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PRESIDENT'S ADDRESS.

GENTLEMEN,—It is my pleasing privilege and duty, as President, to address you on the occasion of this, the first meeting of the Odontological Society; but, while I feel it to be a pleasing, yet it is both a difficult and responsible duty—inasmuch as, in addressing an assembly like the present, when members of the same profession have met together for the first time, I have to satisfy that increased amount of expectancy and curiosity, and to contend with that degree of excitement, which is inseparable from new movements; also to undergo the ordeal of criticism from gentlemen well able to pass judgment on my performance. I must therefore beg your indulgence, if my words do not fully express the interest and importance which, I so strongly feel, attach to this inauguration of our new Society.

It is a source of much satisfaction, on looking back, to find that great progress has been made in our special branch of practice within the present century. In the last century, dental practitioners were limited in number, and, generally speaking, of

very limited acquirements. The operations were roughly performed, and the instruments in use unsatisfactory in principle and rude in construction. Those who practised as dentists were, for the most part, uneducated men, and the removal of teeth (the operation chiefly performed, in the country especially) was consigned to the stalwart arm of the village blacksmith, to the barber, or, at best, to the indifferently educated surgeon. It must be admitted, however, that in the metropolis, at the close of the last century, a few good practitioners sprang up, some of whom, as qualified surgeons, and some without any recognised qualification, exercised the specialty with credit and success.

In all periods of the history of surgery, there have been men, holding the highest rank in their time as surgeons and physiologists, who have written fully on the subject of the teeth; but it was our great anatomist Hunter, whose work treats in many respects so ably of the physiology, and enters so minutely and with so much evidence of acute observation, into the development of the teeth and the phenomena of dentition, who first drew particular attention to the subject, and indirectly led to the establishment of dental surgery as a special branch of practice in this country.

The increase in the number of dental practitioners during the last twenty or thirty years has been remarkable, and it is satisfactory to observe that the standard of professional acquirements and

knowledge has progressed greatly during that period. Not only in the metropolis have numbers increased, and has the character of the dentist improved, both as regards operative and mechanical practice and mental cultivation, but the same influences have extended throughout the country, there being in every town of any note a dentist established; and we find there also, to a considerable extent, the same upward progress in professional knowledge.

But while, in a large class of practitioners, the educational acquirements are all that can be desired, it cannot but be felt that in another, and a large class too, the standard of education is calculated to form merely a successful artisan; and, consequently, there are two distinct bodies of practitioners—the one practising dentistry as a profession, the other carrying it on as a trade or business.

It cannot be doubted that a liberal education is of the greatest advantage to those engaged in practice; and the more education is extended in all ranks of society, the more it becomes necessary that the members of our profession qualify themselves as highly as they can; for those who employ the services of the dentist in these days have a right to look, and do look, to the qualifications of the mind, as well as to the mechanical adroitness of the fingers.

Dental surgery is in itself a well-defined specialty; but in its present state in this country, there

is, unfortunately, no defined course of education required from those who seek to practise it. No one, I think, who has once undertaken its cares and responsibilities, can fail to feel that it is strictly a branch of the surgical profession; and cases are constantly presenting themselves to the notice, and for the opinion of every practitioner, which cannot but convince him that dental surgery and surgery are too closely allied to bear separation. It was, then, from a conviction of this kind, long and generally entertained among many distinguished members of the profession, and from a feeling that the time had arrived when it was very important that some steps should be taken calculated to secure to our body, so mixed, and so made up of discordant elements, a higher and a recognised position, which, whilst it raised the tone of our department of practice, would at the same time check the influx of many persons into our ranks, whose connexion even nominally with our profession is a subject of regret to all respectable practitioners, that a Memorial to the College of Surgeons was prepared in December, 1855, and submitted to a certain number of members of our profession for their signatures, in order that it might be laid before the Council of the College for consideration on the occasion of their next meeting.

It was not thought necessary by those who prepared this Memorial to procure to it the signatures of *all* the leading members of the profession, as the

Memorial contained only a *suggestion* for the consideration of the members of the Council of the College which, if entertained by them, will be submitted for the approval of our profession. Circumstances, however, connected with medical politics have hitherto prevented the College of Surgeons from giving a definite reply to this requisition; but I believe I may say that the subject is favourably entertained by many, if not by most, of the members of the Council. No other feeling guided those who prepared and signed this Memorial than an earnest desire to benefit their profession, and a sincere conviction that a recognised connexion with the College of Surgeons is best calculated to raise the status of the dentist to an equality with other medical practitioners, and rescue our profession from the anomalous position it has hitherto held.

It is my opinion that any attempt to separate dental surgery from the profession of surgery, in reference to the future education of members of our profession, is impolitic in the extreme. By allying ourselves to the parent institution, the College of Surgeons, we must hold a proper position as professional men, while our status, I think, could not but be lowered by any scheme which involves a *voluntary* separation from that body.

The members of the dental profession have hitherto kept aloof from one another, and retained in exclusiveness the modes and peculiarities of private practice. The want of a point of union

among its members, where subjects interesting to the whole body of educated practitioners might be introduced and fairly discussed for the mutual benefit of all, and through which the contributions to dental literature at present scattered through the pages of medical journals, and often lost to those to whom they are most interesting, might be collected so as to form both an instructive and available library for reference, has long been felt.

The necessity of such a union, generally acknowledged but never carried out, has given rise to the formation of the Odontological Society. Founded on the basis of other scientific societies, it, like them, originated with one or two, and has been organized by several—the gentlemen applied to to form it being those who had signed the Memorial to the College of Surgeons. These formed themselves into a society, and out of their number appointed officers and a council for the first year. Having arranged the bye-laws for the governance of the society, it was then determined to invite a limited number of town and country practitioners to join it, so as to secure, from the first, a sufficient number of members for the purpose of carrying out the objects of the society previous to throwing it open to the profession at large, for admission in the ordinary mode, by ballot—a plan borne out by the early history of every society on the model of which the present is based. Such limitation of invited members was found absolutely necessary, and was made without

the slightest intention of creating any invidious distinction, it being evident that the names selected could not be considered as representing *all* the gentlemen who rank high in the profession, there being many not included, who are equally well qualified, and equally respected as intelligent practitioners, as any among those to whom the invitation to join the society was sent.

And now, gentlemen, our society being formed, and having met together for the first time under such favourable auspices, it only remains for me to urge upon you the necessity of holding together, and doing the utmost in your power, individually and collectively, to promote the objects for which it was founded, by contributing papers of interest, and joining in free and friendly discussion on points of practice, and ungrudgingly communicating to each other the results of our individual observation and experience. The adoption of such a course will elicit, both in the form of written and oral communications, many valuable facts which, when collected, will concentrate and thus render permanently useful to all, the knowledge and talent possessed by the members of our profession. The annual publication of a volume of Transactions will place before the members of the society the matter brought forward at its meetings; and it will, I feel confident, be an object of ambition to those who have information to impart, that it should appear through the medium of a society, the main purpose of which

is the collection and diffusion of professional knowledge.

With such ample means at our disposal, I look forward to the day as not far distant when this—the Odontological Society—will take rank with any existing society, and command the respect of the scientific world.

ON

THE REDUCTION OF LIMAILLE.

Read before the Odontological Society, *February 2nd*, 1857.

By ARNOLD ROGERS, F.R.C.S.

My attention was directed, during the early period of my practice, to the customary method adopted for the reduction of ordinary tray, or skin limaille, which operation consisted in the employment of the magnet, burning, and then by the aid of a viscid flux, gathering the button of metal at the bottom of a crucible whilst in the furnace. All who have used this process, will recollect how carefully regulated the heat must be in the first instance; and even with all this care, some unexpected augmentation of it has frequently caused a portion of the contents of the crucible to rise up and be poured over its mouth; the addition of salt upon such an emergency, might in some degree stay its refractory tendency, but the loss consequent upon the overflow, and other causes to which I need not refer, would, I think, induce a young practitioner to relinquish this method, and probably he would resolve to dispose of his limaille to a refiner. It will be evident upon a little reflection, that the greatest attain-

able fluidity of the flux is to be desired, so that by gravitation, even the finer particles of gold may descend through it and be collected. Equally important is the necessity for employing a flux, capable of separating the impurities prior to the actual fusion of the metal, so that the gold itself may be purified during the process in the furnace. It is my pleasure this evening to offer you results obtained from long experience. I purpose to satisfy you that the process I am about to describe is almost costless, and certain of producing a successful result when strictly carried out; and that by employing so small a proportion of an extremely fluid flux, a large weight of filings may be purified and gathered, without fear of effervescence, or loss of any kind.

The formula is as follows:—Sift the limaille, thoroughly magnetize it, and place it in a Wedgwood basin, in such quantity, that it fills no more than about one-third of the space. By *slow* degrees, add hydrochloric acid and water (in the proportion of one part acid, four water) and place the basin on a sand-bath over a furnace fire; the mixture may now be heated to the boiling point, and the heat continued for an hour, during which time it should be constantly stirred with a smooth stick, the filings will fall to the bottom of the vessel, and the bone-dust will be dissolved; pour off the fluid, and well wash the filings with boiling water; by turning the vessel from side to side whilst washing,

you will by this means liberate much impurity of a dark colour. Undiluted hydrochloric acid is now to be added to the drained filings, and the vessel again placed on the sand-bath for a quarter of an hour's boiling; the filings will have become brilliant, and at this stage all trace of acid and dirt must be *thoroughly* washed away with boiling water.

If it were now submitted to the flux and crucible the button would exhibit a poverty of quality, on account of silver filings, which generally are found in limaille; to avoid this it is necessary to employ a small quantity of dilute nitric acid (one part acid, three water), and submit the whole to a gentle heat at first, which afterwards may be increased to the boiling point; full a quarter of an hour will be desirable for this part of the process; pour off the solution of nitrate of silver, and employ undiluted nitric acid; place the vessel again on the sand-bath and boil for a quarter of an hour (or until nearly dry); thoroughly wash away with boiling water all trace of acid, and dry the filings, which will now be ready for the crucible.

The flux and filings are now to be thoroughly mixed, the composition and proportions as follow:—Say, if sixteen ounces of gold-filings, mix eight ounces of bisulphate of potass (sal enixum),* four ounces of chloride of sodium (common salt), and two ounces of bichloride of mercury (corrosive sublimate). These ingredients must be in powder,

* Commonest kind of sal-enixum.

and on no account should they be mixed *long* before required for use. The skittle-pot should be of such size that the mixture does not more than three-fourths fill it; place the pot in the furnace, then GENTLY raise the fire, and during this part of the process fill the furnace with coke up to the top of the pot. From a quarter to half an hour (according to the quantity submitted to reduction) will be required in order that the fire may be *gradually* raised, and then complete the coking; the fire may now be as fierce as is usual in such operations, and when the heat is reduced low enough to remove the pot from the furnace, the button will be found entire and the whole of the gold gathered, if the operation has been well conducted.

If I have abstained from giving any relative proportions of limaille and the acids (during the process) in the former part of the paper, it is because I am aware that no general rule exists for the accumulation of the board, and tray or skin products. Some practitioners may be more careful in avoiding extraneous materials than others are, and consequently the limaille submitted to operation will differ in quality; for instance, if chalk be employed at the board, any admixture of it would, in the process, neutralize some portion of the hydrochloric acid, and in that case an average quantity of acid would scarcely suffice. There is no disadvantage in employing a slight excess of acid.

I have found by experiments that bone-filings

(being light) may be considered as possessing about half the specific gravity of water, that is, a half-pint measure filled with bone-filings will weigh about four ounces, and that this quantity requires for its solution nearly four fluid ounces of hydrochloric acid; if, therefore, a measured half-pint of limaille be submitted to the process, however rich or poor in quality, four fluid ounces of hydrochloric acid and sixteen of water would be such proportions as I think would meet every case. For the purpose of experiment for this paper, I desired to test another practitioner's limaille in preference to my own; my friend Mr. Tomes kindly allowed me the opportunity. Eight ounces by measure of his limaille weighed fifteen ounces avoirdupoise: to this was added four fluid ounces of hydrochloric acid and sixteen ounces of water for the first part of the process, and two ounces of undiluted hydrochloric acid for the second part. On the application of nitric acid, subsequent to the above, and for the part completion of the operation, one fluid ounce of nitric acid and three ounces of water were mixed and added to the filings (for the removal of the silver usually found accumulated), and one fluid ounce of *un*diluted nitric acid was employed in the second part of the process to complete the cleansing of the filings. If, then, these proportions of the limaille and acids from the sample of another person have given results very closely corroborative of years of experience, I think that other samples may

reasonably be expected to afford results equally satisfactory.

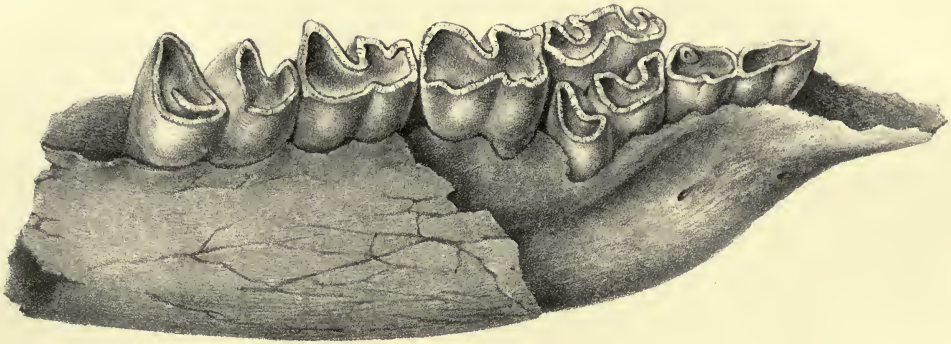
I would remark, that the silver which has been dissolved by the nitric acid may be recovered, by precipitating it with a little chloride of sodium, and afterwards treating the precipitate with zinc and diluted sulphuric acid, a process no doubt well known to every one accustomed to working with precious metals.

I would refer also to the importance of having at hand large evaporating dishes, or vessels of some kind, to receive the washings during the process, especially if carried on in a hurry, so that the particles of gold, which are liable to escape with the water, may be allowed to settle, and be collected afterwards. I need scarcely observe that separate vessels will be requisite during the process of washing with water.

It may be thought objectionable, in a sanatory point of view, to employ bichloride of mercury. The decomposition of the materials, through the agency of the fire is, I believe, so complete, that the escaping gases, during the process in the furnace, are rendered as innocuous as need be.

I have, however, substituted a like quantity of chlorate of potass instead of the bichloride of mercury. The only difference in the result was, that the gathering of the gold was not quite so thoroughly effected, although the quality of the product was slightly improved by its adoption.

NATURAL HISTORY.



T. Spence Bate del. Tuffen West sc.

W West imp.

ON ABSORPTION.

Read February 2nd, 1857.

By C. SPENCE BATE, Esq., F.L.S.

Among the many subjects of interest to the members of this Society, there is none from which would probably result greater practical utility than that of the elucidation of the process of Absorption, the economy by which nature gets rid of a worn-out organism, in order that its place may be occupied by another better adapted to the requirements of the individual.

It is unnecessary here to enter into the numerous hypotheses of the earlier physiologists, except so far as they may assist to a conclusion of the subject at the present stage.

One of the first ideas was, that the new tooth pressed against the old one, and produced disintegration of its structure. But this has been so long given up by all, that it is not just to refute it as an accepted theory, and it would not have been alluded to in this paper, except that the discovery of a very interesting fossil beautifully demonstrates the error (Plate I). It moreover shows, that not

only is pressure in itself inefficient for the purpose, but that mammals were liable to abnormal conditions in the development of those organs before the period of the human epoch.

Since the hypothesis of pressure of the new tooth against the old, which could not have stood the test of a single dissection, has been given up, there has been a tendency among modern observers to run into the opposite extreme, and to account for the process as one totally independent of the new organ.

This notion was first asserted by Hunter,* who affirmed, that "when the first set falls out, the succeeding teeth are so far from being destroyed, by their pressure, the parts against which they might be supposed to push, that they are still enclosed and covered by a complete bony socket."

It was repeated by Bell,† who calls it a process of anticipation, but qualifies the general acceptance of the hypothesis, by asserting that "the presence, though not the pressure, or even contact of the new body, is necessary to excite the action of the absorbent vessels."

And, very recently, Mr. Tomes has not only accepted the same opinion, but carries it still further. If I gather correctly from the general tenor of his paper,‡ he asserts that a papilla is deve-

* "Microscopic Journal," vol. iv.

† "Natural History of the Human Teeth." (Palmer's Edition.)

‡ "On the Teeth."

loped within the deciduous alveolus, endowed especially with the power of absorbing the old tooth; that, as fast as it encroaches upon the deciduous organ, a layer of osseous tissue is developed at the base, which separates it from the new tooth; with which it not only has no connexion, but that when there are no successors it still continues to absorb the fangs of the temporary teeth.

In order that we may arrive at the knowledge of the laws which regulate this process, it is necessary that its progress should be observed under distinct conditions, and also in different animals.

Absorption of the teeth exhibits itself under two forms, that is, normal and abnormal; the former being obedient to a natural law, the latter the result of extraneous causes. Although it is the former of these that it is our object to discuss, yet most probably the subject will be assisted in elucidation by the study of the latter also; for when a law is strained to meet peculiar conditions, it is liable to be more distinct to our conceptions.

We know that a blow given to a tooth, although it produces no immediate result, will occasionally induce aborption of the whole fang.

Fig. 1, Plate II., represents the crown of a central incisor that was so absorbed. It received a severe blow, but as soon as the immediate pain had passed away, appeared to have undergone no injury. It attracted no further attention until it began to loosen, and the crown came off some eighteen

months after the accident, accompanied with a similar absorption of the alveolar walls.

Again, a tooth that has been fractured by a blow, but not dislodged, may absorb at the point of the injury.

Fig. 2, Plate II., illustrates an upper bicuspid tooth that had been so injured. It remained for two or three years free from inconvenience. Absorption gradually encroached upon the structure from before and from behind, and ultimately the tooth rocked upon a central pivot. It then became painful, and was consequently removed.

Fig. 3, Plate II., is taken from a tooth in which absorption of the fangs was the result of irritation, caused by salivary calculus having been deposited in one of the alveoli, in which the roots of the tooth are implanted. The tooth was strong, healthy, and firm. It was removed in consequence of acute local pain.

In Fig. 4, Plate II., we have an example of a different kind. It is usually met with in old persons, whose teeth are getting loose, when the sockets fill up, and the walls of the alveoli equally pass away by the same process, as if nature was approaching that period when their loss would not be felt. It may with propriety be denominated "Senile absorption."

Normal absorption is an economy in nature for an especial purpose. We consequently perceive that the process corresponds to the position of the new tooth.

Fig 1

Fig. 2.

Fig 3

Fig 4

Fig 6.

Fig 5.

BRITISH
NATURAL

This is beautifully shown in the Lacertine reptiles, where the succession of teeth is constant with the animals' existence (Fig. 5).

The new organ is developed on the lingual surface of the fang of the old, which is gradually absorbed in a direct proportion to the development of the new tooth.

That which is so distinctly manifest in the reptile, is but the simplification of the process as exhibited in the higher types of animals.

In man, the new teeth are developed within the arc occupied by the deciduous set. Absorption, as a general rule, commences upon the inner surface of the extremity of the fangs of the single fanged teeth, and in every case corresponds to the position of the new organ in relation to the old.

The teeth which are in the progress of development are formed in alveoli, distinct from those in which the deciduous are implanted. But this only continues for a time. The bony cases in which the former exist are gradually removed by absorption, and then those parts of the fangs of the deciduous teeth which are first exposed follow in exact proportion with the surrounding osseous tissue.

This is the case in those animals where the teeth are developed in close approximation with the deciduous set. But when there is a great separation between individual teeth, as in those planted in the intermaxillary bones of the common pig (*Sus scrofa*), one of the few recent mammals that possess

the typical number of teeth—viz., forty-four—the young organs lodge in their own alveoli, and possess plenty of room for development: they encroach not upon the alveoli of the previously existing set. The consequence is, as distinctly illustrated in the annexed sketch (Fig. 6, Plate II.), that the deciduous fangs remain entire, although the permanent teeth are nearly complete in their development.

