been filled years before. Soon after they had been filled, one or both ached; this condition being followed by a swollen face, since which time they had given no trouble. Both teeth were found to contain putrescent pulps, with no visible means of escape for the foul matter and gases that were continually forming.

The teeth were both extracted and an opening into the antrum was found. Injections of warm water into the antral cavity were made, and a large amount of pus and abnormal products removed. This was followed by cleansing treatment with sprays to the nose, and in a year's time the patient had fully recovered.

**Pathology and Symptoms.**—A prominent symptom is a discharge from one nostril, but there is always the possibility of both antra being affected and a consequent discharge from both nostrils. Further inquiry should lead to an inspection of the teeth, and to an intra-nasal examination.

Dull pain in the antral region, heat, and slight swelling of the external soft parts are seen only in cases of obstruction of the orifice to the antrum.

If the disease is due to the teeth, in a large proportion of cases we shall find alveolar abscess or its history.

In the nose, a swelling obstructs the passage more or less, and the surface of the middle and inferior turbinated bodies are partially covered with a thick, creamy, yellow pus. The act of leaning forward and inclining the head downward increases the discharge of pus, as described by Boyer of Brussels.

In some cases, especially if the passage to the nose be closed, the face on the affected side is swollen, there is distension, and a sensation of fullness and pain referable to the cheek.

In many cases the disease is insidious, and active symptoms are absent, especially in the early stages. The patient suffers in such

cases less from pain than from the inconvenience resulting from the discharge, and from the uncomfortable feeling of obstruction in the nose.

**Diagnosis.**—Authorities differ widely as to the ease with which diseases of the maxillary sinus may be diagnosticated. The presence of pus in the antrum, as before indicated, may excite no symptoms beyond a purulent or muco-purulent nasal secretion which may be taken by the patient for that of a common cold; and therefore it has been suggested that antral diseases have been more frequent than past clinical observations would lead us to believe. These outward signs are the more important for the reason that little dependence can be placed upon the subjective symptoms.

As a constant symptom we may place reliance on the purulent discharge, usually from one nostril. Dr. M. R. Brown of Chicago shows a record of bilateral discharge in seventeen per cent. of his cases. The character of the discharge varies from a purulent, creamy consistence to a thickened caseous degeneration, according to its chronicity. The odor varies also, sometimes from a mere unpleasantness to one which is very offensive. If the pus is wiped away from the middle meatus and inferior turbinal, it can often be made to reappear immediately by holding the head downward. This procedure may form a distinctive feature between causes acting in the maxillary sinus and those originating in the other accessory cavities leading to the nose, for all of the above-mentioned symptoms may occur in disease of the frontal and anterior ethmoidal sinuses.

As a means of diagnosis, resort may be had to the following methods of procedure, as suggested by Dr. Brown of Chicago: Transillumination. Sounding. Irrigating. Exploratory puncture.

The method of *transillumination* is of use as a means of diagnosis, but it is not always a conclusive test. It is easily applied and is becoming popular as a preliminary step to the more conclusive method,—exploratory puncture.

Dr. Holger Mygind of Copenhagen has recently laid stress upon the importance of examining the antrum in the healthy individual and in a large number of cases. He gives a list of two hundred persons, eighty-eight males and one hundred and twenty-two females, of ages varying from two to seventy-six years, examined by a lamp of eight volts burning with a perfectly white light. Dr. Mygind says that in order to have satisfactory results

there must be a totally dark room. It is necessary also to observe whether the patient is wearing a plate containing artificial teeth.

Dr. Mygind observes that very different results are obtained in the examination of different individuals, and makes the following observations: In thin, slightly built individuals the illuminations are very intense, and the pupils of the eyes exhibit a deep red color differing from that of the face. In strongly built men of dark complexion the transillumination was less pronounced and the pupils remained dark. In many persons the transillumination of the pupils was unequal. This is important and shows the necessity of a thorough knowledge of the appearances of transillumination of the face in the healthy individual. The shape of the antral cavity may influence the amount of light which would reach the eye; for instance, if this cavity be comparatively wide, it is obvious that more light would pass than if the antral cavity were narrow and high. The consistence and extent of the fatty layer of the orbits probably influence the amount of transillumination, therefore "the above-mentioned circumstances must be taken into consideration" in making a diagnosis, for non-illumination may be caused, not by pus only, but by other conditions which are not necessarily pathological.

Cases are cited by Dr. Brown, showing that with decided indications of the presence of pus, upon opening the antrum no pus was found; and on the other hand, when pus was found and removed by thorough irrigation, the electric light showed the same signs of pus as before. Dr. Brown does well in calling attention to the fact that transillumination, while not conclusive as to the presence of pus, does show an abnormal condition of thickened and infiltrated mucosa of the antrum and accessory cavities, and the method thus becomes valuable in noting the progress of the case.

The method of *sounding* is pronounced so difficult and unsatisfactory that it is dismissed without further remark.

Dr. Brown describes in detail his method of using *peroxid of hydrogen* as a diagnostic means:

Having thoroughly cleansed the nose and cocained the nasal mucosa (especially the middle and inferior turbinals), a small hypodermic syringe having a long silver cannula, bent within a quarter of an inch from the distal end to nearly a right angle, is passed into the semilunar hiatus, and a solution of peroxid of hydrogen (one part to twelve parts of water) is injected into the antrum. If pus is present it is displaced, and fills the nose with a

white foam. That the solution has entered the sinus will be made evident by the patient complaining of slight pain at the roots of the teeth and a sense of fullness of the cheek. The method is free from danger and fairly easy of application, and is to be commended.

There are various methods of entering the antrum for purposes of exploration and treatment. Each of these methods has its advocates, but the method to be employed in many cases is suggested by the conditions of the case; sometimes one method is best, and sometimes another. Of the following a selection may be made which seems best suited to the conditions which present: A perforation may be made through the outer wall of the nose at the site of the inferior meatus, by means of a suitable trocar, aspirating syringe, or trephine. Or, entrance into the antrum may be afforded through the canine fossa, or through the alveolus of an extracted tooth, that of the first molar being preferred. By this means the presence or absence of pus may be determined, unless there are septa within the cavity which divide it into separate compartments.

**Treatment.**—The principles of treatment of antral diseases are few and simple. These consist mainly in affording a passage for the escape of abnormal products from the antral cavity, followed by irrigation and the application of certain medicinal agents to the lining membrane.

If an opening into the antrum is to be made, the circumstances may be such that there can be no question as to its location. In many cases, however, there is a division of opinion in this respect, and it must be said that there are advantages in some methods that do not obtain in others. With a clear idea of the objects which are to be attained, the method possessing the greatest number of advantages should be employed. In opening into the antrum, it is important (as in opening an abscess) to have the opening at the most dependent part in order to facilitate drainage. If there are numerous septa of bone dividing the antral chamber, it will be more difficult to secure perfect drainage, and this would be an added reason for making a large opening through the canine fossa, in order that the cavity may not only be thoroughly explored, but accessible to treatment in all its parts. If there is a useless molar or stump at the site where an opening might be made, it is undoubtedly good practice to remove this and enlarge the opening. It is the experience of many that pus does not always make its



appearance immediately upon opening the antrum, but upon the following day.

When a suitable opening has been obtained, the cavity should be thoroughly irrigated with some antiseptic solution, as that made with Seiler's tablets, Dobell's solution, a saturated solution of boric acid, peroxid of hydrogen, or carbolic acid. This should be done twice at least each day, the opening being kept free by means of a drainage-tube.

In cases of long standing, and in which there seems to be little or no progress, an opening through the canine fossa is justifiable. Through this opening, sufficiently enlarged, one may explore with the finger and the electric light, and if the mucosa is very much thickened, or there is much caseous pus, the parts should be thoroughly curetted, washed out, and packed with antiseptic gauze. The patient may then be dismissed till the following day, when the gauze is to be removed and the cavity irrigated, following this treatment by insufflation of euophen, aristol, or iodol. This should be repeated every second day.

While local treatment is usually imperative, it is necessary to look after the general condition of the patient, for it may be responsible in a large measure for the production and continuance of the local trouble. Therefore the general health should be brought up to the highest point.

OTHER PATHOLOGICAL CONDITIONS OF THE ANTRUM.—While the antral cavity may be the subject of other pathological conditions, they are not often manifest until degeneration and pus-formation has occurred.

Syphilitic ulceration may extend into the maxillary sinus, necrosis of its walls may take place, and various tumors may occupy this cavity,—requiring bold therapeutic treatment in the case of syphilis, and more extensive surgical interference than that indicated in the ordinary forms of antral disease; and the reader is therefore referred to works on surgery.