Moreover, it is not uncommon to meet in practice with deciduous teeth that retain their position in the mouth and fulfil the duties of permanent teeth. This may be the result of an arrest of development in the permanent organ, or from some abnormal condition forcing the permanent tooth out of the regular arc, as exhibited in the accompanying drawing of a fossil rhinoceros (Plate I).

The teeth retained can only be so by means of deeply-seated unabsorbed fangs—an opinion which has been corroborated by those which circumstances have required us to remove.

Opposed to this, we find absorption in progress under very distinct conditions. We have observed in the pig, where the development of the huge canine tusk has encroached upon the alveolus of the first deciduous molar (Fig. 6, Plate II.), that it had induced absorption of the extremity of the fang of that tooth. In this case the process was carried on at that extremity of the new tooth, and during the time that it was developing dentine. In the

sheep, the second premolar (the first being permanently absent) is represented by no deciduous organ; but appears to be developed by a gemmiparous process from the next posterior, analogous to the development of the second and third molars in mammals generally. Constant with my own experience, absorption takes place on the fang of the deciduous tooth at the neck, corresponding to the connecting link between the two undeveloped teeth. (Plate III., Figs. 1 and 2.)

In reviewing these several cases of absorption, we perceive that the action may be set up through the means of widely different causes. Abnormal absorption may result from some extreme injury or disease. Normal absorption may take place at either extremity of the growing tooth, should it be brought into contact with a deciduous tooth.

There may be, moreover, an amalgamation of the two, in consequence of the organ being attacked by disease during the process of absorption, as seen in Plate III. Figs. 3 and 4. If we give our attention to those conditions that are constant under every kind of absorption, we shall perceive first, that the peridental membrane which protects the fang of the tooth is destroyed at those points where absorption is in progress, and next, that it must be in immediate contact with a highly vascular tissue. It matters not whether the capillary plexus be the result of disease or a constant law in nature. The process is the same. It is the inducing cause alone that differs.

In looking in mammals for the vascular organ, we find that portion of the capsule of the tooth which covers the enamel organ, of condition equal to that which is required. Nature always makes use of material at her command. To create an especial organ for the purpose of absorbing fangs of the deciduous teeth would appear to be a work of supererogation. The more so since, if the remark be true,* that osseous tissue is developed beneath the absorbing papilla as fast as it encroaches upon the old organ, it would again require an absorbing organ to remove that osseous deposit.

That the vascular surface of the enamel pulp is not only capable of performing the function of absorption, but that it actually does perform that office, can be shown, I think, to demonstration in the following case of irregular normal absorption in the mouth of a young child, as shown in Plate III., Figs. 5, 6, 7.

The permanent central incisor is well developed. The lateral deciduous incisor having been removed, the deciduous canine closely approaches the permanent central incisor. The consequence is, that the permanent lateral has come into contact with, and absorbed the upper portion of the deciduous canine, while the permanent canine on the one side has distorted the partially developed fang of the permanent lateral incisor, and on the other absorbed the lower portion of the fang of the deciduous

* Hunter. Tomes.

Fig 1.

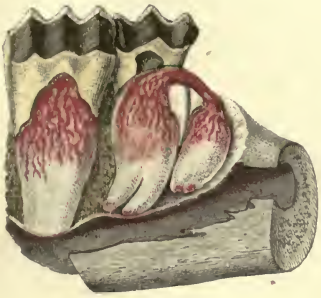


Fig. 2.

Fig. 4.

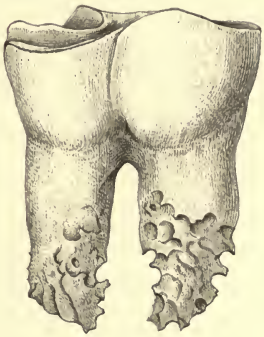


Fig. 3.

Fig. 5.

Fig. 6.

Fig. 7.

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canine. Thus we have a specimen of two teeth during the progress of development inducing absorption by the contact of their soft vascular tissues with the fang of a deciduous tooth, the destruction of which takes place in positions corresponding to each of the new teeth; whereas, the extremity of the fang, and every portion where we should presume an especial organ to act, are uninfluenced.*

It was first asserted by Dr. Ashburner, and recently in the pages of Dr. Kirke's *Physiology*, that, previous to absorption of the deciduous tooth, death or degeneration of that organ must have occurred.

But this appears by no means to be the case, inasmuch as we have repeatedly had evidence of all the tissues being in healthy connexion with the tooth, except at that point where absorption is actually in progress; and we moreover know that absorption of the bone takes place, and that bone redeveloped around that portion which becomes the fangs of the permanent tooth, a circumstance which

* The mouth from which this specimen is taken strongly evidences the necessity of those who have the care of young persons' teeth having a clear idea of the means by which they are removed. The deciduous lateral was early lost, the canine tooth consequently closed in upon the central incisor, leaving no room for the permanent organs to obtain their normal position in the dental arc. The opposite side of the mouth having not been deprived of the deciduous teeth, the result is of a different character. If the two sides of the superior maxilla be measured, they will be found to differ in their respective lengths in a ratio corresponding to the lost deciduous lateral.

could not, we presume, occur if the bone had undergone any degree of degeneration.

Reviewing the whole subject, we are led to the conclusion—

That the cause of absorption in teeth is the destruction or separation of the peridental membrane from the surface of the tooth.

That this is always the result of a vascular surface brought into immediate contact with that membrane.

That the vascular surface may be induced by accident or disease.

But that, in normal absorption of the deciduous teeth, it is the external surface of the enamel organ of the growing permanent tooth which fulfils this office.

That the development of the new tooth has a distinct and decided influence upon the progress of absorption of the deciduous tooth.

That in those cases where the deciduous teeth are early removed, it has been the result of some abnormal cause.

ON THE MEANS BEST ADAPTED FOR EXCLUDING MOISTURE FROM TEETH DURING THE OPERATION OF PLUGGING.

Read February 2nd, 1857.

By JOHN TOMES, F.R.S.

There are but few engaged in operating who have not felt the advantage of excluding all moisture from the gold or other material used in filling teeth; and there are many who believe that if gold-foil becomes wetted with saliva when the plug is partly formed, the operation will eventually prove unsuccessful. If the solidity of the plug depends upon the adhesion of the duplicatures of the foil to each other, this is most unquestionably true; but if the density of the filling depends upon wedging the successive folds of foil introduced between each other, it then admits of question, whether the admission of a small amount of moisture acts so destructively. In those cases where the crystalline gold is used, the plug will be totally destroyed if the saliva is allowed to run in during the progress of the operation.

The urgent necessity of keeping the tooth under

operation dry, has led to the adoption of various expedients. Folds of blotting-paper, of linen rag, of lint, and masses of cotton-wool, have been placed on one or both sides of the tooth with more or less success; but it is always a struggle between the operator and the accumulating saliva. The napkins have to be changed when the operation is prolonged, and all our efforts are not unfrequently rendered futile by the fluid overflowing the unfinished plug during the withdrawal of the wet and the substitution of the dry napkin.

Syringes, and even syphons, have been contrived for the removal of the saliva, but their use has not been attended with any great advantage. I have heard a practitioner talk of building up a dam of wax around the faulty tooth before commencing to introduce the gold; but in my hands the method has altogether failed.

Some time since it occurred to me that with a membrane made very adhesive on the one side, and perfectly water—or rather saliva—proof on the other, we should be able to command a much greater degree of success than is attainable by the means at present in use. The first experiment was made by coating the gutta-percha membrane of the shops with a thin layer of gelatine; and the first case in which the new material was tried demonstrated the success of the principle adopted. The tooth operated upon was a second molar of the lower jaw, decayed on the anterior surface. After the softened dentine

had been cut away, and the excess of saliva removed with a napkin from the lingual surface of the teeth and gums, a strip of the membrane was applied, and after slight pressure with the finger, it adhered firmly in its place. The free edge was allowed to project about a quarter of an inch above the level of the masticating surface of the teeth. A smaller patch was placed over the orifice of the parotid duct. After all moisture was removed from the cavity, the introduction of the gold was commenced. The operation extended over twenty minutes, during which time the tongue, loaded with saliva, could be seen moving against the insoluble surface of the membrane, but without a particle of fluid gaining access to the tooth. The new material was experimented with in numerous cases, and with equally favourable results.

An unexpected difficulty, however, arose. When the gelatine had become perfectly dry, it parted from the gutta-percha membrane. Various means were tried by Messrs. Bell to overcome this difficulty, but hitherto without success. In the mean time I have used a membrane made in the following manner. Several coats, either of gelatine or gum-arabic, are laid upon one side of a piece of thin muslin. When perfectly dry, the opposite side of the fabric is painted over with a solution of gutta-percha. The membrane so made answers quite as well as that first described, but it is not (what the chemist would call) an equally elegant preparation. Thin silk or

gauze, or even tissue-paper, may be used as a medium for holding together the soluble and insoluble components, which we have hitherto failed to unite, excepting by the interposition of some fibrous material.

When operating upon the front teeth from the lingual surface, a strip of membrane may be laid upon the anterior surface of the teeth and gums with advantage. The lip may then be allowed to fall into its place without any chance of moisture finding its way between the faulty teeth; and when the gold is introduced from the anterior surface, the strip should be applied upon the lingual surface. But the manner of using the membrane is too obvious to need any detailed explanation. I may, however, remark that it is necessary to secure perfect adhesion of the membrane before the operation is commenced. The adhesive material is, of course, soluble, and would soon be washed away, but for the protection afforded by the layer of gutta-percha. When adherent to the gums and teeth, the thin edge is alone exposed to the solvent action of the saliva, and the action upon the mere edge is too slow to produce any mischievous result.

ON DENTAL EXOSTOSIS.

Read March 2nd, 1857.

By HUBERT SHELLEY, Esq., M.B. Lond., M.R.C.S., &c.

Although exostosis of the fangs of teeth forms the subject of a chapter in all our works on dental surgery, still, after perusing them, a feeling of dissatisfaction is expressed, from the many points manifestly requiring further elucidation. Thus, its cause in many cases remains involved in mystery; of its mode of increase and manner of deposit no account is to be found; and there are no symptoms at present discovered by which it can with certainty be diagnosed. The object of the present paper is therefore an attempt—humble, I acknowledge—to clear away some of these difficulties, if it be only by rendering our present stock of information a little more exact concerning this disease, which is one of the most curious to which the teeth are liable.

The term "exostosis" turns out to be, when examined by the aid of modern science, more applicable to the disease in question than others which, like it, have been derived from osteological pathology. Since it is necessary to understand whether we

include under this name every known enlargement of the substance of the fang, I must beg your attention to what might otherwise be deemed a digression from our subject. John Hunter calls it, in simple Saxon, a "swelling of the fang, in which," he says, "although the body continues sound, is of that kind that would be called in any other bone *spina ventosa.*" This comparison is unfortunate, since that name is applied to increase in the size of a bone, accompanied by a corresponding excavation within, and is therefore totally inapplicable to exostosis, as he himself correctly describes the body of the tooth to be sound. Fox gives a long chapter on exostosis, in which he details several remarkable cases, and a little further on gives a very meagre and unsatisfactory account of what he is pleased to call *spina ventosa,* in which he says the fang is hollowed out within, and roughed and enlarged without. The description is unaccompanied by any engraving, and answers more to death of the pulp, followed by necrosis of the tooth and its consequences, than to anything to which the term *spina ventosa* might be applied.

The proximate cause of this disease is referred, and correctly so, to irritation of the periosteum connecting the fang with its socket; but its remote causes are not always sufficiently obvious to be pointed out with exactness. This irritation is, in the majority of cases, an extension of a similar

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Fig. 1.

Fig. 2.

Fig. 5.

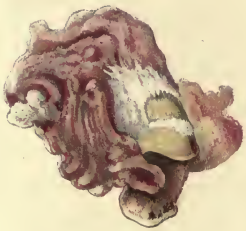


Fig 6.

Fig. 3.

Fig. 4.

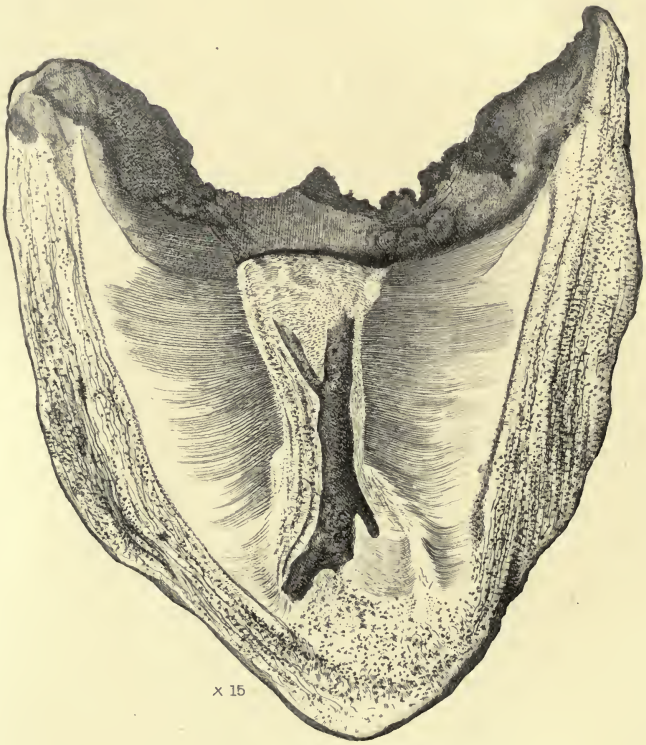
morbid condition excited in the pulp through lesion of the crown of the tooth—as for instance in caries, which, as is well known, is one of its most frequent causes. Another source of irritation of the dental pulp, producing exostosis, springs from a wearing down of the crown, which is well exemplified in this skull of an Esquimaux, where the crowns of the teeth are fully one-third, and many more than half, worn away; and in those that have been extracted, more or less exostosis will be observed (Figs. 1 and 2; Plate 5). Similar cases have also presented themselves to my notice among the patients at the hospital, where the teeth, having been much ground down by mastication, have become so painful that the patients have urgently requested their removal; but the operation has been rendered tedious and difficult, owing to enlargement of the fang.

There is, however, another class of cases in which, as John Hunter observes, "the body of the tooth is sound," neither caries nor attrition being present to excite irritation in the pulp, and thus we are necessarily driven to the conclusion that the disease arises primarily in the alveolo-dental periosteum. Now this may be occasioned by the tooth having to perform the office of mastication almost or entirely by itself—by being deprived of the assistance of its fellows on that side of the jaw, and sometimes of the other also. We cannot be surprised in such a case if the elastic cushion interposed between the tooth and its bony

socket, to avert the evil consequence of concussion during mastication, should become the seat of disease. In Mr. Tomes's work an admirable illustration of this condition of things accompanies his remarks upon the subject of my paper. But in other cases, where the body of the tooth is sound, we cannot even cite this as a cause for the enlargement, and its origin remains veiled in mystery. It has been therefore referred to "constitutional tendency," the meaning of which being obscure and mysterious, well accords with the cause of the disease, but explains nothing. These cases are rare; but in individuals in which they occur, several teeth are affected with the disease, as in the case quoted by Mr. Fox.

The cause, I say, has been correctly referred to irritation of the dental periosteum; but it is manifest that this irritation runs on to inflammation of the chronic kind, and that to this is to be referred the pain so frequently present in this affection. This opinion will, I hope, be borne out by a careful investigation of its progress. In teeth that appear otherwise sound, or slightly affected with caries, it appears to commence around the dental foramen, and gradually to spread and increase over the apex of the fang. Upon making a section of such teeth, the deposit will usually be found to be thicker just over the apex, and gradually diminish down the sides of the fang. The thickness which the additional deposit attains is, in specimens which are frequently to be

× 20



x 15

seen, very great, causing the end of the fang to be as large as the crown, and extending quite to the neck of the tooth. Upon making a section of a tooth thus encrusted, the extent of the hypertrophied mass can be easily distinguished by its colour and texture from the fang upon which it is deposited; but in stumps its deposition is very uneven, sometimes one side is encrusted, while the other retains its natural appearance; or it exists only as nodules scattered here and there, distinguishable from the original structure by their pearly whiteness. A very common appearance, and one which is frequently ascribed to absorption, is a nipple-like projection of the apex of the fang (Fig. 3, Plate V). That this is not due to any removal of substance is shown by submitting a thin section of such a stump to a low magnifying power, when it will be seen that the nipple-like portion is still covered with its natural layer of cement, but that an additional deposit has taken place over the rest of the stump, gradually diminishing and blending with the normal tissue towards the carious end, and terminating abruptly in the opposite direction in an elevated thickened border (Plate VII). A thin section of an exostosed fang submitted to a low magnifying power shows that the deposit has taken place layer by layer, their boundaries being defined by irregular wavy lines, running almost parallel with the border of the dentine (Plates VI. and VII). The limit of the original layer of cementum is usually marked by

a well-defined line, and in some places a small chink intervenes between them and the additional deposit. Vascular canals frequently traverse its substance, interfering with the regularity of the layers, and sometimes complete concentric rings are found around the canals, thus bestowing upon the cementum the characteristics of bone. The lacunæ are very variously distributed in the different layers, some being quite full of them, whilst in others they are entirely absent; and they are, moreover, usually larger, and furnished with more numerous and larger canaliculi than those found in the normal cementum. They do not always occur in lines parallel with the layers, but sometimes are to be found in little round clusters, or scattered irregularly in the layer. That appearance which has led to the belief that they are situate in the centre of cells is frequently to be observed in this cementum of abnormal growth. The hyaline, or interlacunar substance, is by no means homogeneous in appearance, and indeed is much less so than in the natural layer of the cementum, being irregularly streaked across the layers. After removal of the calcareous matter with dilute hydrochloric acid this appearance is still preserved, or indeed more forcibly shown, proving that this heterogeneous appearance is entirely due to the structure of the cartilage with which the earthy constituents are combined. I may remark that cartilage thus obtained, when attempt is made to tear it, splits up into the component laminæ.

Having thus given a brief sketch of the structure fully formed in exostosis of the fang, I will now proceed to describe the manner of its formation, as far as my investigations have hitherto advanced.

The periosteum being the seat of the disease, it may be as well just to call to mind the tissues entering into its composition, since we shall then be the better able to judge of any departure from its natural healthy condition. The principal element is the common white fibrous tissue, well known by its beautiful wavy tresses shown under the microscope, and in this clusters of fat globules are to be found, whilst traversing it are seen minute bloodvessels and nervous filaments. The space thus occupied, intervening between the fang and surface of the alveoli is extremely narrow, and, were exostosis to be confined to the natural periosteum, its extent would be always extremely limited. How then does it attain so large a size as in the specimens which are before you?

Since stumps, as I have stated, are so commonly the seat of exostosis, and, from the facility with which such specimens can be procured, I have made my observations principally upon them and upon the exostosis of teeth affected with caries. Teeth affected with exostosis, but otherwise apparently sound, being of rare occurrence, I have not been able to verify my results upon them; but since the deposit of cementum presents exactly the same character, both to the naked eye and microscopically,

as in the cases above mentioned, I can see no reason for hesitating to assign to the hypertrophied tissue the same mode of formation.

Upon examining the periosteum of a stump or tooth recently drawn which has been the subject of long-continued irritation, we find it much more vascular than usual; in some places it is very much thickened and slimy, and very frequently adhering to it are reddish fleshy shreds or masses, which have been called coagulated lymph (Figs. 4, 5, 6, Plate V). These are sometimes of comparatively large bulk (Fig. 5), especially where this has been the subject of recent inflammation; and it not only follows that the tooth must be elevated in its socket, but that even the latter must be itself excavated to accommodate the morbid growth. In Fig. 5, Plate V., the stump is imbedded in an immense mass of this coagulated lymph, and the walls of the alveolus, having to be removed for its accommodation, have softened during the process, so that a piece of living spongy bone has been brought away with the mass. And in order to assist our conception of this fact, I may here remark upon the extraordinary facility with which the jaw-bones change their shape. An alveolar abscess hollows them out, and drills a hole through them in a few days; or two or three double teeth are extracted, and in a few months not a vestige of their former implantation is visible, and they will slowly expand before a tumour, covering it with a thin papery envelope, rapidly to

collapse again after its removal into a firm bony ridge.

Let us now investigate more closely a mass of this so-called coagulated lymph. It is soft, almost diffluent on the surface; in the middle it is somewhat denser, and at its union with the fang, which is extremely firm, it is of a gristly cartilaginous texture. The smaller and whiter shreds on the periosteum also partake of the latter character, being tough and less vascular.