## CHAPTER XLIII.

## HYPERTROPHY OF THE FAUCIAL TONSILS.

THIS condition of the tonsils is generally seen in children; it may be found in others up to the age of forty years, but after this age it is of rare occurrence. A scrofulous diathesis plays an important part in the causation of this condition; while certain diseases also, such as scarlatina and diphtheria, may be classed as having a causative action. The dentist is often asked for the cause of fetor of breath; he should then be able to say whether it arises from the teeth, and if not, he should have a sufficient knowledge of the normal and abnormal condition of the tonsils to be able to advise patients as to an examination of these organs as the probable cause of the trouble.

In very many cases of enlarged tonsils, irregularities of the teeth and adenoid growths are associated.\* Extreme hypertrophy of the tonsils should be especially noted before administering an anesthetic.

Enlarged tonsils are also an indication of a uric acid diathesis, and therefore a factor in phagedenic pericementitis.

**Symptoms.**—The breathing of the patient is usually through the mouth, and is noticeable by reason of its noisy character. Sometimes the gland is so enlarged as to be seen from the outside, and it certainly may be felt by digital examination. The obstruction causes snoring, disturbed sleep, and a muffled tone of voice which is characteristic.

**Treatment.**—If the tonsils are large enough to obstruct the breathing in any way, or to interfere with the health or comfort of the patient, they should receive treatment at once. The fact that they tend to disappear after the age of forty should not weigh against operation or treatment, for much damage may be done to the general health before this age is reached.

Enlarged tonsils are always liable to acute attacks; and, certainly, during the treatment of an acute disease such as scarlatina

\* Dentists should bear this fact in mind, for upon them, in great measure, rests the responsibility of informing parents of the probable existence of adenoid growths.

or diphtheria, their presence must be considered as an unfavorable complication and as a decided interference with proper treatment. This condition must also be reckoned as an undesirable factor to be taken into account when one is about to administer an anesthetic; moreover, the crypts of the tonsil often contain septic matter, affecting the breath and inviting disease.

We have a choice of several methods of treatment. Those cases in which ablation is not desirable may be treated by means of the galvano-cautery knife,—a safe and sure remedy.

As a substitute for the cautery, trichloroacetic acid may be used with good effect, applied by means of a finely pointed glass tube.

The cold wire snare should be used in preference to the tonsillotome, especially in adults, in whom there is the possibility of a serious hemorrhage, for in the use of the snare the loss of blood is very slight.

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## CHAPTER XLIV.

### HYPERTROPHY OF ADENOID TISSUE IN THE POST-NASAL SPACE.

**Synonyms.**—Adenoid growths; Adenoid vegetations; Adenomata of the pharynx; Hypertrophy of the pharyngeal, or Luschka's, tonsil; Hypertrophy of the third tonsil; Lymphoid growths in the vault of the pharynx.

**Definition.**—By adenoid overgrowths is meant the enlargement of lymphatic glands, situated in the vault of the pharynx.

**History.**—Post-nasal growths have within the last half-dozen years awakened great and increasing interest in the dental profession. The comparatively recent date 1868 marks the first account of the true clinical and therapeutic importance of these structures, by Meyer of Copenhagen. Other observers had, however, as early as 1860, referred indifferently to growths in the nasopharynx. At the International Medical Congress held in London in 1881 the subject received a detailed discussion by some of the leading authorities on the nose and throat, since which time the profession generally have been more or less familiar with the disease.

**Etiology.**—Adenoid growths occur most frequently in children and in young adults. They are rarely seen after the age of thirty. The author, however, has removed with benefit from a patient aged fifty-five years several stalactite adenoid growths averaging half an inch in diameter.

Authorities differ as to the direct causes of this condition. Heredity, of course, is a possible factor, though there are those who deny its importance. Dr. Harrison Allen states that the growths are frequently hereditary, since the pre-existent states on which they depend are transmissible.

Climate, according to some authorities, may have an influence in the causation of this disease, since it is found most frequently in damp and cold climates. Yet, at the Australian Medical Congress at Sydney in 1892, Dr. Hamilton said: "A disease so extensively prevalent in Europe and Australia must owe its cause [origin] to other than climatic causes." He believed it to be due rather to a depressed condition of the general health.

Mackenzie and Loewenberg have observed that adenoid growths are common among cleft-palate patients. It is interesting to note, in this connection, the immunity of the negro from cleft palate. In order to obtain full information on this point, the author sent circular letters to many of the prominent surgeons of the South and also to prominent specialists in this country and in Europe, asking the following questions:

1. Have you ever seen a case of congenital cleft palate or hare-lip in the negro?
2. Do you ever see enlarged faucial tonsils in the negro?
3. Have you ever known of a case of adenoid overgrowth in the vault of the pharynx of the negro?