Examined by the microscope, the external soft surface is seen to be principally composed of large corpuscles, granular and nucleated, and which in water swell up and burst after a time. The more diffluent parts are entirely composed of these spherical bodies, which agree in character with those corpuscles usually met with in parts recently inflamed, and termed by some exudation corpuscles. In addition to these, small masses of a granular blastema are also visible (*vide* Fig. 1, Plate IV).

The principal constituent of the next undermost portion is seen to be fibrous tissue in a state of formation. For here may be seen (and in some instances it is most admirably shown) oval corpuscles with fibrous prolongations, some with a short fibre at one end, others lengthened out at both ends, and putting on the characteristic undulation. The corpuscles are light, and generally bi-nucleated, whilst the fibrous extensions are slightly more opaque (*vide* Fig. 2, Plate IV).

Still nearer the fang we find the mass tougher, and composed of fibrous tissue, but mingled with it amorphous granules of a gelatinous appearance, and in the meshes, and floating about the margins of the mass, are a number of oval cells (*vide* Fig. 3, Plate IV).

At its junction with the fang the substance becomes dense; it is torn with difficulty, and under pressure slips about between the two glasses, and refuses to be flattened out. Under the microscope it appears as a solid, amorphous, yellowish mass, in which, however, may be still distinguished the wavy appearance of the fibrous tissue (Fig. 4, Plate IV).

In this dense gelatinous substance osseous matter, which has been detached from the fang along with it, may be seen; not, however, shooting out into it in the form of spiculæ-like ossification in the fibrous matrix of the bones of the skull, but as rounded amorphous molecules.

A more careful examination of the cells found floating freely in the field of the microscope around the margins of preparations made from the two last-described modifications of the so-called coagulable lymph, and which may also be distinguished imbedded in the masses themselves, shows them to be, from their shape and size, identically the same cells, but with different contents, and these contents singularly agree with different modifications of tissue above described. For instance, cells may be

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Fig 1.

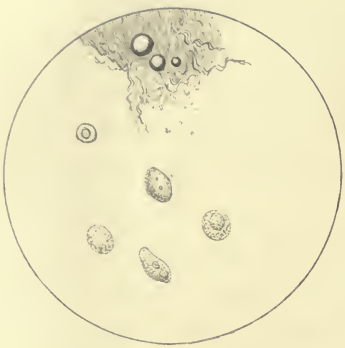


Fig. 2.

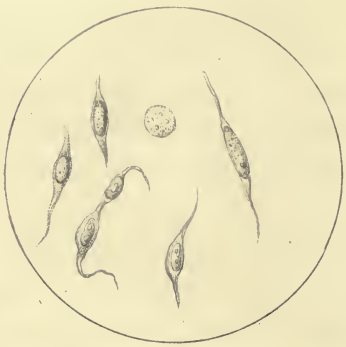


Fig. 3.

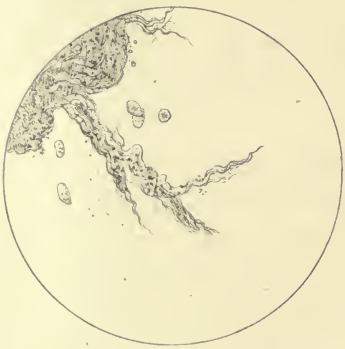


Fig 4.

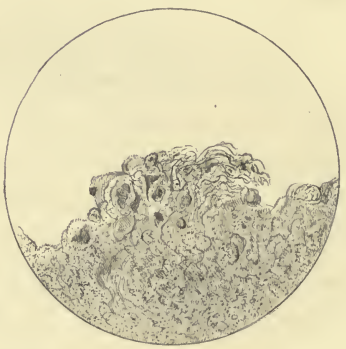
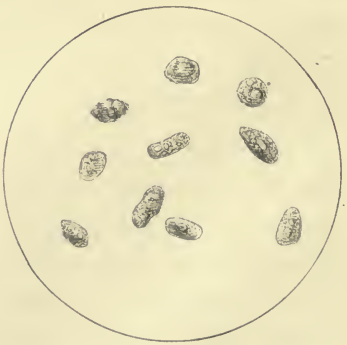


Fig. 5.

Fig 6.



seen particularly abundant in the middle of the "coagulable lymph," of an oval or elliptical shape, transparent, homogeneous, and furnished usually with two nuclei (Fig. 5*a*, Plate IV). Then they may be seen with faintly granular contents and larger nuclei; and lastly, their interior seems stuffed with a more opaque and denser substance, disposed in large granules, among which the nuclei cannot positively be pointed out (Figs. 5*b* and 6, Plate IV).

When a fang to which these masses of so-called coagulated lymph has been allowed to dry; or still better, if a section be made, it is at once evident that the spots to which they were attached is the seat of a preternatural deposit of cementum; and a thin transparent slice submitted to microscopic examination shows the extra cemental deposit as I have above described it, and also the fibrous matrix still adherent to its margin, in spite of the rough usage to which it has been subjected in preparing the section.

Having now investigated the structure of the soft and hard tissues in a tooth subject to exostosis, I think we may reasonably infer the following history of its formation:—Inflammation, excited by some casual or persistent irritation, is set up in the periosteum of the fang, and its usual products effused into the fibrous tissue of which it is formed. These products consist of plasma, or blastema, and exudation corpuscles; and from these are produced cells, some of which undergo a transformation into

white fibrous tissue, whilst others produce the firm cartilaginous matrix in which the white fibrous tissue is imbedded; with which it is ultimately blended, and in which finally the ossific matter is deposited. That this ossific matter is something more than the calcareous salts which form an ingredient in bone is, I think, proved by the fact, that after their removal by means of dilute acid, instead of obtaining again precisely the original tissue which I have described, there remains behind a matrix in which the appearances of this original tissue are preserved, but it seems to have been infiltrated with an ingredient which has rendered it much denser and more compact. After the cessation of inflammation, and the subsequent change of its products into cementum, fresh attacks being excited from time to time, the deposit soon extends far beyond the original layer of the dental periosteum; but still all the requisite elements are formed, as we have seen (viz., fibrous tissue and cartilaginous matter), from effused plasma, and thus the morbid growth increases to a surprising magnitude. In stumps and carious teeth, the products of the inflammation are converted at times into pus, and an abscess is the result; so that if a stump be drawn when violent inflammation is present, we frequently find, in addition to the histological elements already mentioned, globules of pus on the outer surface of mass of "coagulated lymph." That changes in the alveolus should take place, must necessarily

follow from the presence of an additional substance; and it is first enlarged to make room for the so-called masses of "coagulated lymph," and afterwards remains permanently so for the exostosis formed. It is generally loose and cancellous in structure; but where the inflammation has long subsided, and the whole of the effused products have been ossified, we find it closely applied to the surface of the fang, and of a preternaturally smooth, even, and dense texture opposite the seat of exostosis.

As a practical corollary to the foregoing pathological observations, I would submit that the following are the indications of treatment in a case of suspected exostosis:—First, to remove all source of irritation,—the smallest speck of caries should receive due attention and treatment, and any undue pressure upon the tooth, especially during mastication, should be avoided and remedied; and secondly, to reduce inflammation by frequent topical depletion.

ON THE REMOVAL OF THE FOUR PERMANENT FIRST MOLARS, IN CERTAIN CASES, AT AN EARLY PERIOD OF LIFE.

Read February 28th, 1857.

BY

SAMUEL MACLEAN, F.R.C.S.S., F.R.M. & C.S.L., M.O.S.

At the first meeting of the Odontological Society, it gave me much pleasure to hear from Mr. Rogers that it was his intention to bring forward a paper on the subject of the removal of the four permanent first molars, believing, as I do, that there is no subject connected with dental surgery of more practical importance, or deserving of more attention and investigation, than the removal or non-removal of these teeth when attacked with caries at an early period of life.

As the subject is one to which I have myself paid considerable attention, and in reference to which I have been assisted in forming my opinions by the extensive experience and mature judgment of my father, I trust I shall not be considered presumptuous in laying a statement of my views regarding it before this Society. The practice which I advocate, and which it is my purpose to support

in the following remarks, is the *systematic removal of the four permanent first molars in over-crowded arches, especially when attacked by caries.*

Before entering upon a consideration of the reasons, which in my opinion justify this practice, I wish it to be distinctly understood, that I am far from advocating any officious interference with nature. So long as the teeth in question, though affected by caries, appear capable of being saved, or the arch, though limited in extent, seems likely to expand sufficiently to accommodate the full number of teeth, so long I advocate non-interference. I add the latter condition in conformity with a fact noticed by Mr. Saunders in one of his works—namely, that in the arches of many children the eye-teeth are often cut very prominent, but do not in all cases continue so, since, as the jaw developes itself, they frequently fall into their normal position.

The practice, as I have said, which it is my object to advocate in the present communication, is *the systematic removal of the four permanent first molars whenever the arch has a decided tendency to be over-crowded, and especially when the teeth in question are affected by caries.*

A strong argument for the removal of these particular teeth in the case of *over-crowded* arches, may be derived from the observations of Mr. Fox, and, since his time, of many other writers, that of all the teeth of the second set, the first molars are in most cases the least durable.

An interesting table, given by Mr. Tomes, exhibiting the relative durability of teeth, confirms this. From this table it appears, that of three thousand teeth removed from various causes, eleven hundred and twenty-four, or upwards of one-third, were first molars, and of these a large number were extracted under the age of fifteen.

This table further shows that the removal of these teeth for the correction of irregularities is a practice by no means generally adopted; for of all the eleven hundred and twenty-four cases recorded by Mr. Tomes, it would appear that in one case only was the operation performed with this object.

I now proceed to consider more particularly the advantages connected with the practice I am advocating, and also the objections which may be urged against it. The advantages I conceive to be as follow:—

(1.) The prevention and correction of the simpler forms of irregularities in the easiest and most desirable way, in a great majority of cases, without the aid of mechanical means; in all, in such a manner as least to disfigure the appearance of the mouth.

(2.) The promotion of a healthier state among the remaining teeth, and an increase in the facility of treating caries when it presents itself.

(3.) The prevention of the distressing, and in some cases even very serious symptoms, which frequently accompany the development of the wisdom-teeth in over-crowded arches, and a material diminution in the chance of the formation of sinuses in after-life.

In support of the first advantage which I here ascribe to the practice in question, I beg leave to submit the following cases :—

I. Some years ago I was consulted by the mother of a little girl for irregularity of the four upper permanent incisors. On examination of the teeth,

FIRST CASE.

Fig. 1, representing the upper arch of teeth between the ages of nine and ten.

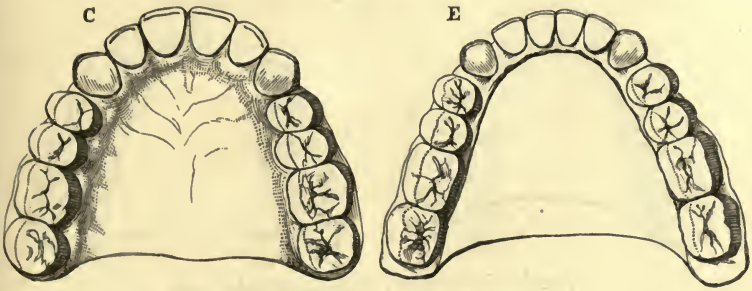
a a, Diseased first molars, removed.

Fig. 2, representing the upper and under arch at the age of fourteen.

I found all the first molars affected by caries, some to such an extent as to cause toothache. I at

once removed the four first molars. It was the first, and up to the present time the only operation of extraction to which she has had to submit. I may here mention that the teeth of this patient

FIG. 3, representing the upper and under arch at the age of nineteen.



are delicate, and susceptible of caries; but by her own attention to the directions I gave her after the operation, she is likely to retain them to an advanced period of life.

II. In this case I was also consulted for irregu-

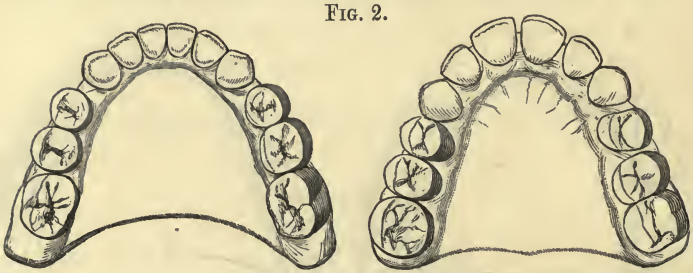
SECOND CASE.

FIG. 1, representing the upper arch.

a a, Diseased first molars, removed.

larity by the mother of a little girl. On examination, I found the four first molars affected with caries, some of the teeth causing toothache. I at once removed them. Fig. 1 represents the irregularity, and Fig. 2 its correction.

Fig. 2.



Result of operation: upper and under arch.

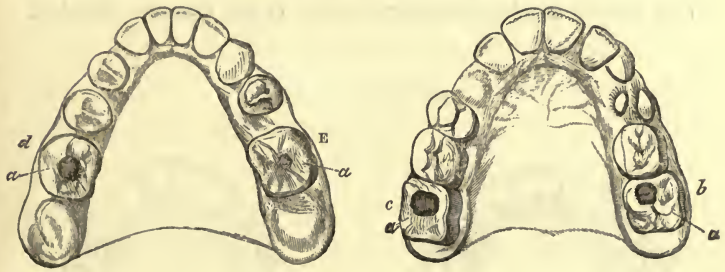
III. In this case I was requested by the father of a little girl to remove a first molar for toothache. I removed it on the 20th of March, 1854, and advised the removal of two other of the first molars. The father, however, declined to let the child submit to so severe an operation. On the 15th of June, in the same year, the child was again brought to me to have the opposite tooth removed for toothache, the child having suffered much pain from time to time during the three months. I removed the tooth. Fig. 1 points out the state of the teeth before operation, and Fig. 2 the benefit derived by the patient from the operation.

On the 20th of June, 1855, I was again consulted by this little patient for toothache, proceeding from

the left under first molar. From the time of the first operation, up to its removal on the above date, it was a constant source of pain and annoyance.

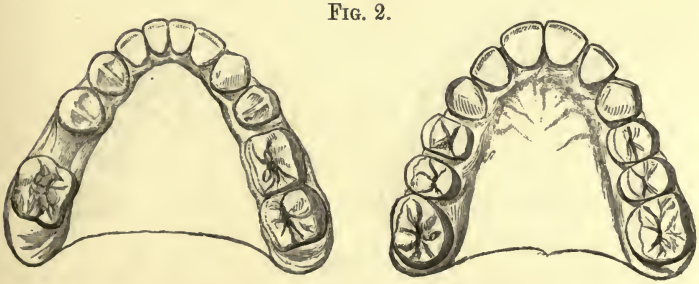
THIRD CASE.

Fig. 1, representing upper and under arch.



a a a a, Diseased molars.
b, Molar removed March 20th, 1854.
c, Molar removed June 15th, 1854.
d, Molar removed June 20th, 1855.
E, Molar removed November 12th, 1857; the second bicuspid having made its appearance at the age of fourteen, and after this Paper was sent in to the Odontological Society.

Fig. 2.



Upper and under arch after operation.

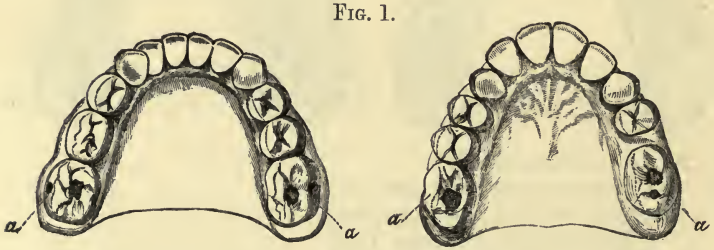
On examination of these casts, it will be seen that two of the bicuspides are wanting. Whether this is

a natural defect, or the result of operation, I cannot say. A gentleman in Glasgow had been consulted previous to my seeing the patient, and had extracted some teeth, but the parents could not remember what teeth were removed.

IV. Fig. 1 represents a very small arch, where the upper centre incisors were very deeply affected

FOURTH CASE.

FIG. 1.



a a a a, Diseased molars, removed.

FIG. 2.

Result of operation.

with caries, as well as the first molars. The first molars it will be seen, on reference to Fig. 2, have been removed, and other teeth that were affected

with caries treated by total excision. I have not the least doubt but that, with proper care and attention, this patient will retain his remaining teeth for many years to come. Again referring to the Fig., it will be seen that three of the upper bicuspides are retained in rather a mal-position by the points of the corresponding under teeth. Were the relations anxious for the removal of this defect, it would be most legitimate on the part of the dentist to have recourse to mechanism; for, once corrected, the defect cannot again occur, owing to nature providing the mechanism to retain the teeth permanently in their normal position.

The uncle of this patient has also rather a small arch; his case for the cure of irregularity was treated by the removal of anterior teeth. On the right under side an eye-tooth and bicuspid were taken out. The result has been a large gap; the under wisdom-teeth have not had room to properly develope themselves. The only stopped teeth in the head are some of the first molars.

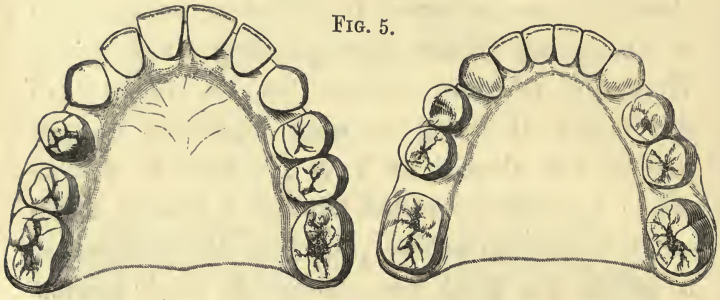
Had this case been treated by the removal of the first molars, there would have been no gap or vacancy on the right under side; the wisdom-teeth would have had room to fully develope themselves, and there would have been no stopped teeth in the head.

V. Fig. 5 represents a very large arch, where the first molars were removed for most extensive

caries and toothache. At present, at the age of fifteen, there is only one stopped tooth in the head. The patient's brother, a year older, has by constant

FIFTH CASE.

FIG. 5.

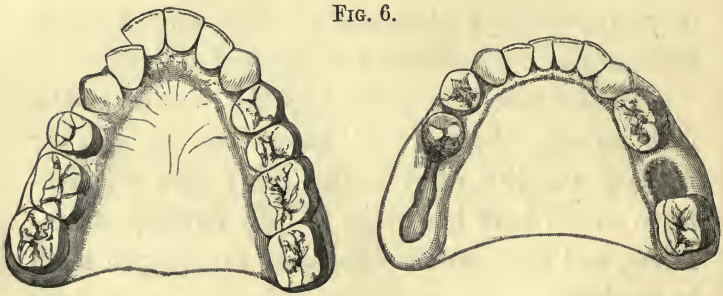


care retained the first molars; but there is the greatest possible difference between the health of the two arches.

VI. The next case I will refer to is that of a

SIXTH CASE.

FIG. 6.



young person who was brought to me some time ago. At the time I strongly advised the removal

of the first molars. I found the two under ones so much affected by caries, that any interference with them on my part would have entailed a long attendance, and the more than chance, in my opinion, of gumboil following on such attendance, for which reason I left the under teeth to nature, being aware that before long toothache would compel their removal. It will be seen from Fig. 6 the teeth have been since removed; had they been removed sooner, the patient would have been saved many nights of toothache, and the success of the operation would have been more certain and perfect, although I expect the result will be good, owing to the position of the remaining teeth. The first time I saw the patient, as I did not receive leave to remove the first molars, and as it was not in the power of the parent to grant me the necessary time to assist nature by means of mechanism, in placing the upper laterals in their normal position, I decided on the removal of the right upper first bicuspid, to admit the eye-tooth into position, which was placed completely over the lateral. Had it been in the power of the parent to grant me the necessary time, and had I been allowed to remove the first molars, this would have proved a most beautiful case in support of the operation I am advocating.

VII. The last case I will refer to is that of a family of five children. The eldest girl, who is either the eldest or the second eldest child of the

family, had at an early period of life the first molars removed, also an upper anterior bicuspid. As to the propriety of removing this last tooth, I gave no opinion, having no history of the case; all I can see is, that she has not a bad tooth in her head at the age of eighteen. The other children, with the exception of the youngest, have had attempts made to save the first molars—some of them have been refilled by myself since the children came under my care. Other teeth have also been attacked with caries; in my opinion, owing in a great measure to the want of proper care and cleanliness, which they have not received, owing to diseased *and tender teeth* being present in the mouth. The youngest boy has had the first molars removed by me; I may say they were very much diseased, and that I expect the result will be as fortunate as in his sister's case, where the first molars were removed.

There is no form of arch which derives more benefit from this operation than the rabbit or V-shaped arch. This arch can seldom retain the full number of second teeth without irregularity taking place, but by the removal of the permanent first molars *before the bicuspides are fully developed, or have articulated the upper with the under*, these latter teeth will in a measure recede, and the eye-teeth will take up their normal position in a more rounded form and curve than if the anterior bicuspides had been removed. In this form of arch, in addition to the removal of the first molars, it is

sometimes necessary to have recourse to mechanical assistance in order to obtain space for the eye-teeth. Fig. 1, in second case, points out a case where such assistance was necessary.

Before having recourse to mechanism, however, it is well to see that the eye-teeth are not retained in a mal-position by a callous state of the gum. I knew one case in which a young person had her anterior bicuspides removed, and for some months every effort was made in vain to place the eye-teeth in position by mechanical means. At last my father was consulted, and on inspection he found the crowns of the teeth surrounded by a band of thickened gum. On removing this, the teeth fell at once into their normal position without any further care or trouble. The band of gum on removal was found to be quite like gristle, it was so hard.

I do not think it necessary before this Society to dwell upon the remaining advantages I have ascribed to the practice I am advocating. Professional men will at once recognise their force. They are familiar with the fact that a roomy arch is more likely to be healthy than an over-crowded one, and is certainly more easily treated when the teeth are affected by caries. The question really at issue is, how are over-crowded arches most effectually and most safely relieved? and the cases I have brought forward in support of my view are sufficient, I think, to justify the course I am advocating.

I now proceed to consider the objections which may be urged against this practice, and the disadvantages connected with it.

(1.) Its apparent severity, and, in the eyes of sensitive persons, even cruelty.

(2.) Its apparent needlessness at the time of operation.

(3.) The slowness and self-operating character of its results.

(4.) Its occasional difficulty.

(1.) It must be admitted that the operation is, at the time, a painful one; but the teeth once successfully removed, the after-results are trivial. In the first case described in this paper, the child was quite well next day. In a case I operated on about ten days ago, the child went from the operating-room to the Polytechnic, and he told me he enjoyed himself very much. In this case I administered chloroform sufficiently to remove all pain during the operation. The worst account I ever heard of the bad effect of the operation was in the case of a little girl who remained nervous for three days after it. It is worthy of notice, however, that of four sisters, this is the only one with a perfectly regular set of teeth.

(2.) To ensure perfect success in the result of the operation, it is necessary to remove the first molars before the upper and under bicuspides are fully developed, or have articulated one with the other. I admit in some cases a perfect result will follow,

even when the first molars have been removed after the bicuspides have articulated, but the dentist can *never* guarantee the result to the parents, for the bicuspides will not always recede in such cases, wherefore it is better to remove the first molars while the bicuspides are developing themselves; by so doing, the irregularity is in a great measure anticipated. Parents, however, at this period are unable to see the necessity for the operation, and consequently object, in most cases, to its being performed unless they have perfect confidence in their dentist. It is only this week I have heard of an irregularity having established itself in a case where, had my advice been taken and the first molars removed, the parents would never have seen the irregularity. They now admit the correctness of my views, and the child is to be brought to me when next in town.

(3.) Many parents, owing to the slowness of the results, become fearful that the irregularity will not disappear without mechanical assistance. Once an arch, however, is equal in capacity to the number of teeth in it, and that those teeth are not fully developed in their positions, I have, from practical observation, every confidence in the power of nature to place, in time, the teeth in their normal positions. As I have already mentioned, the first molars once removed at the proper time, the assistance of mechanism is the *exception*, and not the *rule*.

(4.) In regard to the difficulty of the operation,

I have myself only met with one case of serious difficulty. It was the case of a little girl, on examination of whose teeth I found the right upper first molar without a crown, the posterior bicuspid developing itself in close proximity, so close that I saw at once the danger of interfering in the case, for I knew that if an irregularity were present in the fangs of the first molar, I must of *necessity* remove the bicuspid in my endeavour to dislodge them.

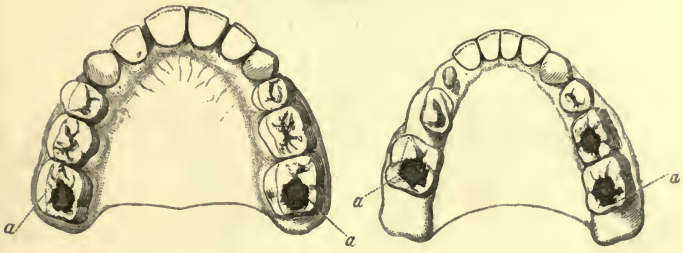
Unfortunately the molar proved to have two fangs, one broad and flat, the resistance to remove which was far greater than the resistance necessary to remove the bicuspid the last-named tooth was therefore necessarily sacrificed; but the casts at present in my possession prove the correctness of my interference. As soon as the arch in this case is complete by the development of the wisdom teeth, it is my intention to lay a cast of it before this Society, with a few remarks. I may mention that since my own case, I have seen a similar one in the son of one of our medical men. In this last case I fear, in addition to the loss of the bicuspid, there was too free use made of the elevator, for there is a very large gap between the first bicuspid and second molar, with an accompanying loss of the alveolus. The opposite molar I removed, and the result has been most perfect. I may here remark, that while an elevator of proper form and in careful hands is a most valuable instrument, if of improper form and in careless hands, it is about the most dan-

gerous that can be used, in consequence of its great power.

Fig. 7 represent the teeth of a young person, brother of the patient whose case is the third re-

SEVENTH CASE.

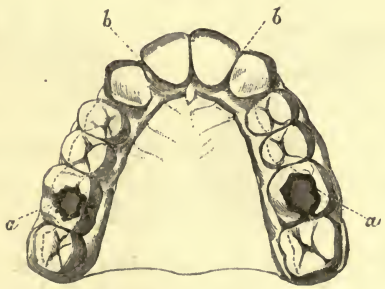
FIG. 7.



a a a a, Diseased molars, retained.

ferred to in this paper. On comparing the two upper arches, the advantage of removing the first molars will be apparent to every one. I may say

FIG. 8.

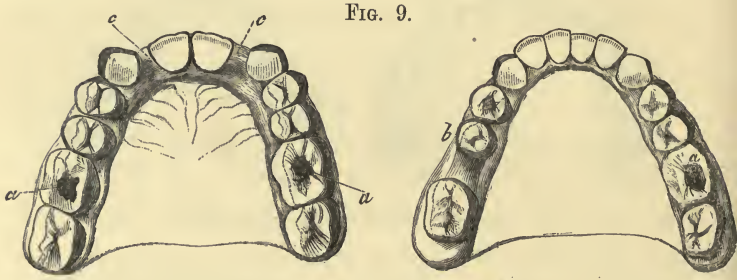


a a, Diseased molars, retained.
b b, Sound laterals, removed.
Left first molar removed in this case, at the age of fourteen, for toothache.

I proposed the removal of the first molars in this boy's case, but the father would not give his consent; now, when too late for a perfect result, consent is given.

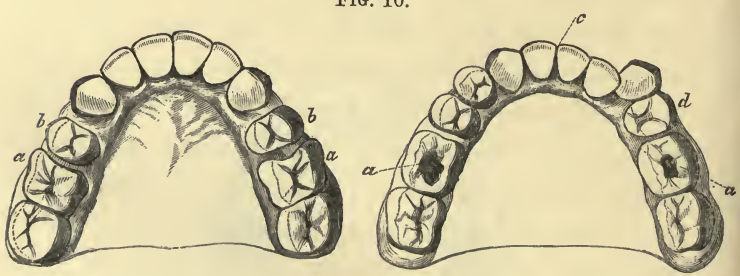
Figs. 8, 9, and 10, are those of young persons where sound anterior teeth have been removed in place of the diseased first molars.

Fig. 9.



a a a, Diseased molars, retained.
b, Diseased molar, removed at the age of thirteen for toothache.
c c, Laterals, removed.

Fig. 10.



a a a a, Diseased molars, retained.
b b, Sound bicuspides, removed.
c, Under incisor, removed.
d, Under bicuspid, removed.

A NEW OPERATING CHAIR.

On the advantages of being able readily to adjust the head of the patient to any position required by the Operator, and also on the means for effecting this.

Read April 6th, 1857.

By H. J. BARRETT, Esq., M.R.C.S.

The general importance of the subject will be readily admitted by every operator in dental surgery. Not only may the quiet endurance of the patient depend upon the ease with which he reclines during a long operation, but the success of the operator may be equally affected. All have occasionally experienced the great inconvenience of having to operate in the sick-room, where the straight-backed chair of the nurse or ordinary bedroom chair was called into requisition.

It is not, however, until we have to perform the more difficult and tedious operation of stopping the teeth in situations not readily arrived at, that we duly estimate the necessity for paying great attention to the position of our patient.

It may appear almost needless to describe the effect upon the health of the operator himself, when,

as not unusually occurs, he has to perform his task in a constrained attitude. The congested capillaries of the face and impeded functions of the body too plainly indicate the cause of these evils.

The position in which the patient should be placed, appears to be governed by several circumstances, namely, the height of the operator, the

height of the patient, the situation of the tooth to be operated on, and the direction of the light.

The operator who is six feet high will naturally experience immense inconvenience in using the chair suited to the dentist of five feet, and *vice versâ*.

An equal inconvenience must occur when the subject for operation is very tall or very short, and these difficulties will be by no means lessened when

the short patient requires the upper molar teeth to be stopped by the tall operator, whose chair is fixed at a very low level.

The first object to be gained, therefore, is to be enabled to place the head of the patient, whether he be tall or short, upon such a level as will best suit the height of the operator; unless this can be done,

the operator himself must make his own height and position conform to that of his patient; in other words, he must acquire the mode of balancing himself adroitly on the top of a footstool, or of bending gracefully on his knees, as the exigencies of the operation may require.

Contrivances for lessening these serious inconveniences are various. When the chair with a fixed back

and seat is used, the patient is adjusted by the aid of moveable cushions, and is requested to sit higher or lower in the chair, as may be required. Mechanical appliances for raising the seat and effecting other movements in the chair, have not hitherto met with very general approval in this country, partly on account of the intricate character of the machinery employed, which was difficult of application, and consequently became easily deranged; partly because the exterior of the chair usually exhibited a more formidable appearance than the ordinary reclining chair. The prejudice which exists in the mind against making any change in that which has been used successfully for many years has also had some weight.

In directing the attention of the meeting to the operating chair exhibited to-night, it is believed that the object desired by the operator, viz., that of being enabled readily to adjust the head of his patient in the best position for operating, has been accomplished.

The various movements in the chair are effected by the aid of the Archimedean screw and pinion-wheel, and can be used almost insensibly to the patient whilst sitting in the chair. The parts of the chair capable of being moved are, the seat, back, and head-piece.

The following are their movements:—

The *seat* may be moved
Upwards
and
Downwards.

The *back* may be moved
Forwards,
Backwards,
Upwards, and
Downwards.
The *headpiece* may be moved
Backwards, and
Forwards.

The combined movements of all or any two of the parts may also be enumerated among the effective adjustments. It is not proposed to give any minute description of the particular uses to which the various movements of the chair can be made subservient, believing that they will for the most part suggest themselves to those who may be desirous of adopting this or any similar principle of construction.

Of, first, the Seat-movement.—The seat (independent of the back) can be raised nine inches from the ordinary height of a chair by a few movements of the foot upon the pedal placed at the bottom of the chair. Thus, whether the patient be under four feet in height or above six feet, the head can be brought to the same level for operating. When the upper teeth are to be operated upon the head of the patient is required to be upon a higher level than when the lower teeth have to be treated. This change can be effected by the seat-movement.

Of the Second, or Back-movement.—By the backward or forward movement any required angle of inclination may be given, from the upright to a position almost horizontal with the seat. This is

effected by a few revolutions of a small handle placed at the back of the chair.

When operating upon lower incisor teeth, which incline inward, the upright back will afford great advantage over the inclined, by enabling the head to be placed in such a position as that the direct rays of light will fall on the posterior surfaces of these teeth. The extreme horizontal position will be favourable should the patient be overcome by faintness. Some operators have found the horizontal position desirable for stopping the posterior molars.

The upward and downward movements of the back of the chair serve to adjust its curve to that of the spine; by means of this movement also, in conjunction with that of the seat, we may raise the head to a much higher level than can be obtained in the ordinary operating chair, thus enabling the operator to stand or sit whilst operating. The back of the chair can be raised five inches, by means of a small handle placed behind and at the side of the chair.

Head-piece Movement.—Next to that of the seat, perhaps, this will be found most frequently called into requisition, owing to the numerous purposes to which it may be made subservient, and also to the facility with which it may be applied.

The movement is obtained by detaching with the pressure of the thumb a pin which secures the head-piece by entering a perforated segment plate; the head-piece can now be rotated freely, but upon

withdrawing pressure from the pin the head-piece again becomes fixed in any position required.

The centre of the shaft upon which the head-piece rests, being curved from the axes upon which it revolves, an eccentric motion is produced, by which an additional height of three inches can be instantly given, to suit the tall patient, without the necessity for raising the back of the chair or lowering the seat.

When the posterior surface of the upper molars requires examination, the head of the patient may be brought to recline at almost a right angle with the body, thus enabling the light to fall directly upon the part. The head being in this position, the saliva will gravitate towards the back of the mouth, and the operation will consequently be less impeded.

In extracting a tooth from the superior maxilla the advantage of this position of the head is obvious, the operator being enabled to economize his force by applying what he has to the greatest advantage, at the same time the eye is enabled with extreme facility to follow the movements of the instrument.

In submitting this plan of an operating chair to the Society, I am conscious that it will not meet the requirements of every operator; each one necessarily has his own ideas respecting the position in which the patient should be placed, but the great assistance which this chair has afforded me, by lessening the fatigue and inconvenience experienced

whilst using the fixed-back operating chair, induces me to hope that others may derive similar advantages.

I would also avail myself of this opportunity to introduce to the Society the name of Mr. Betjeman, of No. 28, Oxford-street, to whose persevering industry I am mainly indebted for what is exhibited to you this evening. Every gentleman present will justly appreciate the services of that skilful artisan, who, possessing an unusual amount of mechanical ingenuity, has also acquired a great facility for embodying any ideas which may be given to him.

CLEFT PALATE: ITS SURGICAL AND MECHANICAL TREATMENT.

Read May 4th, 1857.

By EDWIN SERCOMBE, M.R.C.S.,
FELLOW OF THE ROYAL MEDICAL AND CHIRURGICAL SOCIETY OF LONDON, ETC. ETC.

There are few lesions of the human body attended with more inconvenience to the individual concerned than Cleft Palate, whether we consider it as affecting the utterance of articulate sounds, or whether from the unpleasant suspicions as to its cause which may arise in the minds of those with whom the unfortunate individual affected with it may occasionally be brought into contact. There are few lesions which have more successfully baffled the skill of the surgeon: there are few which more amply reward him when effectually relieved.

Cleft palate must, from the nature of things, have affected the human subject through all time; it must be coequal in antiquity with the other ills to which flesh is heir; but we search in vain among the oldest works on surgery for any directions for its surgical treatment.

Frequent reference is made to it by the older authors, but the only remedy suggested is an

obliteration of the aperture by some foreign body, and this, we may infer from the plates and descriptions on record, must have been most imperfectly accomplished.

Cleft palate may be either congenital or accidental, and in either case it may be either simple or compound; that is, it may be confined to either the hard or soft palate, or it may extend through both. It may vary in degree from the mere bifurcation of the uvula, or an opening in the hard palate no larger than the smallest probe-point, to the entire absence of the velum, the palatine processes of the palate and maxillary bones, and the intermaxillary bones. A specimen of such a case is before the Society to-night.

Before proceeding further, it may be well to state the order in which the subject will be treated in this paper.

I propose to commence by tracing the history of the surgical treatment of this lesion, concluding it with an account of the mode of operating at the present day; then the history of the mechanical treatment, concluding it with a description of the form of obturator I am in the habit of employing; then will follow some remarks on the cases supposed most suitable for the one or the other mode of treatment, with reflections on the advantages and disadvantages of the two methods of treatment.

It is a light task to trace the history of the surgical treatment of cleft palate. The first opera-

tion appears to have been performed about the year 1760, by a French dentist, a M. Le Mounier. "A child had the palate cleft from the velum to the incision teeth. M. Le Mounier attempted, with success, to reunite the two edges of the cleft, first making several points of suture to hold them together, and then refreshing them with a cutting instrument."

Velpeau mentions that "in 1813 experiments upon the dead body were made by Colombe, and that he was desirous of repeating them upon a patient in 1815, who, however, refused."

From this date the operation was frequently performed, both on the Continent and in America, by men with whose names we must all be familiar—Graëfe, Etel, Roux, Dieffenbach, Doniges, Velpeau, Hosack, Muttee, Warren, and many others.

In the year 1821 Mr. Alcock performed staphyloraphy for the first time in England. But the operation was attended with such difficulty, and the results were so uncertain, that even amongst the best surgeons it was generally believed that but few cases were suitable for it. In Syme's "Principles of Surgery," published in 1832, we read, "Fissure of the soft palate may be united, in favourable cases, by an operation similar to that for harelip, but which is exceedingly difficult of execution, owing to the situation of the parts, &c."

Liston, in his "Operative Surgery," published 1840, says—"The operation should not be com-

menced before the patient has arrived at years of discretion, so that he may afford every facility for its accomplishment. An attempt may now be made to close the fissure by adhesion of its margins. But it is only in very favourable instances that this velo-synthesis should be attempted."

Fergusson, in 1844, presented a paper to the Medico-Chirurgical Society on Cleft Palate and on Staphyloraphy, in which he pointed out an improved mode of performing the operation. He says—"Up to a recent period, the results have been so unsatisfactory, that I have had little confidence in recommending the operation." Up to this period the operation had been performed very much in the same way by all surgeons, slight differences of opinion as to whether the sutures should be carried through the velum first, and then the edges pared, or whether the edges should be pared first, and then the sutures passed; whether the edges should be pared with a knife or scissors, existed; but with the exception of these, or equally unimportant differences, the operation was the same as performed by all men. Thus, from 1760 to 1840, little or no real advance had been made in the operation for fissure of the soft palate.

Liston, with his skill as an operator, pursued, with very little modification, the same plan as that devised by Mounier, the French dentist, nearly a century before.

Up to this date no one had ever attempted to

operate upon fissure of the hard palate.* Syme writes, in 1832—"Split palate does not admit of any remedy for the division of the hard part, except the closure of the communication between the nose and the mouth by a piece of silver, enamel, or other substance, so fitted as to remain in it without shifting." Liston, in his "Operative Surgery," published in 1840, appeared to consider it so entirely out of the province of the surgeon, that he did not even refer to it; his remarks on split palate being entirely confined to fissure of the velum pendulum palati.

Fergusson, in 1844, says—"Until a recent date, the cleft in the hard palate has been deemed beyond the reach of surgical skill, but Dr. Mason Warren, of Boston, has recently, by a proceeding strictly surgical, closed the fissure here as well as in the soft parts. I have resorted to the operation in several instances, but without success. The process is exceedingly difficult."

The history of the surgical treatment of the hard palate dates from this period. Since Dr. Warren's paper, which appeared in the "New England Journal" for 1843, many surgeons in this country, as well as on the Continent and in America, have performed the operation with success.