To sum up the answers to these questions, it may be briefly said that several surgeons of large practice have never seen hare-lip, cleft palate, etc. in the pure-blooded negro; and that while other surgeons have seen such cases they believe them to be very rare as compared with similar cases in the white race. Occasional instances are found among mulattoes, but it is doubtful if they are ever found in the pure-blooded negro. It should, however, be said that adenoid growths may pass unnoticed in the negro from the fact that his nasal passages are so short and wide that the tissue might attain a considerable growth without producing the characteristic symptoms of nasal obstruction and mouth-breathing.

A scrofulous diathesis should be mentioned as a possible predisposing cause, though not a common one. Taking cold has been thought to be an exciting cause, but this is frequently a symptom. Sajous speaks of "an oft-repeated inflammatory process" as an active cause, owing to the weak recuperative powers of the lymphatic glandular tissue.

Nasal catarrh has also been given as a cause of this disease. Lenox Browne says: "Certainly purulent and muco-purulent nasal catarrh in children, the irritant nature of which is shown by eczema of the nostrils, is almost invariably in association with adenoid overgrowths of the pharyngeal tonsil." But he further adds that he is not sure that the purulent catarrh is primary, for he has seen many cases in which removal of the growths has led to a speedy cure of the discharge.

Bosworth says that this trouble should be looked upon as a general disease with marked local manifestations. He also states that "over sixty per cent. of all nasal catarrh in children is due to the presence of these growths," thus indicating his belief that the nasal catarrh is secondary and consequent upon the adenoid growths.

Adenoid tissue exists normally in the mucous membrane of the naso-pharynx. It consists of a fine network of connective tissue fibrils with fixed cells, within which are pale blood and lymph corpuscles.

There appears to be a marked analogy, both in the structure and the character of the lesion, between the pharyngeal tonsil and the other lymphoid elements of the naso-pharynx and the faucial tonsils. Dr. Harrison Allen defines adenoid growths as papillomata, containing normal lymphoid tissue, of the vault of the pharynx. These conclusions of Dr. Allen were reached after he had made many microscopical sections of these growths, and had observed them personally. The neoplasm may be congenital, when it is difficult to escape the conclusion that it has been in some way associated with the canal which is found in early fetal life penetrating the brain-case and uniting the anterior part of the pituitary body to the lining membrane of the pharynx. Dr. Allen has removed growths the size of a filbert from a child six weeks old, in which the naso-pharynx was completely obstructed. But these growths do not invite scrutiny in infancy, and from the fact that most cases come to notice after the fifth year it is probable

that the papillomata at the vault are apt to take on a hyperplastic condition at this time, or a little later. It is then that the permanent teeth are beginning to erupt and the altered proportions of the face and associate parts announce the change from infancy to childhood.

Another important observation by Dr. Allen is that the shape of the vault may determine whether the growth, normal in other respects, interferes with the functions of the pharynx; for instance, if the angle formed between the basilar, sphenoid, and vomerine processes is of high degree, a disadvantage exists for the pharynx to maintain its patency.

**Symptoms.**—Among the most prominent symptoms, as noted by Sajous, is the peculiar deadness of the voice, due to impaired resonance dependent upon nasal obstruction. It is a muffled, thick voice accompanied by a “nasal twang.”

Dr. Sajous says that as a rule the nasal respiration is not impeded, but when the growths are large, a feeling of obstruction is experienced and breathing through the mouth is established.

The open mouth and stupid expression constitute what is termed the “adenoid facies,” and is held by some to be a sufficient diagnostic sign. Associated with these facial signs, inattention is often apparent, and occasionally deafness exists.

The obstruction to respiration interferes with sleep, and the child never sleeps soundly, has frequent dreams, and often awakes suddenly screaming and frightened.

In a large percentage of cases, enlarged faucial tonsils are present, but their presence or absence cannot determine the diagnosis. The chest walls are often depressed, as the inspired air is not sufficient in quantity to properly expand them. Defective development of the teeth and a narrow and apparently high arch are also symptomatic.

**Prognosis.**—The prognosis, in view of treatment, is highly favorable; but if the growths are left to their natural course, the process of absorption is so slow that a great amount of damage may be done before there is much reduction in size, and therefore in such a case the prognosis is less favorable.

It is obvious that adults, who have suffered for a greater length of time, are more likely to have such serious complications as middle-ear disease, which may render complete recovery doubtful.

**Course, Duration, etc.**—Of the three tonsillar growths, the pharyngeal tonsil develops in infantile life, and is more frequently made manifest at about the fifth year, continuing until puberty, when by absorption it is gradually reduced in size; though occasionally much of the growth may remain throughout life.