I will now proceed to describe the operation on the soft palate, called staphyloraphy, as performed

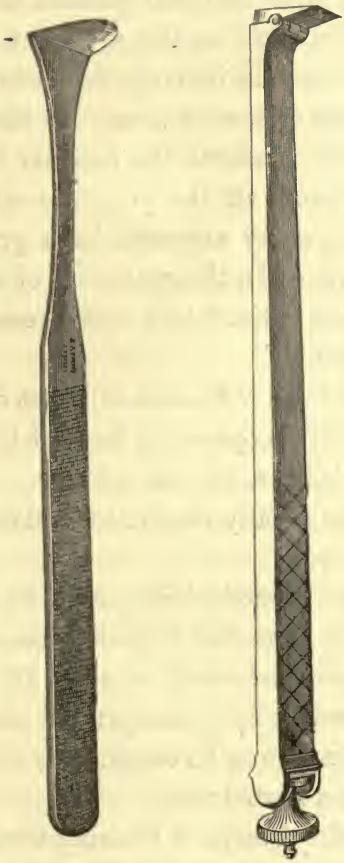
* Unless Mounier's operation extended through the hard palate, which appears somewhat doubtful.

at the present day. The first step is the improvement recommended by Mr. Fergusson, the division of the levatores palati, and the palato-pharyngei muscles. One great obstacle to the success of this operation, previous to Mr. Fergusson's paper, was the violent muscular action which the irritation of the operation appeared to provoke; this Mr. F. was induced, after dissecting a cleft palate, to attribute to the combined action of the before-mentioned muscles, and therefore he divided them rather than, as had hitherto been the fashion, inflict sundry empirical gashes upon the soft palate with the object of relieving tension, and paralysing the muscular action of the part. The result of this more reasonable practice has been to make the operation more frequently successful. After this step has been taken, the edges of the fissure should be pared with a probe-pointed bistoury, and then brought together and retained in apposition by means of two or three interrupted sutures. All motion of the parts should be guarded against as much as possible. Fluid food should alone be taken for the first forty-eight hours, and of this but sparingly. The stitches should be carefully cut out on the second or third day.

The surgical treatment of the hard palate is, as has been already said, of very recent date. Dr. Mason Warren must be considered as the originator of this operation, which consists in dissecting the soft tissues from the bones of the palate by means

of knives of this shape (Fig. 1), so as to form two flaps, which falling downwards towards the tongue,

Fig. 1.*



their edges shall meet in the mesial line; these edges are then to be pared, so as to present clean cut raw

* Copied from an illustration given by Mr. Pollock in his paper on Congenital Deficiency of the Palate, &c., published in Vol. xxxix. of the "Medico-Chirurgical Transactions."

surfaces, which are to be kept in contact by means of the interrupted suture, until union has taken place. In those cases where the fissure extends through both hard and soft palates, the operation must be divided into two, three, or even more parts, as, for several reasons, it is injudicious to attempt the union of a large surface at once. In these cases the operator generally selects the anterior extremity to commence upon. Of the propriety of performing this operation many surgeons have grave doubts. Fergusson says—"In the generality of such cases, I believe that the patient had better remain satisfied with an obturator."

Erichsen, in his "Science and Art of Surgery," 1853, says—"This operation has not been hitherto successful, I believe, in this country. Fissures of the hard palate usually require to be closed by means of an obturator."

Miller, in his "Practical Surgery," 1852, says—"If the aperture be large, the deficiency can only be supplied by mechanical contrivance. If, however, it resembles merely a fistulous opening, closures of the mucous membrane may be obtained by the occasional application of a heated wire."

The late Mr. Avery, of Charing Cross Hospital, appears to have been the first English surgeon who attained any encouraging measure of success in this operation. Mr. Pollock records, in a paper published in the last year's volume of the Medico-Chirurgical Society's Transactions, two cases successfully treated

by this gentleman. Mr. Pollock enjoyed the benefit of Mr. Avery's friendship, and assisted him in some of his operations on the hard palate, and to this circumstance Mr. Pollock attributes in some measure his own success in this operation, which appears to have exceeded that of others. But Mr. Pollock attributes some measure of his success to the instruments he uses, which have been made according to his own directions. On this point he remarks, "The first consideration must be paid to the instruments which are necessary in these operations; a consideration of the utmost importance; as much so, indeed, as any other point in connexion with the treatment of these cases. The broader cutting edge should be chiefly employed, in preference to the narrower blades, as it secures greater expedition with less chance of bruising the soft parts. I prefer throughout the detaching process, the broadest edged blade that can be conveniently used. I have had several new knives constructed." In this paper Mr. Pollock records two cases of his own which were successful, and since that paper was read, Mr. Pollock has reported in the Journals other cases in which he has operated successfully.

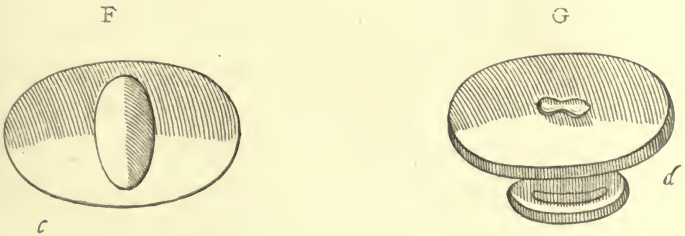
I now proceed to trace the history of the mechanical treatment of cleft palate. Since the first surgical attempt to remedy this lesion dates only as far back as 1760, we may expect to find the help of the mechanic invoked to overcome the most disagreeable and inconvenient effects of cleft palate,

and accordingly in all the oldest works on surgery I have had the time to examine, when reference is made to this condition of the mouth, obturators are spoken of as the only remedy. These obturators are figured in several of the works, some of which, for the further elucidation of this subject, I have copied.

The oldest surgical work from which I shall quote for this purpose, is the one of James Guillemeau. A translation of it into English, which I have the good fortune to possess, was imprinted, 1598. In it are figured "two goulden roofes of the mouth, which are as thin as a French crown. They are composed to retain therewith the breath, from the roofe of the mouth, therebye to evite the speaking thro' the nose." (Plate VIII. A. B.) He remarks, "There are some which cannot very well suffice themselves with this plate, by reason that the gouldsmith cannot soe conveniently make the same, that it equally of all sides doe touch the palate of the mouth, so that instead therefore they use a tent made of lint or sponge, to the which intente there are divers which are provided of them, because that if the one fell out they incontinently have another in readiness and preparation to put therein, because otherwise they should speak thro' the nose."

The next work is that of Ambrose Paré: the translation, from which I have derived the following, was printed in London, in 1665, nearly a century later than the last. In the chapter on filling the

Jaques Guillemeau, 1598.



Ambrose Paré, 1665

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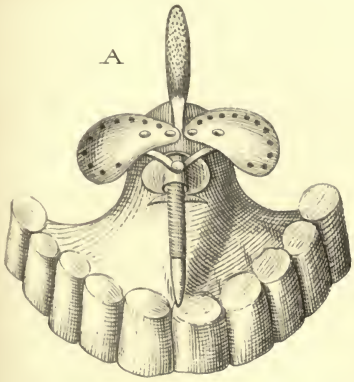
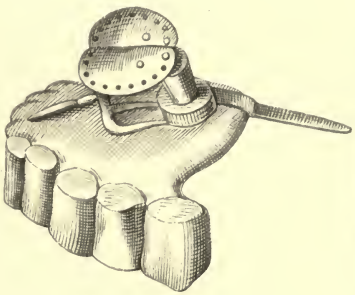
hollowness of the palate, he says: "Many times it happeneth that a portion or part of the bone of the palate being broken with the shot of a gun, or corroded by the virulency of the Lues Venerea, falls away, which makes the patients to whom this happeneth that they cannot pronounce their words distinctly, but obscurely and snuffling; therefore, I have thought it a thing worthy the labour to show how it may be helped by art. It must be done by filling the cavity of the palate with a plate of silver or gold, a little bigger than the cavity itself. (Plate VIII., Figs. C, D, E.) But it must be as thick as a French crown, and made like unto a dish in figure, and on the upper side which shall be towards the brain, a little sponge must be fastened, which, when it is moistened with the moisture distilling from the brain, will become more swollen and puffed up, so that it will fill the concavity of the palate, that the artificial palate cannot fall down but stand fast and firm, as if it stood of itself. This is the true figure of those instruments, whose certain use I have seen not by once or twice, but by manifold trials in the battles fought beyond the Alps." This author figures a second plate, which is retained in its position by a button, oblong in shape (Fig. F, *c*), which is attached to one extremity of a screw, the other extremity of which appears on the concave surface of the dish-shaped plate (Fig. G, *d*). The long diameter of the button is passed through the long diameter of the fissure, and then by turning the head of the screw

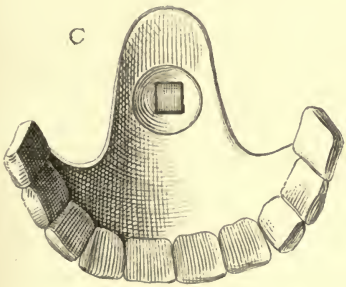
which appears below with a pair of forceps, the long diameter of the button is made to correspond with the short diameter of the fissure, and so the plate is kept up.

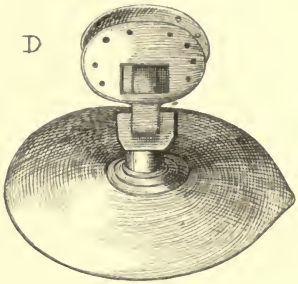
I will now bring you a century later, and quote from the celebrated work of Heister, published 1756. This eminent surgeon, when speaking on the subject, says: "When the palate is perforated into the nose, your remedy is to close or stop the perforation as exactly as possible by art, with a proper instrument, since you cannot procure the bone and flesh to grow so as to fill up the space. The patient must, therefore, have a plate of silver or gold adapted to the perforation, and, furnished with a handle or small tube, which being armed at the top with a sponge, he may thereby exactly close the perforation (Plate IX., Figs. G, H). The sponge being inserted into the perforation, prevents the plate from falling down from the palate, and by that means renders the patient able to speak and swallow as if his palate was entire."

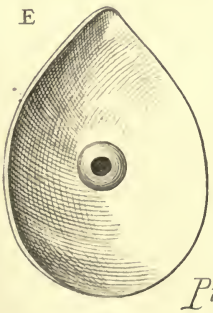
I will not trouble you this evening with the opinions of the numerous writers on surgery who have referred to this lesion, but will content myself with one from each century. From those just read it will be seen that up to this date the obturator was very ill-adapted for the purpose for which it was made, and we must give our ancestors credit for being easily satisfied with the provisions of art for their relief.

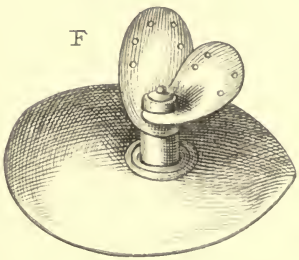












Pierre Fauchard, 1728.

Laurence Heister, 1757.

It is evident that the instruments hitherto described were not only wrong in principle—as (with the exception of the one described by Paré as kept in by an oblong button) they were kept in place by the pressure of sponge on all sides of the fissure, which we know must have ended in aggravating the evil it was intended to overcome—but their adaptation to the roof of the mouth must have been extremely imperfect, as they appear to have been made by a goldsmith without a model of the mouth, and hence the complaint of Guillemeau:—"There are some which cannot very well suffice themselves with this plate, by reason that the gouldsmith cannot soe conveniently make the same, that it equally of all sides doe touch the palate." But we now arrive at a period when a great improvement was effected in these instruments (Plate IX., Figs. A, B, C, D, E, F). M. Pierre Fouchard, in his treatise, 1786, entitled, "Le Chirurgeon-Dentiste," describes four or five different obturators; and the great improvement in their construction over all preceding ones consisted in the mode which he employed for keeping them in their place. Instead of filling up the fissure with sponge, which when moistened would swell and exert pressure on the margins of the fissure, he made a concavo-convex plate to cover the fissure: to the centre of the convex surface he attached a tube, through which passed a screw, to the superior extremity of which were attached two wings, the inferior extre-

mity terminated in the concave surface of the plate in a small head. The wings were folded together and passed through the fissure, and when the artificial palate was in its place, the screw-head was turned, and the wings were spread across the fissure, and rested on the nasal surface of the roof of the antrum of Highmore. These wings had each a small piece of sponge attached to their under surface, which readily adapted itself to the surface on which it rested, and thus the pressure of the wings on the tender mucous membrane could be tolerated. As Paré's button-plate was constructed on the same principle, but without the sponge, I can only draw the conclusion that the reason it was not generally adopted was the absence of a soft substance intervening between the button and the mucous membrane on which it rested, causing thereby considerable pain and even ulceration, as the weight of the plate must have been sustained by one or two points only of the button resting on the mucous membrane of the roof of the antrum. By this plan of Fouchard's, pressure against the margins of the fissure was entirely avoided. This I cannot but consider an essential improvement in the principle of construction.

The next great change was effected by Boudet; he objected to those instruments which were passed through the aperture, because they were likely to impede the natural filling up of the cavity, and therefore he conceived the plan which is now

generally adopted, of securing the plate in its position by means of processes given off from the plate, and carried round the teeth. These processes we call "collars."

M. De la Barre describes a very ingenious apparatus contrived by him to supply, for a special case, the whole of the hard and soft palate, but as it was designed for an exceptional case, it is unnecessary to repeat his description of it here.

The first Englishman who distinguished himself as a maker of obturators was a Mr. Snell, a surgeon of London, who published in the year 1828 a most interesting book on the subject, which I recommend to any who may be interested in this matter, as well worthy their attention.

This gentleman appears to have been singularly successful in his attempts to remedy this lesion. I find that he first obtained a correct model of the mouth upon which to work up the plate. I pause to say that Mr. Snell is the first author who pointedly speaks of commencing his treatment by obtaining a *correct* model of the defective parts. Upon the plate so worked up, he fitted, when the vomer was deficient, a piece of ivory to the superior or convex surface, which was filed up to a shape which represented this bone; when the soft palate was fissured, he attached to the posterior margin of the gold plate a curtain of india-rubber, which was made at once both stiff and flexible by a gold spring attached to it. The construction of such an

apparatus could only be accomplished by the man who first designed it, and hence we find that a few years later the then best known author on dental surgery, I mean Fox, says,—"Fissure of the hard palate is generally easily remedied, but where there is a loss of the velum pendulum palati the successful use of any substitute, however ingeniously contrived, is very doubtful."

During the year 1845, four articles appeared in the "Lancet," by Mr. C. H. Stearn, a surgeon of London, on "Congenital Deficiency of the Palate." In the course of these he described a most ingenious apparatus which he had contrived to remedy a congenital fissure of the soft palate in the person of a near relative of his own. He first fitted a gold plate to the roof of the mouth: to the upper and posterior margin of this plate a flat spiral spring was attached, which could vibrate backwards and forwards; to the free extremity of this spring an artificial flexible velum was attached. This velum, made of india-rubber, consisted of a body and two wings. The body, which consisted of three pieces overlapping each other, was made the shape and size of the fissure when the parts were at rest; and the wings, each composed of a single piece, projecting forwards and outwards from each lateral margin of the body, were made to conform to the shape of the columns or fleshy sides of the fissure, and to rest upon their anterior surfaces. In like manner, from each lateral margin of

the body there projected obliquely backwards and outwards a flange, which rested on the posterior surface of the sides of the fissure. In this way the wing and the flange of the same side together formed a groove fitted to receive the movable sides of the fissure, and, therefore, when the fleshy columns of both sides tended to approximate, as in the act of deglutition, the three parts of the body being pressed upon laterally, glided one over the other, and thus the extent of the surface of the body was diminished. This apparatus succeeded in perfectly restoring to the gentleman for whom it was made, the power of distinct articulation, and thus the fact was at once established that congenital deficiency of both the hard and soft palate could be effectually relieved by mechanical means. It now only remained to simplify the apparatus, to render the mechanical treatment of this lesion successful, even in the hands of men less ingenious than Mr. Stearn. This, I may venture to hope, I have accomplished, though I knew nothing at the time, nor, indeed, until I commenced writing this paper, of Mr. Stearn's invention. It must be evident that when such a velum as the one I have just described required to be renewed, it would have to be renewed by the original designer of it. This would be a grave objection, as from the material of which it was made, it would be required frequently; on the other hand, the velum to which I now draw your attention, can be renewed by the wearer, however

deficient in mechanical ingenuity, with little trouble and in a short time. The first velum must of course be fitted by the dentist, as it requires to be made with a nicety which only a mechanic could attain; but this once made, copies can be produced with certainty and ease.

It would be a useless waste of your time to describe the various patterns I tried before I arrived at the very simple one I now exhibit. It will be enough to say that this pattern has been in use for about two years; during this time it has never been out of order, which from its simplicity you will readily believe; that it has been renewed several times by the wearer—in fact, about every four months—and his articulation, according to a report which reached me only last week, is more and more easy and natural.

The principle laid down by Mr. Stearn as necessary for the construction of a useful velum, I recognised and acted upon, without, as I have already said, knowing of the existence of his paper; had I known of it, it is more than likely that I should have contented myself with endeavouring to imitate his very ingenious contrivance, but, ignorant of his plan, I was free to work out my own design.

My velum is made of two pieces of vulcanized india-rubber, the larger piece extremely thin, the smaller much thicker. The shape of both is represented in Plates XI. and XII., Figs. B, B. The dotted line on both shows where they are attached by sewing to the posterior margin

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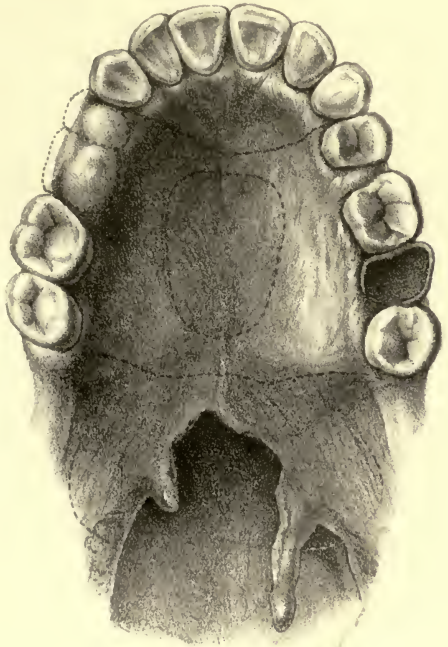

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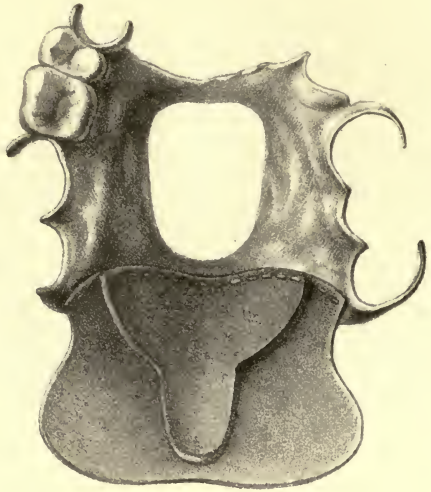

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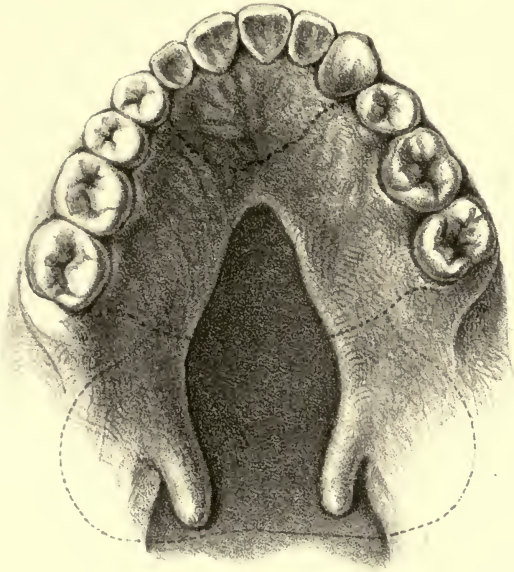

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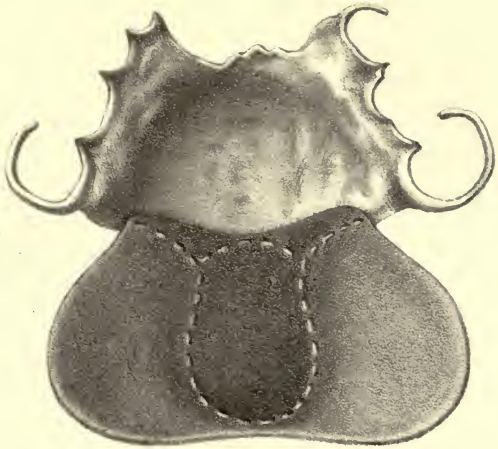

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of the gold plate, which has a single line of holes punched in it for this purpose. The exact size of the larger piece will vary in each case, for it is necessary that its free convex margin should not touch the back of the pharynx when the sides of the fissure approximate in the act of deglutition; as, however soft the material of which it is formed may be, a raw and painful spot will quickly be the result; but at the same time it must be close to the back of the pharynx, or otherwise the articulation will be more or less indistinct, as the sound will not be retained in the cavity of the mouth long enough to undergo the coining-like process of articulation, but will escape into the cavity of the nose, and produce more or less of the characteristic nasal sound of this lesion. This piece should also be extremely thin, as it is absolutely necessary that it should adapt itself with great readiness and completeness to the ever-varying sides of the fissure; but a piece of such tenuity as is necessary to secure this vital point, weighted with mucus, would quickly droop, but for the support which is given to it by the smaller and stouter piece which lies immediately underneath it.

These two pieces of sheet rubber sewn to the posterior margin of the gold plate,—the thinner to its upper surface, and the thicker to its lower,—have been found in more than one instance to restore to the person using them a distinct articulation.

The fact appears therefore established, that not

only can complete relief be afforded, in fissure of the soft palate, by mechanical means, but that the apparatus necessary is simple and easily constructed.

The mechanical treatment of fissure of the hard palate requires but a word from me. The artificial palate should be constructed of a durable material, so as to save the wearer the inconvenience and expense of frequent renewals; it should be fitted with absolute accuracy to the surrounding parts, and when in its place should be retained there with firmness. But to secure this necessary point, the ingenuity of the dentist will often have to be taxed, as the ordinary method of securing plates by collars cannot always be employed.

A model of such a case is on the table to-night. (Plate X., Fig. A.) In that case, while a sufficient hold could be obtained for the anterior portion of the plate by collars round the canine on one side, and the bicuspid on the other, none could be obtained for the posterior extremity of the plate, in consequence of the molar teeth being too short to offer a neck around which the collar could be carried. The plan employed was to carry a process of plate (Fig. C) from the nasal surface of the obturator to rest upon the nasal surface of the roof of the antrum, of which a correct model could be easily obtained, as the turbinated bones and the vomer had exfoliated. This was soldered to the obturator, and it was found that by carrying the apparatus in edgeways, this process of plate could be got into

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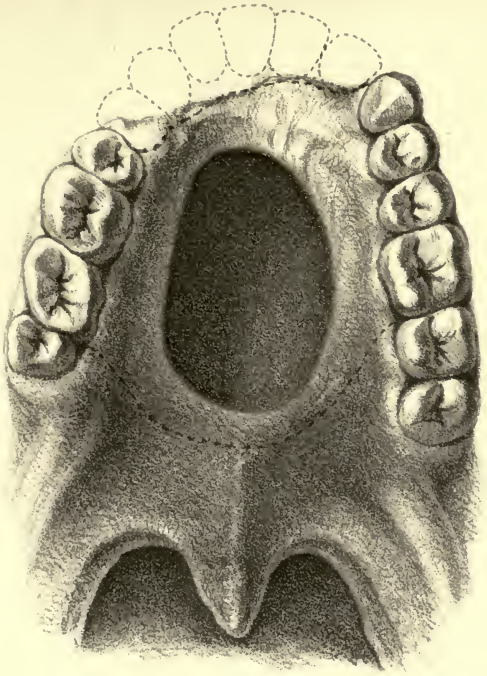

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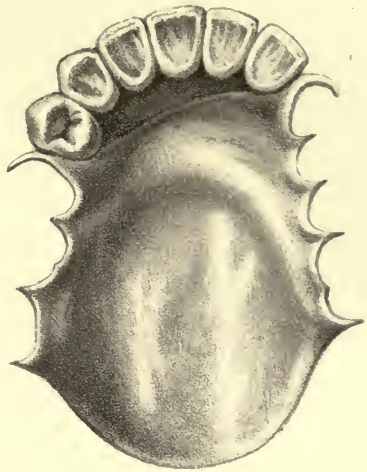

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its intended place. This, with the assistance of the collars in the front, was found sufficient to hold the plate firmly in its place.

A natural conclusion to this paper is the inquiry, Is either or both modes of treatment applicable to all classes of cases? if not, what cases are inappropriate for the one or the other mode, and what are the respective advantages and disadvantages of the two plans?

From what was said when speaking of the surgical treatment of fissured palate, it appears that all surgeons are agreed that cases of extensive fissure of either the hard or soft palate, or of both, are beyond their power. These then, without dispute, fall to the care of the dentist. Of the remainder, it may be said, all surgeons are now agreed that a successful result may be anticipated in those cases where the fissure affects only the soft palate, provided certain conditions of the patient, to be enumerated immediately, exist.

In those cases where the fissure affects the hard palate alone, or implicates both hard and soft, surgical treatment has failed in a very large proportion of cases, in the hands of most English surgeons; though some few have published several cases in which with them the operation has succeeded.*

Among the conditions upon which success

* *Vide* "Medico-Chirurgical Trans.," Vol. xxxix., and the Medical Journals, especially of last year.

depends, as given by the most recent writer on the subject, are: A *perfect* state of health of the patient, without which the operation must be postponed or deferred altogether. Union by first intention *must* take place, otherwise the operation is as abortive as if it had never been attempted. Careful dissection of the soft parts, without bruising or tearing of the flaps. Ample flaps to enable their edges to meet readily without the traction of the sutures. Repeated operations rather than any extensive separation of the soft tissues at one proceeding.

As to the first condition, the importance of which cannot be too strongly insisted upon, it is, unfortunately, but too well known to all operating surgeons, that no one can with unerring certainty be pronounced to be in a state of health to render an operation safe.

It was but a short time back that a young gentleman, apparently in vigorous health, came to town to be operated upon for varicocele, not because it troubled him much, but simply, as he was about to get married, to rid himself of the inconvenience. The veins were tied, but within a week the patient was dead. It is scarcely a month since a healthy-looking country lass was admitted into St. George's to have a goitre cured; a single thread of silk was carried through and left in it as a seton, but in three days she was dead. It was subsequently ascertained that she had diseased kidneys.

Another risk of a fatal termination to this opera-

tion I conceive to arise from the possibility of diffuse cellular inflammation of the soft palate extending downwards. Sometimes this kind of inflammation occurs idiopathically, and terminates in death; may we not reasonably expect that it might follow incisions in the palate?

One case of a fatal termination to the operation for cleft palate is recorded in the *post-mortem* book of St. George's, where the patient, a girl of fifteen, died from erysipelas of the head and neck, following upon the operation. Whether the *post-mortem* books of other hospitals will furnish other cases of a fatal result, I have had neither the opportunity nor time to ascertain.

If such fatal results sometimes so quickly follow trivial operations, when performed on apparently healthy subjects, is not the operation on cleft palate, which is obnoxious to the same, invested with an importance which its mere performance, difficult though it be, would fail to give it? Can there be any wonder that persons are often to be found unwilling to incur this risk when the lesion can be so successfully remedied by treatment which is altogether free from it?

Again, there are other of the necessary conditions for a successful termination which may be absent, —union may not take place by first intention. With the greatest care the flaps may still be so much bruised, that instead of retaining their vitality they may slough away. It may be impossible to get

ample flaps, for the simple reason that the soft tissues may be too thin to allow of their being made.

As these necessary conditions cannot always be fulfilled, surgical treatment cannot always be employed.

But before bringing these remarks to a close, I must mention two or three of the objections which may be urged on the one hand against the surgical treatment of this lesion, and what may be said on the other hand in its favour.

In one instance which came under my own observation, the velum was so contracted by the healing process, that instead of being a curtain of great mobility, it was a stiff, and to a great extent, a useless appendage to the hard palate, and, as I have been informed by one or two gentlemen of some experience that they have occasionally seen the same condition follow as a result of the operation, I infer that it cannot be a very rare one. In the case which I examined, the voice remained *very* defective, and, from the condition of the parts, the patient was beyond the reach of successful mechanical treatment.

The pain of the operation may be urged by some as an objection, for it is very great; chloroform is inadmissible, as the surgeon requires all the assistance the patient can render him during its performance.

The uncertainty as to the result of the operation

may be urged as another objection. Beyond the very serious results already referred to, the operation may fail from extensive sloughing. Up to the present time, the number of successful cases recorded is small. What proportion they bear to the unsuccessful I am quite unable to learn, as of these there is no very accurate account kept. I have examined the surgical registers of three of the London hospitals, and if I may judge from these, I fear it is very small.

Finally, the necessity of repeated operations where the fissure is extensive, at each of which the above enumerated and other conditions necessary to success must exist, may be urged as another objection to the surgical treatment.

But, on the other hand, it may with truth be said that when the surgical treatment is successful, the patient is saved all further inconvenience and expense; that a natural palate must always be more useful and comfortable than an artificial one; and that, should it fail through *sloughing* of the soft parts, the patient is not in a worse condition for mechanical treatment than before.

All that is to be said for and against the mechanical treatment of cleft palate may be summed up in one word, viz., that *all* classes of cases may and often have been successfully relieved by it; the cases most difficult to the surgeon—fissures of the hard palate—are the easiest to the dentist; and when the fissure involves the velum alone, or the hard and

soft palates together, still mechanical treatment may, as has been now shown, be successfully employed. But, should it fail, it leaves the patient in no worse a state than it found him. It demands no endurance of pain, or sacrifice of time, and finally, it places him in no risk of his life.

WHAT IS THE CAUSE OF THE TEETH BEING SO MUCH MORE LIABLE TO DISEASE AND EARLY DESTRUCTION THAN OTHER ORGANS OF THE BODY?

Read June 1st, 1857.

By WILLIAM ROBERTSON, Esq.,

BIRMINGHAM.

We are constantly asked the question, "What is the cause of the teeth being so much more liable to disease and early destruction than any of the other organs of the body?"

Now, that bones are highly organized and liable to inflammation, and that they occasionally become carious, are well-known facts; but it will be readily admitted that decay in bones is of much rarer occurrence than in the teeth; for where it occurs once in the former, it takes place a million of times in the latter; and yet the destruction of both has been attributed to the same cause.

That the teeth are liable to *early* destruction is also a well-known fact, for in many instances we find that as soon as a tooth appears above the gums, an attack is made upon it, and in a few short years its destruction is accomplished Take, as an example, the following case, which is one of common occurrence. Not long since, a gentleman consulted me

in consequence of the severe suffering of his child, only nine years of age. His statement was, that he had narrowly watched the progress of his daughter's teeth; that the four molar teeth, two of which occasioned the pain, only made their appearance two years before, and that during that short period they were so broken down by decay as to occasion the most acute suffering. He further expressed his belief that this destruction of his child's teeth could not have arisen from an unhealthy state of the constitution (as the public are sometimes led to suppose) inasmuch as she had enjoyed excellent health from her infancy to the present time.

Cases of this kind frequently come before us, and we are often obliged to remove one or more of the permanent molar teeth soon after they have appeared. From my own observation during a practice of many years, I feel convinced that more teeth are lost, or permanently injured, before the age of twenty than during the after periods of life. It is true, that the durability of the teeth greatly depends upon a healthy state of the constitution during that period when they are being formed; but after they have been formed, and have made their appearance above the gums, the mischief that subsequently befals them is not attributable to any unfavourable change that the constitution is liable to undergo; the evil arises from another cause.

The *great error* into which some of our popular writers upon the diseases of the teeth have fallen,

and from which many other mistakes have originated, is their having overlooked the peculiarity of the structure and organization of these organs. They have assumed them to be similarly constituted to the other parts of the body, and have therefore naturally enough concluded that the exciting cause of disease in the one case must be the same as in the other. Hence the public have been led to believe that decay of the teeth is the result of inflammatory action, originating in the internal structure of the tooth, either in its membrane or in its bony substance, and consequently that the commencement of decay must necessarily be attended with pain: and according to this doctrine so it would, inflammation being the exciting cause, and decay the result. The patient is therefore induced to believe, that in the absence of pain his teeth *must* be in a sound and healthy condition; they thus become neglected, and the dentist is scarcely ever consulted before pain has been experienced, and *when* consulted it is for the same object for which the physician or surgeon is consulted, namely, that the patient may be relieved from pain. It is true, that the physician's and surgeon's object is to *cure* disease; that of the dentist is, or rather ought to be, to *prevent* it; but so long as the true nature of the cause of the teeth's destruction is misunderstood, an application to the dentist will not, in the majority of instances, be made until pain compels the patient's attention to the subject, and *then* it will be found that so far as

the painful tooth is concerned, the mischief has become irremediable, and the only resource left will be its removal.

The parts with which the medical man has to deal are highly organized, and possess the power of restoration; but it is *not* so with the teeth; in them, as we shall presently show, there is no power of restoration; if they are to be preserved, disease must be prevented. For when the membrane of a tooth has been laid open by the destruction of a portion of the enamel and bone which surround it, it *continues* exposed, the constitution having no power of restoring or repairing the breach which caries has made; and any attempt to stop up the cavity by artificial means would only irritate the already inflamed membrane, and thus increase the pain.

The dentist is not the only individual who ought to have a correct knowledge of the cause of the destruction of the teeth: it is equally necessary that the patient should be aware of the insidious nature of the destructive agent, otherwise he will fail to apply for assistance until it is too late. I am well aware of the difficulty there is in persuading a person to avoid an evil which he has never experienced; and particularly so if the mind has been impressed with the mistaken idea that inflammation is the exciting cause of decay; for under this impression he naturally concludes that because there is no pain, there is no disease, and that it will be

time enough to apply for advice when the pain begins.

We find this to be the system generally adopted, and that most of our patients gain their experience by the loss of several teeth before they have recourse to the necessary means for the preservation of those that are left. And I repeat, that this false security arises from a prevailing prejudice that, as in the other organs of the body, so in the teeth, disease cannot commence without pain. This impression is so generally true with respect to the diseases of most of the internal organs, whose functions, being immediately necessary to health and life, cannot be deranged without uneasiness and suffering; and also to most of the external parts, which, being endued with extreme sensibility, experience pain from the slightest and most superficial injury; that it has also become a received principle with respect to the diseases of the *teeth*. But such persons are either ignorant of the fact, or they do not consider it, that the enamel of a tooth is an inorganic substance, and perfectly insensible, and that the bony structure beneath is also so void of feeling, that the destruction of these parts is effected without pain or suffering. And further, they are so universally led to believe that decay originates in the internal structure of the tooth, and that the exciting cause operates by inducing some internal morbid process, commencing with inflammation of the membrane, or the bony substance of the organ,

that they have never suspected the true cause to be a chemical agent acting upon the external surface—*that* wall of enamel and bone which surrounds and protects the vital part of the tooth.

Now, if for one moment we look at the mode in which the enamel and bone of a tooth are formed, and compare the growth of a tooth with that of other bones, we shall find no analogy existing between them. On the contrary, we *shall* find a striking resemblance between the growth of the enamel and bone of a tooth, and that of *inorganic* bodies; both of which begin with a nucleus, and become enlarged by a deposition of layers upon their surface; and also a striking resemblance to each other in the manner of their destruction.

Examine the rudiments of a young bone, and what do we see?—vessels entering on all sides, and in the centre a small bit of bone, of a loose and spongy texture, which can be made quite red by injection. We can trace the hardening through every intermediate stage to that of a perfect bone, the vessels of which, even in its most compact state, are still easily demonstrable by the anatomist.

Compare this now with the growth of a tooth, and the result is different. Examine it at ever so early a period, when only a speck of ossification is discernible, and what do we see?—a part complete in its formation, having all the properties that belong to the bone of a perfect tooth.

The substance of which the bone of a tooth is

composed is generated by a membrane called the pulp. It is a compound of lime and animal matter, which is thrown out by the pulp so as to enclose itself within a wall of bone—not unlike the oyster, which performs a similar office by enclosing itself within its shell. I have only time to hint at this similarity between the formation of the bone of the tooth and the shell of the oyster, though I think it worthy of further investigation. In both cases the substance that forms the structure is generated and thrown out by the pulp, and the surrounding walls are thickened, enlarged, and strengthened by a succession of layers.

The outer part of the body of the tooth and its fangs being thus formed, the tooth is prepared to emerge above the gums, though there is yet a large portion of the work to be accomplished; for perhaps, upon the appearance of the tooth, not more than one-third of the bone has been formed. The pulp continues to the latest period of life to generate and throw bone upon the inner walls—one layer being added to another, each portion perfect in itself, neither receiving nor requiring further nutriment, as other bones, and indeed as all organized bodies do; and in this way the surrounding walls increase in thickness, until the cavity that contains the pulp frequently becomes in old age almost filled up with bone.

Now, the office of the pulp or bloodvessels within the tooth is not to supply nutriment to the bone

already formed, as some have supposed, but to deposit new bone upon the inner walls of the tooth, in order that the fabric may be strengthened and supported, and compensation made for the waste occasioned by abrasion from without, during the process of mastication. But *other* bones are not formed in this manner: they are highly organized; from circumference to centre they abound with vessels conveying nutriment to all parts alike; and from small soft bones they increase in size and density, until the middle period of life, when they reach maturity. And not only is their mode of formation altogether different from that of the teeth, but their constitution is of a more delicate nature, and requires a covering—a periosteum and other investments—to protect them from the influence of foreign bodies.

We now come to the enamel of the tooth; and in giving a short description of the mode of its formation, we shall be enabled to trace the origin of the pits and fissures so frequently seen upon the surfaces of the molar teeth, and which are the principal predisposing cause of their destruction.

The enamel is more speedily formed than the bone. It is completed before the tooth appears above the gums; and the membrane that secreted this substance, having fulfilled its office, is removed. There cannot, therefore, be two opinions regarding the inorganic nature of the enamel, for it is certain

that nutriment cannot be derived from a membrane after it has ceased to exist.

When the grinding surface of a tooth has been formed by the first layer of bone thrown out by the pulp, a deposition of enamel begins upon the highest parts of the surface, and which will ultimately form the most prominent parts of the crown of the tooth. At the commencement, therefore, there will be several isolated spots of enamel that will gradually increase in size and thickness, till at last, in a well-formed tooth, they coalesce, so as to constitute a continuous covering over that portion which is necessarily exposed for the purpose of grinding the food. In the great majority of cases, however, a perfect union of the several portions of the enamel does not take place. The secreting membrane furnishes an abundant supply, up to the very period when the isolated portions of this substance are *apparently* upon the point of uniting; but in many instances a perfect union does not take place—the isolated portions continue to increase in thickness, but they do not spread out and incorporate so as to produce a level surface, a continuous covering, over every other portion of the bone. Whether this defect can be traced to the compound forming the enamel being of a less fluid nature, in consequence of its containing perhaps an over-proportion of lime to the animal matter, is a question to be solved. It is no doubt a constitutional defect—one over which, I fear, we have no control.

We find, however, that a complete union of the isolated portions does not take place; when at last the membrane ceases to furnish a further supply; and the result is, that when the tooth makes its appearance, fissures are found in the enamel, which often extend to the surface of the bone.

The enamel of a tooth, as we all know, consists principally of the phosphate of lime combined with a small portion of animal matter. It is a more dense and rocky structure than the bone of the tooth, because the bone contains a smaller portion of lime, and a larger portion of animal matter. Between these substances—that is, the lime and the animal matter—there exists a strong power of affinity which combines them into a solid body, and holds them together in rocky union, whereby the structure of the tooth is formed and maintained. But this power of combination may be destroyed by chemical agency: for by the application of a strong acid to the tooth, the part acted upon loses the power of affinity, and crumbles into its original particles. This is what has been termed *decay* of the teeth. Now, the term is applicable in the case of organized bodies which depend upon foreign aid for their existence, nourishment, and growth, so that if this nourishment be withheld, death and decay must be the result: but the term is *not* so applicable to the destruction of inorganic bodies.

The materials which compose the structure of

a tooth, the enamel and bone, when once formed, depend as little upon nutriment for their future support, as do stone, brick, and plaster, used in the erection of a building; both structures are supported and upheld by the power of affinity; both require watchful inspection, and a similar mode of treatment is necessary to protect them from external agency; and if this be neglected, the result in both cases will be the same—a breaking down of the structure.

This destructive influence from without is not always confined to inorganic bodies; an attack is often made upon a tree, and when it becomes necessary to lop off any of the branches, the gardener is careful to cut them in a slanting direction, so as to leave no lodging-place for extraneous matter, otherwise if the branch were broken, or torn off, a ragged place would be left—a resting-place for the destructive agent to settle in, which would not fail to work its way into the body of the tree.