Next in order of appearance and disappearance, is the faucial tonsil, and following that the lingual tonsil, which reaches its highest point of development in advanced life.

**Diagnosis.**—It has been considered by many that on the whole the diagnosis is easy. This may be true in a comparative degree, but many cases are deceptive.

Many authorities rely largely upon the “adenoid facies” for diagnosis, but it should be remembered that neither the face nor the dental arches afford conclusive evidence of this disease. Neither should the high dental arch, deafness, or mouth-breathing alone be relied upon to establish a diagnosis. A careful study of the symptoms will, in most cases, enable one to make a tolerably good guess, but this should only form the basis upon which you decide to make further and decisive examinations. These examinations consist of posterior rhinoscopy and digital exploration. When the former is not practicable, as may be the case in small children, the latter means may be employed.\* In both these examinations the application of a four per cent. solution of cocain hydrochlorid is a decided advantage.

It should be remembered that in many children there is normally present a thickened cushion of tissue extending over the surface of the pharyngeal vault, which may be felt with the finger and which may even encroach to a slight extent on the lumen of the breathing space. This should not be mistaken for genuine adenoid growths, which are masses of soft clusters hanging pendent from the vault, and cannot be mistaken for the condition of thickened membrane above described. Digital exploration then forms the conclusive step in the diagnosis. To one who is familiar with the anatomy of the parts, and whose touch is expert through practice, it cannot fail to furnish conclusive evidence.

**Treatment.**—The treatment is mainly surgical, although the medicinal treatment by astringents offers hope. The recommen-

\* The author rarely uses digital exploration at the present time, unless an anesthetic is administered for this purpose, when, if the growth is present, it may be removed.

dation in cases of slight obstruction by soft growths in children, is: A lotion of glycerite of tannin to be syringed along the inferior meatus to the pharynx, night and morning.

The surgical method has two objects in view: First, by means of scraping, or scarification, to cause free hemorrhage and consequent absorption. Second, a complete removal of the growths. This should be accomplished if possible, for the reason that when this is done there is little prospect of recurrence.

In the same surgical treatment of these growths a large variety of instruments is used, depending upon the operator's conception of the method to be employed, and especially upon the size and character of the growths, these conditions being governed by the age and condition of the patient. The instrument most commonly employed is a modification of Loewenberg's forceps, the beaks of which have been greatly enlarged in recent years.

In infants, the growth is tender, and in many cases may be removed by the finger-nail (left purposely long and sharp). The finger may, however, be armed with a steel finger-nail, to accomplish the same thing, when it is deemed advisable.

Gottstein's curette has been modified and its popularity has increased during the last five years.

The pharyngeal tonsillotome, recently devised, is proving to be a very useful instrument.

There are also various cautery instruments which may be used to advantage in certain cases of sufficient age to permit the introduction of the instrument into the pharynx, and in which the growths are not large.

The methods of operating are also various. In adults cocain may be applied and the growth removed at one or several sittings.

A commendable method is that in which the patient either sits or is held upright after being etherized; the mouth is held open with a Mason's mouth-gag, and the operator, with the forceps and palate retractor, proceeds to remove the growth. Often the finger of the opposite hand may be used to guide the instrument. Assistants, with forceps armed with cotton, stand ready to remove blood from the pharynx as soon as hemorrhage occurs, the head, as soon as the forceps are removed, being carried forward to prevent blood from going down the throat.

Nitrous oxid gas is often a sufficient anesthetic, and in many cases the operation may thus be completed at one sitting.



The patient should keep indoors for three or four days after the operation, avoiding the inhalation of dust; after which time the treatment should consist of nasal and post-nasal sprays, to reduce catarrh and to promote healing and absorption of the parts operated upon.

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## CHAPTER XLV.

### THE RELATION OF ADENOID VEGETATIONS TO IRREGULARITIES OF THE TEETH AND ASSOCIATE PARTS.

THE following statements will indicate the position taken in relation to the subject under consideration:

1. Adenoid growths may exist, though rarely, without mouth-breathing. Mouth-breathing may exist without adenoid growths, being due in many instances to a chronic hypertrophy of the turbinated bodies or to some septal deformity.

2. Mouth-breathing is the result of the irritation due to the presence of adenoid growths in the pharyngeal space, rather than to the obstruction which they produce.

3. Mouth-breathing does not produce adenoid vegetations.

4. Mouth-breathing does not cause irregularities of the teeth.

5. Many cases present deformed arches and irregular teeth, in which no adenoids exist.

It is argued by G. Macdonald that nasal stenosis is a constant factor in post-nasal growths, and that this being the case, "As long as respiration is conducted through the nose, there is, of a physical necessity, a diminution in the barometric pressure behind the seat of stenosis. This inevitably results in more or less overfilling of the bloodvessels, which in its turn leads to hypernutrition and hypertrophy." It is obvious that when the diaphragm is depressed, the mouth closed, and the nose partially closed, there is more or less suction produced which would draw an excess of blood to the pharyngeal region; but according to the writer's observations, patients breathe through the mouth, by force of habit, even when it is possible to breathe through the nose. The swollen turbinates, with their rich supply of nerves, readily convey a sense of suffocation to the brain, and the mouth is immediately

opened. The author has repeatedly found children breathing through the mouth, who upon request to breathe through the nose were able to do so, but as soon as their attention was drawn in another direction the mouth opened and mouth-breathing was continued. Moreover, the mouth opens so readily upon so little provocation from the nasal irritation and stenosis, that it does not seem possible that sufficient "diminution of the barometric pressure" can be produced in the pharyngeal vault to cause a growth of tissue. This view also necessitates nasal stenosis to begin with, but it is generally understood that the enlarged turbinates are the result, not the cause of the adenoids, and observation shows that the nasal obstruction gradually disappears after the removal of the growth. Again, this will not account for the congenital growths, and those growths in infants whose respiration has only been established a few weeks or months; and again, those cases of nasal stenosis of long standing in which there is no adenoid hypertrophy. If it is true that this "diminution of the barometric pressure" acts also to increase the size of the faucial tonsils, how shall we account for many cases of post-nasal adenoids in which the faucial tonsils are normal? Their growth and development are acknowledged to be on the same principle, they have physiological limitations in common, and it would seem reasonable to assign a common cause to both.

It has been said that adenoid growths in the pharyngeal vault cause irregularities of the teeth, but it would seem rather that the dental irregularities are the result of the same cause that operates to produce the adenoid growth; in other words, there is one cause common to both, yet this cause may not be able in all cases to produce both. Deformities of the hard palate are frequently associated with adenoid growths, but not always, as many would give us to understand. There are various reasons given concerning the origin of these irregularities. For instance, it is said that a so-called high arch or V-shaped arch is a diagnostic sign of adenoids in the pharyngeal vault. The late Dr. F. H. Hooper in his pamphlet on "Mechanical Effects of Adenoid Vegetations," says, "The hard palate, from the constant atmospheric pressure within the mouth, is pushed upward."

It is difficult to see how there can be a constant pressure within the mouth while it is open and the air is free to move either in or out. The air must be confined in a given space, and a force ex-

erted, in order that pressure in any direction may be made. Therefore we cannot believe that this deformity of the arch is due to atmospheric pressure caused by nasal stenosis.

The theory of David which accounts for the deformity of the hard palate in persons suffering from nasal stenosis, is that a partial vacuum is produced in the nasal cavities and upper pharynx by the act of swallowing. The atmospheric pressure remaining the same in the mouth, its roof is pushed upward. It is difficult to reconcile this theory with the writer's view of the case. In the first place, it must be a rare case in which the nasal stenosis is so complete that a partial vacuum would be produced behind it. It is well known that in the act of swallowing the tongue presses forcibly against the roof of the mouth from before backward, the soft palate is slightly raised, the posterior pillars of the soft palate then contract on either side of the uvula, forming a nearly perfect closure, which, with the application of the superior surface of the soft palate to the posterior wall of the pharynx, forms a successful barrier protecting the posterior nares. The necessity of this, as well as the proof of this function, is shown in cases of paralysis of the soft palate, in which liquids swallowed regurgitate into the nose.

Now, the act of swallowing is momentary, and the muscles contract firmly, and it does not seem possible for this temporary diaphragm to be so pulled downward as to cause a partial vacuum in the nasal cavities. Moreover, immediately after swallowing there is a reaction; the breath, which is held during deglutition, is now expelled with some force through the nose, the mouth being closed in the act of swallowing. If the air does not find exit through the nose the mouth does not open until after considerable pressure, not suction, has been exerted in the upper pharynx and the nose. This may be demonstrated by occluding the nose with the thumb and finger, and performing the act of deglutition. Again, we cannot account for *asymmetrical* deformities of the hard palate if they are caused by atmospheric pressure, for the pressure must bear on all parts equally, and the palatine arch should be pressed upward equally high in all directions. Fig. 35 shows the case of Mr. C., aged thirty-nine years, with a large adenoid growth in the pharyngeal vault, but one side of the hard palate is much higher than the other side.