I have met with several instances of this kind, where decay had made some progress, and where the gardener had exercised the art of the dentist, by removing the decayed portion, and filling up the hole with some kind of cement, as a remedy for the evil.

Upon examining the molar teeth immediately upon their appearance above the gums, we generally find them presenting deep pits and fissures, arising, as I have before said, from the irregular distribution

of the enamel. We also find interstices produced by the crowded position of the teeth and the irregularity of their shape. In these situations particles of food are retained, and which cannot be dislodged by means of the tooth-brush on account of the depth of the receptacles; consequently the portions thus retained undergo a process of decomposition, and acquire the property of an acid, with its power of dissolving the connexion hitherto existing between the earthy and animal matter of which the tooth is composed.

This is the *true cause* of the destruction of the teeth. It is *not* the result of inflammatory action, either in the membrane or the bone. Neither is it necessary that the bone of the tooth should undergo abnormal action to predispose it to chemical action; because the agent that can effect the destruction of the enamel, will find it less difficult to effect the destruction of the bone after penetrating the enamel. But, that chemical action is the true cause will appear evident, if we observe the situations where the mischief begins, and take a correct view of the operations necessary to retard, or effectually to arrest, the evil when it commences.

The question, then, which I have here to ask is—Which are the parts of the tooth where the mischief first begins? We never find an attack made upon the plain and smooth surface of a tooth; there must be a resting-place; and those teeth which present receptacles best adapted for retaining

extraneous matter, will be the first to be attacked by the chemical agent. The molar teeth being of this class, are therefore more liable to decay than any of the other teeth.

We have the reverse of this liability to decay in the canine teeth and the incisors of the lower jaw; they are more uniform in their shape—their fangs are thicker in proportion to their bodies—and they do not present depressed necks and interstices as the upper incisors do, and therefore they are less liable to decay than the other teeth. To be convinced of this fact, we have only to glance along the shelves on which are arranged the models required in preparing artificial teeth, and we shall find a large majority of them containing the lower incisors when all the rest of the teeth have disappeared. There is another reason to be assigned for the lower incisors not being so liable to decay. The saliva has a natural tendency to occupy the lower part of the mouth, and these teeth are constantly bathed in this fluid, which, by its property of dissolving the particles of food, is in a great degree calculated to remove them. The saliva itself has no injurious effect upon the teeth: it is the food that mixes with it by which the mischief is occasioned. The earthy matter contained in the saliva, when allowed to be deposited upon the necks of the teeth, takes possession of the fangs, forces the gums from them, produces absorption of their periosteum and alveolar processes; and from this cause they

loosen and drop out, but their loss takes place in the absence of decay.

Again, the attack is always made upon the teeth from without, and never from within. The bone, so long as it is covered with the enamel; and the fangs, so long as they are protected by the gums and periosteum; are safe. It is only when these parts are exposed, and present resting-places for the destructive agent, that an attack upon them begins.

We also observe, that the teeth are liable to decay in pairs; and this is readily accounted for from the striking resemblance they bear to each other in shape, and in the distribution of their enamel. If a molar tooth shows one or more deep pits upon its surface, its fellow on the other side of the mouth will show a similar formation.

Again, the teeth are more liable to decay in youth than in the after periods of life. It often becomes necessary to remove one or more of the permanent molar teeth soon after their appearance; and the parent of the child is surprised when told that the faulty tooth belonged to the second set and not to the first. The predisposition of these teeth to early destruction is easily accounted for, when we consider that the enamel is completed before the tooth appears above the gums; and if the distribution of this substance be irregular, so as to present deep pits and fissures upon the tooth's surface, these parts immediately become resting-

places for the chemical agent—the work of destruction then begins and is speedily accomplished, because at this early period the cavity within the tooth is large, and the wall which protects the pulp is thin, so that there is only this thin portion of bone to penetrate ere the membrane becomes exposed. In the middle and later periods of life the bony partition becomes thickened, thus increasing the distance between the surface of the bone and the cavity of the tooth; and, moreover, it is to be assumed that those teeth which have escaped destruction up to the latter periods of life, had their enamel more regularly distributed, and never did present those pits and fissures already described.

When an attack is made upon the teeth in the after periods of life, it generally begins on their lateral edges, occasioned by the receding of the gums. For if the gums be not kept in a healthy condition, they recede from the necks of the teeth, and to whatever distance they may have receded they cannot be restored to their original position; consequently interstices—those resting-places for the chemical agent—are produced for the first time, and then, at this late period, the work of destruction begins.

The rapidity of the chemical action upon the teeth will depend upon the adaptation of the interstices, pits, and fissures, to receive and retain more or less of the destructive matter. A tooth may be destroyed in one year after its appearance above the gums; in other cases it may be ten, twenty, or even

forty years before chemical action has proceeded so far as to lay open the internal membrane, and produce toothache.

If we inquire into the nature of the successful operations, constantly being performed for the purpose of retarding or effectually arresting the evil to which the teeth are so liable, we shall find them to be in strict accordance with the view now taken of the exciting cause of their destruction. For example, we find a pit upon the surface of one of the molar teeth, and we know from experience what will be the result if this be neglected. Before, then, the membrane has become exposed and inflamed, we proceed effectually to remove the decomposed matter, to wipe the cavity dry, and firmly and securely to fill it up with gold; and if this operation be judiciously performed, the destructive agent is for the future deprived of its resting-place, and the tooth is saved.

Now, we know, from our study of the laws of the animal economy, that the presence of a foreign substance in other parts of the body will certainly be attended with inflammation of such parts; but does this occur in the bone of a tooth? Why, the gold introduced into the cavity of the bone not only excites no inflammation there, but actually arrests the very process of decay itself, and has been known to remain in such situations for forty years without producing the slightest irritation.

Again, the operation of filing the teeth has the

same object and principle as that of filling them. When decay takes place on the lateral edge of an upper incisor, the carious part, owing to the thinness of the edge, or the shallowness of the decay, its position or formation, may not admit of filling, therefore *filing* is resorted to. And why? In order that the carious part may be removed, and a separation from the adjoining tooth effected, whereby the parts are made plain and smooth, and the necks and points of union, which had become a resting-place for the remains of food, are done away with. Hence, the exciting cause being removed, the evil is remedied, and decay proceeds no further. Of course it is to be understood that these operations have been performed in the earlier stages of decay, and before it has penetrated to the internal cavity, otherwise preventive measures will not be available.

We often hear of the success of the operation in removing the nerves of a tooth after they have been exposed, and then filling up the ducts with gold to the extreme points of the fangs. But, after many years' experience, I cannot say that *I* have met with much success from filling when the membrane had become exposed and inflamed. The inflammation is not always confined to the internal membrane; it often extends to the periosteum, and he must indeed be an expert operator who can get rid of this membrane and save the tooth. Doubtless, every means should be employed to reduce the inflammation, and if possible save the tooth by

filling; but the experiment seldom succeeds; we can never say positively that it will answer, and its failure is calculated to do harm, by creating a prejudice against filling in favourable cases, where success would be complete.

Again, in making an artificial set of teeth, where bone blocks and natural teeth are used, great nicety is required in fitting them to the gold frame, and also in adapting the pivots to the holes; for if all be not accurately performed, apertures will be left, and the work of destruction will begin and go on in the artificial, as in the pits and interstices of the natural teeth.*

If it be asked, how is it that the teeth of the lower animals are almost quite exempted from disease, whilst the human teeth are so particularly predisposed to it, and need so much care and watchfulness for their preservation? I would reply by noticing the perfect covering of enamel upon the teeth of the lower animals, and the regular mode of their arrangement. They do not present fissures and interstices, as the human teeth do, in which the food may lodge; and moreover, *their* food requires a greater degree of mastication, and this has a tendency to keep the teeth in a cleanly state.

Not so, however, with man. He is the most

* Thanks to Mr. Ash, and to a few other makers of mineral teeth, for the introduction of a substance so well adapted to supply the loss so often arising from the defective nature of the human teeth,—a substance not liable to inflammatory action, chemical action, or even to abnormal action.

artificial of all animals; and no doubt the imperfect state of his teeth has arisen from that change in his constitution which is a result of the departure from nature's laws. Besides, his food, from the tenacious character it acquires, and from the refined modes of cookery that civilization and luxury have introduced, is more liable to be retained in the pits and fissures of the teeth. And therefore has it become necessary that man should consult his judgment rather than be guided by his feelings; and by a timely application to the dentist have that evil, which man has brought upon himself, remedied.

Whatever may have been said or written on this subject in the way of theory, I cannot believe that amongst practical dentists there *can* be two opinions as to the exciting cause of the destruction of the teeth. The nature and object of the operations that we daily and successfully perform—the tendency of the advice that from time to time we seek to impress upon our patients' minds,—all this seems to me to be a clear confession on the part of the operator and adviser, that *he* believes chemical action to be the exciting cause of caries of the teeth.

We begin with our patients at an early age, when the permanent teeth are about to appear. Our first consideration is to prevent them from getting into a crowded position, and this not altogether for appearance sake, but also that they may be more easily kept clean. A crowded set of teeth are

extremely liable to become carious, from their zigzag position, and from the one tooth standing before the other; and even when the teeth are regular, food will be found lodging in their interstices, if the gums have partly receded.

The patient is therefore instructed to brush them upwards and downwards, as the best mode for removing the destructive matter. His attention is also directed to the masticating surfaces of the double teeth, and he is told to apply the brush firmly across them; and if he cannot succeed in reaching the bottom of the pits, and so dislodging the remains of the food, then the defect must be at once remedied by the art of the dentist.

Such is the advice which is or ought to be given. And I hold it to be strictly in accordance with the theory, that chemical action is the exciting cause of the destruction of the teeth. If inflammation of the internal membrane or of the bone were the exciting cause, the pain which always accompanies inflammation would be *previous* to the commencement of decay; and our patients would be consulting us whilst the tooth was yet in a sound state, for the purpose of having the pain removed, and decay prevented by subduing the inflammation.

But very few *such* cases come under our notice. On the other hand, I myself have not met with more than two or three cases that I could *not* trace to inflammation of the periosteum, or to the exposure of the internal membrane occasioned by

previous decay; and these few mysterious exceptional cases I have put down under the head of tic-douloureux. We have often pain arising from inflammation of the periosteum of the fang of a sound tooth, but inflammation of the periosteum never occasions decay of the tooth.

Is it not rather a singular circumstance, that one dentist should suppose caries to be the result of inflammatory action, and another, the result of chemical action, and yet that both should adopt the same means for preventing or remedying the evil? It will, however, at once be perceived that the treatment by the latter is in character, and perfectly consistent with the views he entertains of the cause; but that the former, whose views are the very opposite, should resort to the same means—that he should perform the operations of filling and filing, in order that inflammation might be prevented or subdued—appears very inconsistent, and altogether incomprehensible. What, let me ask, is the universally adopted mode for subduing inflammation in *all the other* organs of the body? Is it not either by taking blood from the vessels leading to the inflamed part, or by the application of blisters, so that the serous part of the blood may be withdrawn from the contiguous vessels, or by the free administration of active purgatives, or by the application of warm or cold poultices, or by sudorific medicines? If so, why, then, are not the same remedial measures adopted by those who contend that inflammatory

action is the exciting cause of the decay of the teeth? Why should they have recourse to the operations of filling and filing?

In conclusion, I would observe, that if the pathology of the teeth were more intimately known and more minutely investigated by the medical profession generally, a vast benefit would be conferred upon the public. It is from the want of this knowledge that the patient is so often doomed to a course of tedious and ineffectual treatment, and to the endurance of much misery that might have been prevented. How often does it happen, when the teeth alone are the cause of suffering, that the mischief is overlooked by the general practitioner, and the pain which the patient suffers attributed to tic-douloureux or rheumatism, or earache, or cold in the face, or to some other equally innocent and unlikely cause? I believe it to be the duty of every medical man to combine with his other acquirements a sufficient knowledge of dental surgery, so that though he may ultimately refer his patient to the dentist for the remedy, he yet himself may be enabled to form a correct idea of the nature of the diseases of the teeth. I have known cases where for months the patient has been suffering from pain in the face, taking medicine, using external applications, &c., and yet the teeth have never been investigated, although the pain has been traceable to one or more of these organs.

I have often thought how desirable it would be,

and how much suffering might be prevented, if some arrangement could be made that would enable the lower classes to reap all the advantages derivable from the advice and assistance of the dentist, so that caries might be prevented, or arrested in time. We have hospitals open to the poor, where they receive the full benefit of the physicians' and surgeons' skill and treatment; and in many instances as effectually as if they were private and paying patients. But it is not so as regards the treatment of the teeth. True, the poor man may have his tooth extracted gratuitously, and return again and again for a similar operation, but no *preventive* measures are employed, nor can there be in the present state of things. Take the community at large, and we shall find not one in a thousand who bestows *that* attention upon the teeth which is absolutely necessary to preserve them in a healthy condition. And yet it may safely be asserted that none of the organs of the human body are so often the subjects of disease; none whose diseases are so little understood, but, when rightly comprehended, none so completely under individual control.

Since writing the above, some six weeks ago I had some conversation with Dr. Fraser, of the 10th Hussars, as to the practicability and desirableness of some arrangement that would enable the lower classes to partake of the benefit that may be derived from an application of the means now so generally and so successfully employed by the more

wealthy portion of the community for the preservation of the teeth.

I was informed by Dr. Fraser that a similar idea had been suggested by the Director-General of the Medical Department of the Army, Andrew Smith, M.D., and that circulars had been issued to all medical officers in her Majesty's service, directing their best attention to the subject, and pointing out the important advantages that must accrue to the men under their care from the introduction of the improved modes of treatment in dental surgery; by obviating the necessity of having so frequent recourse to the forceps; by adding to the comfort and health of the soldier; and by securing a greater degree of efficiency for military service.

Unlike the internal organs of the body, the teeth are easily inspected by the practised eye of the experienced dentist; and with the aid of the mouth glass and the bent probe, the defects are readily discerned. There is no difficulty in discovering decay in its first stages. Nay, from the first appearance of the teeth through the gums, it may be foreseen from their construction which of them, and what parts of them, are predisposed to decay. The only situations where caries may commence and proceed without detection till it becomes irremediable, are the interstices of the double teeth.

I am not aware that much light has been thrown upon the cause of the teeth's destruction, or that

much practical benefit has as yet resulted, from the more minute and scientific mode of investigation which the bone of the tooth has undergone, by means of the microscope. It appears evident enough to me that sufficient cause for the evil to which the teeth are liable is to be found upon the surface: there the predisposing cause of their destruction clearly enough presents itself to the naked eye.

In examining the bone of the tooth through the microscope, to *some* it appears to present a tubular structure, and the tubes to contain a circulating fluid, which *they* assume to be sufficient proof of the vitality of the bone; to *others* the same tubular structure presents itself, but to *them* the tubes appear to be filled up with earthy matter, thus putting a stop to the circulating medium.

We are greatly indebted to the microscope for many grand and useful discoveries; but we perceive that the high power of this instrument is liable *sometimes* to present to the mind's eye appearances which are not always real, but imaginary.

We have, however, come by experience to the knowledge of two important facts in connexion with the character of the bone of the tooth; the one is, that its destruction takes place in the absence of pain; and the other, that the attack is always made from without, and never from within.

Much has been said and written, and various representations have been given, of the bone's struc-

ture; but I cannot see that any practical benefit is likely to result from this mode of investigation; nay, I rather fear that the efforts that are being made by means of the microscope to trace the origin of decay to the bone of the tooth, may have a tendency to lead the public into a wrong direction, by encouraging the old and dangerous theory, that inflammation of the bone of the tooth is the exciting cause of caries—a *dangerous* theory, I call it, because it is calculated to uphold the mistaken notion, that it is time enough to apply to the dentist for relief when pain has been experienced. One of the earliest of our English writers upon the diseases of the teeth, made a *most unfortunate mistake* when he compared the teeth with other bones, and came to the conclusion that a similarity of structure and organization existed in both. This erroneous impression has no doubt had its influence upon the minds of some of our subsequent writers, if we may judge from the theories they have advanced; but the sooner we can get rid of the notion of the bone of the tooth being liable to inflammatory action the better.

There is not the slightest reason to suppose that the bone of the tooth is liable to inflammatory action. Its mode of formation, its structure, and its constitution, are altogether different from that of other bones. There is no analogy between them, nor ought we to expect to find any; if it were otherwise, it would be a departure from the laws of

nature, which never fails to fit the organ for the duty it has to perform.

Is it at all likely that a vascular and sensitive part should be destined to perform the office of grinding the hard substances which oftentimes constitute our food, and be thus exposed to the mechanical attrition which this operation necessarily occasions? Substances analogous to the structure of the bone of the tooth are to be met with in various parts of the animal economy, but not in common bones. In the tusk of the elephant and walrus; in claws, horns, and hoofs, &c., we find a striking resemblance to the bone of the tooth, in their mode of formation, in structure, and constitution. These substances, when once formed, are insensible to pain, and therefore fitted for the offices they are destined to perform. Take, for instance, the horse's hoof; a considerable portion of it may be pared off with an instrument, and into the remaining portion nails may be driven without occasioning the slightest pain; so that the membrane which generates the hoof's substance is not interfered with, and a sufficient thickness of hoof is left to protect its membrane from external influence. The same with the bone of the tooth, as before stated, a gold filling may be forced into it without occasioning the slightest inconvenience.

From what has been stated—and many more proofs might be adduced if time would permit,—it must appear evident, I should think, to every prac-

tical dentist, that chemical action, arising from decomposed particles of food retained in those pits, fissures, and interstices, which I have had occasion so frequently to describe, must be the cause of the destruction of the teeth. But in order that proper means may be employed to remedy this evil, it becomes equally necessary that the patient should have a correct knowledge of the exciting cause, and of the insidious character of the destructive agent. He must be in possession of the facts that the attack is made from without, and never from within; that the mischief begins upon the surface of the tooth; that the enamel and bone are insensible to pain; and that it is only after these parts have been destroyed, and the membrane within exposed, that pain is produced. He must disabuse his mind of the erroneous notion of inflammation being the exciting cause of decay, and of the mistaken idea of his teeth being in a state of perfect safety in the absence of pain. The patient must also be convinced of the necessity of looking into his own mouth, and making himself familiar with the form and arrangement of his teeth, in order that he may ascertain whether it be possible, by means of the brush, to remove the remains of food from all their parts; and if, from the irregular formation of their enamel or the peculiarity of their shape, he finds this to be impossible, he must then have recourse to the dentist, who, by exercising *his art*, may remedy the evil: and if it were possible to keep the teeth

perfectly free from tartar, and to remove the particles of food from their resting-places, before decomposition takes place, much suffering and loss of teeth might be prevented.

Inflammation of the *periosteum*, *gumboils*, *abscesses*, and exfoliation of the *alveolar* process, are almost always the results of caries or tartar; and by timely attention on the part of the patient, with the periodical assistance of the experienced dentist, the evils to which the teeth are so liable might, in the great majority of cases, be prevented.

ON CAPPING THE EXPOSED PULP.

Read July 6th, 1857.

By THOMAS ROGERS, Esq., M.R.C.S.

The operation for the destruction and removal of the pulp, and filling the canals in the roots of the teeth, is beyond all question one of the greatest strides that has been effected in dental surgery within the last quarter of a century, rapid as has been the march of events in our speciality during that period. When, however, we pass in review the objections to this operation, whether as regards the suffering and inconvenience to the patient, or the time and labour of the dentist, or, still more than either of these, the extensive loss of vitality to the organ itself, and the evils consequent thereon; we may, I think, most advantageously consider whether it be not possible to restore the tooth to a condition of health and utility without having recourse to this last resource of conservative dental surgery. Every discovery that microscopic observation has effected, down to that lately made known to us by the untiring research of one of the most eminent members of our Society and Profession, I

mean the disclosure of the contents of the tubuli of the dentine,—every such discovery tends to show more conclusively the intimate connexion existing between the pulp and the osseous matter of the tooth, and consequently the dependence of the healthy condition of the latter, and the usefulness of the whole organ, upon the preservation of the former in its natural state. Hence, therefore, it has been my practice in most cases to resort to the destruction of the pulp only when all measures for its preservation have failed, and among other operations with this view I have followed out that of capping the exposed surface of the nerve, with, I think, a fair chance of success. I may premise, that should there be any chance of leaving the pulp covered by its natural protecting substance, I invariably take advantage of it, even should the contiguous dentine be carious, and I have found that teeth so operated upon last many years, and are in most cases capable of successful after-treatment. If, however, the pulp is actually bare when the patient presents himself, or is exposed accidentally or otherwise, during the preparation of the cavity of decay, then, should circumstances to be mentioned hereafter be favourable to the performance of the operation, I proceed immediately to put it into practice.