It is said that mouth-breathing necessitates a constant dropping

of the lower jaw, which, in so doing, causes pressure of the masseter and other muscles upon the buccal surfaces of the upper teeth and consequent flattening of the lateral alveolar arches and the projecting forward of the cuspids and incisors. The dropping of the lower jaw does not produce pressure on the teeth in the superior maxilla; it is approximated to the upper teeth principally by the masseter, temporal, and internal pterygoid muscles, and when the jaw drops by the relaxation of these and other muscles and tissues of the face, unless the mouth be open to the fullest extent by the action of the platysma myoides, digastric, and other muscles, the tissues of the cheek are not put upon the stretch,—in fact, the finger can be easily passed in between the teeth and the

FIG. 35.



Case of Mr. C.

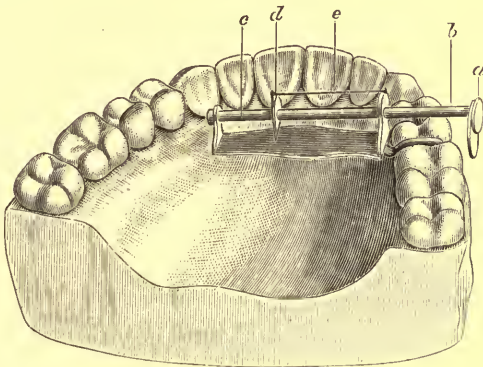
jaw without being sensible of any pressure upon it, provided the mouth is not opened widely; moreover, it is reasonable to conclude that the jaw is held suspended, not by the cheeks, but by the masseter and accessory muscles.

The cheeks cover the jaws and teeth loosely, with tissue to spare, and will, as a rule, admit of the jaws being opened to a considerable extent without separating the lips or stretching the cheeks (this is often the case during sleep); therefore when the lower jaw relaxes sufficiently to let air in through the mouth, it cannot put the tissues of the cheeks on the stretch or draw them tightly against the teeth. Both observation and experiment will show that it is only necessary to open the lips slightly in order to allow sufficient air to pass in by the mouth, and that all the tissues concerned are in a relaxed condition while the mouth-breathing is going on. In order to demonstrate this, the writer made a num-

ber of experiments to determine the pressure of tissues and muscles against the teeth. The device which was found most successful is illustrated by Fig. 36. It was at first intended for the little pointer to make a tracing, but this was unnecessary, as it could be observed while the mouth was being opened.

The use of this mechanism confirms the views above expressed; moreover, the anatomy of the parts involved bears the same testimony upon careful observation and study. Notice the fact that a straight line drawn from the point of origin to insertion of the masseter muscle would not touch the teeth. A profile view shows the fact that the masseter extends no farther forward than the second molar, while the other muscles concerned do not even come as far forward as that.

FIG. 36.



*a.* Flat surface soldered to the movable rod *b c*. Pressure of the cheek being made upon *a*, it moves the pointer *d*, which is also soldered to the rod *b c*. *e*. A very thin strip of rubber dam, to hold the flat surface *a* away from the teeth, but not enough to resist the slightest pressure of the cheek upon it.

Expansion of the lower arch is said to be a result of adenoids; reference is therefore made to the case of Mrs. H., aged thirty, with a history of mouth-breathing from infancy, with a marked lateral contraction of the lower arch, the bicuspid closing entirely inside the upper teeth. The nasal breathing was fairly free at this time, yet mouth-breathing was continued, partly from habit and partly from chronic nasal catarrh. There were no adenoid growths or enlarged tonsils; there may have been in early life, but the one thing to be noted is that habitual mouth-breathing did not expand the lower arch in this case.

Dr. Henri Chatellier, of Paris, calls attention to the bones of

the head and face as affected by obstructed nasal respiration. He points out that the air-cavities of the frontal, sphenoidal, ethmoidal, and maxillary bones, being normally in communication with the air, cease to develop when the circulation of air through the nose is interfered with, and hence the normal dimensions of the face are altered.

Dr. E. S. Talbot says: "There are many cases of contracted arches where mouth-breathing does not exist; there are also many cases of normal arches where it is present." In substantiation of this statement the following cases are presented, both having marked adenoid growths and consequent nasal stenosis and mouth-breathing, but in which the dental arches present a striking contrast.

FIG. 37.



Case of J. H.

Fig. 37 represents a cast from the mouth of J. H., aged thirteen years, who was operated upon November 4, 1893, a large quantity of adenoid tissue being removed. The marked feature in this case is the broad and regular dental arch.

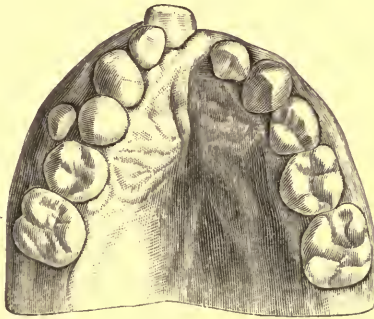
The other case, E. F. (see Fig. 38), aged nine years, was operated upon a week later.

As long ago as 1879 there appeared a paper in the *Philadelphia Medical Times*, by Prof. Harrison Allen, in which he says: "Inasmuch as the face is the result of the lateral visceral half-arches joining the median structures projected from the front of the brain-case, it follows that if there is want of harmony between the two genetic movements, errors of symmetry will readily occur. Explanation may thus be given of asymmetry of the nasal chambers, the

external nose, the two halves of either of the dental arches, entirely apart from the acquired defects in the same localities." Applying this hypothesis to practice, Dr. Allen had recognized a well-defined group of cases in which the nasal chambers remained, from birth, partially or entirely occluded.

Also, in cases of obstinate catarrh in children from seven to eighteen years of age, in whom the upper permanent incisors were overlapping and convergent, the two halves of the upper dental arch more or less V-shaped, the tonsils tumid, the roof of the mouth with a high, narrow vault, he found that the cause was deep-lying and congenital, and affected all the structures of the face.

FIG. 38.



Case of E. F.

Dr. Allen has frequently noted the way in which the dental arch is narrowed and elevated in adults in whom no history of either adenoid disease or nasal obstruction was given.

It should be noticed also that the upper incisors approach the vertical position, sometimes overlapping, in many cases of disease, while in thumb-suckers these teeth protrude from the mouth. In a clinical lecture, delivered before the First District Dental Society of New York, Dr. Allen described a case that is instructive, as showing the possibility of the Hutchinsonian or an allied deformation of the teeth occurring without a history of syphilis or scarlatina; that oral respiration was established as early as the fifth year, due to a large adenoid growth; that the teeth were congenitally deformed; that this congenital deformation could hardly be caused by oral respiration established at the fifth year. The following description and remarks concerning the above case are given by Dr. Allen:

A lad in his tenth year lately came under my observation for difficulty arising from oral respiration. He was the son of respectable parents; there was entire absence of the ordinary signs of syphilis. . . . At the fifth year it was observed that oral respiration became established, and there was also a disposition to take cold easily.

Examination of the pharynx revealed the presence of a large adenoid growth pendent from the roof. The palatal arch was high and narrow, the obstruction to nasal respiration was absolute. The nasal septum was irregular, apparently due to enormous thickenings of the maxillary crests. The teeth presented all the characters of the Hutchinsonian deformity, excepting only that the lateral incisor teeth were not pegged.

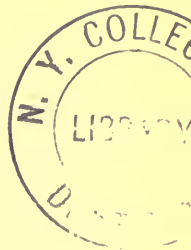
After the removal of the adenoid growth, nasal respiration was re-established. Now what, in all probability, has been the order of events in this case? The clinical condition which brought the child under my care was not announced until the fifth year. Evidently this was not the first factor. So far as the shapes of the teeth are concerned, they must have arisen at a period certainly not later than at the time when the enamel-organs and the dentin bodies were being adapted one to the other. In a word, the shapes of the teeth as seen at the tenth year were congenitally deformed.

Secondly, the maxilla, especially in the alveolar region, must have been changed by the presence of these malformed teeth. It is scarcely likely that the establishment of oral respiration at a period so late as the fifth year should cause an elevation and narrowing of the palatal arch and hyperostosis of the maxillary crests. If this position be accepted, a narrowed, high, palatal arch, with thickened alveolar processes, would be just as apt to arise because of prenatal forces (the same that caused the deformation of the teeth) as to be created by the establishment of oral respiration.

What, then, is the relation which adenoid growths bear to irregularities of the teeth?

Certainly neither a maternal nor a paternal relationship, but rather should the dental irregularities and the adenoid growths be classed as but two among many resultant conditions traceable to some constitutional defect the influence of which has been transmitted from parents to children, and which, as a rule, depends upon accidental or acquired causes for its development.





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