The first mention of this or any similar operation that I have met with, is in Kœcker's work, published in 1826, in which, after advising the

dentist to avoid wounding the pulp if possible, he directs the use of the actual cautery should hæmorrhage be caused by the inevitable occurrence of that injury. He deprecates the employment of acids and styptics; he gives particular directions for the proper cauterization of the exposed surface, &c., and then describes his method of laying a small plate of very thin lead leaf on the part, and filling up the cavity with gold, remarking, that he covers the nerve with lead, because he believes that that metal has a cooling and anti-inflammatory effect upon the irritated nerve, or at least, that it possesses these qualities in a greater degree than gold. The average success of his mode of treatment he gives as being five out of six cases.

Fitch, in his work published in 1829, refers to Kœcker's remarks on this subject, and observes that he had "adopted his plan with perfect success in some cases, but that in others it entirely failed." He then speaks of a method of treatment of the exposed pulp, by the application of some powerful astringent to it, which he keeps in contact by filling the cavity of decay with wax, and changes from time to time. The astringent he used was the soft part of the fresh Aleppo gall-nut, which he renewed every ten or fifteen days for several weeks, or even months, till the sensibility of the nerve or lining membrane is reduced. He then followed Kœcker's plan of covering the exposed point with lead, and affirms that by the combination of the

two methods the operator will seldom fail of attaining complete success.

Mr. Bell recommends "the continued application of a moderate stimulus, such as alcohol, spirits of camphor, a solution of nitrate of silver, &c.," to the exposed pulp, "till considerable pressure no longer occasions pain;" but I do not remember that he speaks of protecting the pulp from the contact of the filling by any mechanical means.

Mr. Tomes gives minute and excellent directions for the treatment of the exposed pulp and its restoration to health, but I am not aware that he mentions the operation of capping or otherwise protecting it, in the final operation of filling the tooth.

Dr. Harris during five years treated 317 teeth in which the lining membrane was exposed. He subsequently saw 220 of these, of which 202 succeeded (about eleven in twelve). He observes, however, that some of these may not have had a sufficiently long trial to allow of their being considered permanently successful. According to his experience the direct application of any metallic substance to the exposed pulp or lining membrane is always followed by inflammation of those tissues, and in filling the tooth, instead of using a cap, he introduces the gold in such a manner, as, by forming an arch over the pulp, to leave a vacant space immediately around it.

Dr. Foster filled the concave side of the cap with Hill's vegetable stopping, taking care to preserve

the concavity, so as not to press against the part intended to be protected. He afterwards obtained still greater results by filling the cavity external to the cap with Hill's stopping, instead of with gold, though he considers this merely as a temporary operation.

Dr. Hullihen (whose premature death we must all regret) substituted for the cap a few coils of gold wire from the end of a spiral spring. The advantage which he considered this plan to possess was that, gold being used to complete the filling, every stage of the operation can be more closely viewed, so that the slightest shifting of the nerve-covering can be rectified.

Dr. Elliott believes that when any space is left between the bottom of the filling and the surface of the pulp, the least increase of circulation forces the delicate lining membrane of the tooth through the opening in the partition which separates the natural from the artificial cavity, and that the sharp and irregular edge of the bone around this opening lacerates the membrane, thus increasing the unavoidable irritation which follows the exposure of the nerve. He therefore, after carefully preparing the cavity, envelopes asbestos in a few thicknesses of gold foil, particularly ensuring the contact of the smooth surface of the foil with the pulp, and presses the mass gently but firmly down with a warm plugger. In only two cases out of a large number (how many he does not specify), did any after

inflammatory symptoms arise, and both of these yielded permanently to leeches and cathartics.

Mr. Spence Bate prefers ivory caps over the pulp to gold ones, as being more congenial to the nature of a tooth, and not conducting changes of temperature.

Dr. Du Bouchet strongly recommends horn for the purpose, cut of a suitable shape, and immersed for a short time in hot water to render it pliable.

Mr. Bridgman employs a very ingenious instrument for carrying the cap to its place. That on the table is the one he uses for posterior and lateral cavities in the lower molars. The cap has a small hole drilled into its convex surface, and the point of the holder being inserted into the hole, the cap is placed in position over the exposed pulp, and by a touch of the finger nail, the spiral spring is pressed down and detaches the cap, leaving it *in situ*.

My own practice has been to wait for the subsidence of hæmorrhage, should any have occurred, and then carefully to adjust a gold cap of the necessary size over the exposed pulp. As I consider it to be a matter of great importance to avoid as much as possible all irritation to the tooth in this delicate condition, I fill over the cap with amalgam. In cases —as in the upper teeth, for example—where the cap would be liable to fall out before the cavity could be filled up, I touch the edges of the cap with a solution of gum-mastic, so as to make it adhere to the bone; and to carry the cap to its place I use either a delicate pair of pliers or blunted excavators

at various angles, made to adhere for the occasion to the convex surface of the cap by the mastic solution.

Owing to want of time, I have only recorded forty-eight cases of this operation. Of these, forty-two have been hitherto successful; but as some of these are only lately performed, this may not be a proper proportion. Of nine cases recorded in 1853, seven are at the present time going on well. Of the two failures, one occurred two, the other twelve months after the operation, both in the absence of the patients from town, and without any examination being made after extraction. In both I had used arsenious acid to lessen sensibility, but in neither was the pulp destroyed at the time of the operation. In 1854, I have recorded ten cases; of these seven are successful and three failures. These three all occurred in two or three months after operating, and from the effects of severe colds. In one which I had the opportunity of seeing, the neighbouring parts were highly inflamed, and the pulp was in a state of suppuration. Arsenic had been used in one case. In 1855 I have seven cases recorded, all of which have succeeded. In 1856 three only, two quite successful; in the other the filling came out in about two months, and was replaced without a cap. The tooth now appears dead, though the surrounding gum is healthy. This year I have recorded nineteen cases, one of which has been since lost. Arsenic had here been used. Another presents one or two interest-

ing points. The cavity was extremely shallow, situated on the posterior surface of a lower bicuspid, which had previously been the subject of considerable filing, so that there was but little room for the filling, which came out in about a month. The spot where the pulp had been exposed appeared covered by a coagulum of blood, but I forbore to touch it, except in drying out the cavity with wool. This caused no pain, and I refilled without a cap, hoping thus to gain more room. Lately, however, the second stopping came out, and I have directed the patient to keep the cavity always filled with wool, trusting that after a while I shall be able to excavate more deeply. There is slight sensitiveness to cold fluids.

For the successful performance of this operation I conceive it to be necessary that the patient should be in good health, and not an inflammatory subject; that the tooth itself should not have been the seat of much pain, and that the neighbouring teeth and tissues should be free from disease. When caustic agents have been used to the tooth during any part of the operation, after-inflammation seems more likely to arise than when the pulp is laid bare and capped without any previous treatment; thus, of the six above-mentioned failures, four had had arsenical applications, whilst only seven of the forty-two successful cases had been so treated. In three of the latter, however, nitrate of silver and chloride of antimony were used. I think also that success

would be more probable in patients of middle age and upwards than in the young, because there is in the former a greater tendency to ossific formations, and because, in the latter, the pulp is more highly vascular, and more liable to inflammation or injury. I do not consider it to be absolutely necessary that every particle of decomposed dentine should be removed from contact with the pulp, but that the exposure of that organ should be as slight, and for as short a time (allowing for the cessation of hæmorrhage) as possible, and I therefore proceed to the completion of the operation the instant of feeling sure that the nerve is in the least touched.

As regards the theory of the operation, it is well known that anything which has a tendency to cause irritation of the pulp, sets up a disposition in that organ to deposit ossific matter in the direction of the irritation. This fact, however, is *firmly* established only in cases where the pulp is not actually exposed; and further observation is needed to decide absolutely whether, after exposure of the nerve, and its preservation from contact with any foreign substances, it will still take on ossific action, whether by conversion of its substance into osteo-dentine, or by effusion of lymph into the space left vacant under the cap, and subsequent organization. Drs. Harwood, Foster, and Dwinelle are of opinion that the pulp does ossify under these circumstances; in which of the methods I have alluded to, they do not say. Harris details three cases occurring in

his practice where, on removing the temporary filling, he "discovered a whitish and apparently semi-translucent substance, slightly elevated from the bottom of the cavity, of a conical shape, with two or three red specks in the centre;" this substance he "at first supposed to be the pulp of the tooth, but on touching it with an instrument, discovered that it possessed but little sensibility, and was almost as hard as cartilage." On removing a second temporary filling from one of the same teeth, after a six months' further trial, the whitish protuberance was found to have become "solid bone, almost as hard as the surrounding dentinal walls." Dr. Codman, of Boston, affirms that he has succeeded in numerous instances in inducing ossific inflammation, and the formation of a bony covering over the exposed pulp, by simply removing the decomposed dentine, and keeping the cavity in the tooth filled with raw cotton. The time required to effect this varied from eight to fifteen months, and the cotton was changed once a day.

My own practice throws but little light upon the subject, since those cases which have failed have either done so too soon for ossification to have set up, or under circumstances where no examination of the tooth has been made. In one case only have I had an opportunity of observing the result of what I may term a successful operation of this kind—it is the one marked No. 23 in my notes, performed in March, 1855, rather more than two

years since. Last month (June, 1857,) the filling fell out. On examination I could find no aperture in the floor of the cavity; the bone was discoloured and somewhat soft, and I removed a considerable portion of it without exposing the pulp again; the dentine becoming very sensitive, however, I desisted, making a solid gold filling, but leaving a little decay underneath it. I trust that a third operation two or three years hence will make this a *perfect* filling. It was rather unfortunate that I was unable to convince the owner of the tooth of the benefit she would confer on science by allowing me to extract it. She was, however, particularly positive on the subject, and I am therefore unable to offer the Society any report of microscopic examinations of the tissues.

I think, however, that the most reasonable way of accounting for the continued health and utility of teeth which have some of them been treated on this plan for more than four years, is by assuming that ossification in some shape has ensued. Were it not so, inflammation of the pulp, and its consequences, would have been likely to occur on every temporary derangement of the general health or local affection of the mouth.

A more systematic course of observation is, however, necessary, before any definite conclusions can be arrived at. The constitution and temperament of the patient seem especially worthy of consideration. I can but regret that my own notes

have been so few and so imperfect; and my apology for occupying the time of the Society must be the great hope I have of drawing forth the general knowledge, and in so doing of increasing my own, by attracting the attention of the members of our Society to the treatment of the pulp at a time when that subject is daily assuming greater prominence.

Should any gentlemen feel inclined to follow out this subject, they will find on the table some specimen leaves of a proposed note-book.

In thanking you, Mr. President and gentlemen, for your patient listening to my paper, I wish I could flatter myself by concluding in the quaint words of Quarles—"I wish thee as much pleasure in the reading as I had in the writing."

DESCRIPTION OF A DUPLEX OR EITHER-SIDE LATHE FOR THE USE OF DENTISTS, ETC.

Read July 5th, 1857.

By GEORGE OWEN.

(*Presented by* J. Tomes, F.R.S.)

The contrivance of what I have called a duplex or either-side lathe, has arisen out of the daily experienced inconveniences which attach to the foot-lathes hitherto used, for carrying the corundum wheels, &c., used in fitting mineral blocks and teeth to their golden or platina bases.

It is intended to obviate the necessity which at present exists for the frequent, not to say constant, removal of the corundum wheels from the mandril, when others of a finer or coarser kind or of a different form are required.

Another object gained by this invention is, accommodation for two persons to work with the same apparatus at the same time, standing on opposite sides, one or both working the driving wheel by a separate treadle, both treadles being connected by a very simple arrangement with the same crank.

The working drawing, No. 1, is of the full size; No. 2, showing the plan of the treadles, &c., is to a scale of six inches to a foot. I have great pleasure in presenting these drawings to the Society, so that any gentleman who may wish to adopt the invention in his work-room or in his operating room, can have tracings made from them for the instruction of the machinist whom he may employ to make it.

It will be perceived at once, upon an inspection of the drawings, that the novel and leading feature as to construction is, that the *headstock*, instead of STANDING UPON and being fixed to a bench or table a little to the left-hand, is SUSPENDED directly over the centre of the little table, by an iron bridge which stands at right angles with the mandril. In order to save space, the mandril carrying the corundum wheels is represented, in this drawing, as occupying the same plane as the bridge that supports it: the proper working position, however, of these parts with respect to each other is at right angles.

The headstock is made to carry two coarse corundum wheels and a point on one side, and two finer corundum wheels and a point on the other side, and is capable, by the handle above the bridge, of being turned half-way round in a horizontal plane, so that either side of it, with its wheels and point, may be brought to the right hand, and so into the proper position for use.

Hence, instead of having to remove the point and the smaller corundum wheel in order to change the larger one for a finer or a coarser, a work which involves some loss of time, and what is perhaps still worse, considerable wear and tear to the fingers, all that is necessary is to withdraw a small pin that passes through the boss in the centre of the bridge, and having turned the headstock so as to bring the other wheels into use to replace the pin.

It will be observed, that in this operation of turning or reversing the headstock, the catgut band of necessity becomes crossed below the pulley. This led me to adopt the suspension principle to the headstock.

It is obvious, moreover, that if the distance between the pulley in the headstock and the driving-wheel remained *fixed*, a longer band would be required when it was crossed than when it passed directly or uncrossed. In order to meet this difficulty, I have made the headstock to turn in the boss upon a double threaded screw of one inch pitch, by which I get, in the half revolution required, an elevation or depression, as the case may be, of half an inch, which corresponds exactly with the range which experiment showed to be necessary between the pulley and the driving-wheel, upon crossing or uncrossing the band. By this contrivance the catgut band is maintained of an uniform tightness in every position of the headstock, and is thus saved from being broken by undue tension, on

the one hand, or rendered uselessly slack and of insecure adaptation to the wheel, on the other.

I need scarcely to remark that, as the headstock is suspended over the centre of the table, it is necessary that the driving-wheel below should also be central.

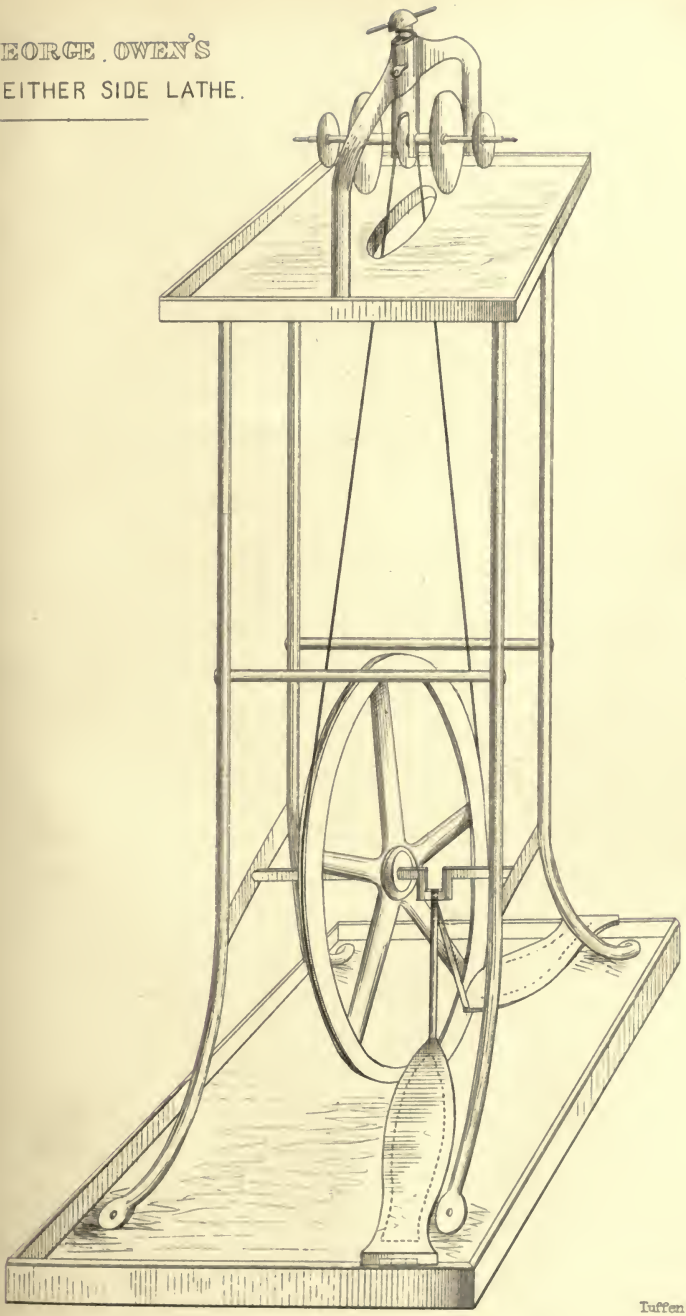
When this lathe is intended for the operating room it will require but one treadle of the ordinary kind, but when it is intended for the rougher and harder usage of the work-room, it may be made available for two persons occasionally to work with it simultaneously. For this purpose two treadles, hinged to the base, directly opposite each other, should be adopted, their noses (if I may use the term) just clearing each other under the crank. (See drawing No. 2.) A strap made to embrace the crank, and firmly riveted or tied around it, having its ends fixed, one to each of the treadles, supplies the place to each treadle of the iron hook in common use; and has the advantage of working smoothly and noiselessly. They can be worked separately or conjointly.

It was my intention to have had one of these lathes here this evening, in order that it might be seen and examined, but unfortunately I have not been able to find a machinist who would undertake to make me one within any reasonable length of time, or at least in time for this evening.

Note.—The drawings referred to in the foregoing paper being unsuited for this volume, I have had made a perspective drawing of the lathe, which I think conveys a better general idea of its construction, and will be sufficient to render the above description intelligible.

Mr GEORGE. OWEN'S

DUPLEX EITHER SIDE LATHE.



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NATURAL HISTORY.

ON GUTTA-PERCHA AS A PERMANENT STOPPING.

Read August 3rd, 1857.

By HENRY LONG JACOB, M.R.C.S.

(*Presented by* Edwin Sercombe, M.R.C.S.)

The utility of gutta-percha as a temporary stopping in certain cases has been long recognised by the dental profession; its insolubility and impermeability to the fluids of the mouth, the protection it affords against changes of temperature, combined with the fact of its requiring little or no force for its introduction, point it out as a most useful agent for this purpose; there have, however, hitherto been certain objections or difficulties in the way of its employment, which have militated against its general use as a temporary stopping, and still more as a permanent one. In its ordinary condition, and unmixed with any other material, its colour prevents its being available for cavities which are in sight, and in all cases it would be too elastic and yielding to allow of ready manipulation, or of its being made to adhere properly to the walls of the cavity. There were, therefore, two things to be desired;

first, to deprive the gutta-percha of its colouring matter, and secondly, to find some material to mix with it, of a pure white colour, insoluble and unchangeable in the mouth, and capable of being obtained in an impalpable powder, so as to be incorporated so thoroughly with the gutta-percha as to form one homogeneous mass, giving it more firmness and solidity without impairing its tenacity.

A few years ago, not having met with any of the gutta-percha cements which were unobjectionable in point of colour, consistence, or chemical composition, I determined to attempt the solution of the problem myself, and commenced a series of experiments for the purpose, which were at last crowned with tolerable success.

To get rid of the colouring matter, a quantity of the native gutta-percha is pulled to pieces repeatedly in hot water, until all dirt and accidental impurities are removed; it is then dried, and with the aid of heat worked up into little balls about half an ounce in weight; one of these balls is tied up tightly in a piece of fine calico, the ends of the ligature being left a few inches long; it is then placed in a wide-mouthed bottle, nearly filled with chloroform, and the ends of the string fixed to opposite sides of the mouth of the bottle by a piece of wet bladder tied tightly over it, the bag of gutta-percha being thus retained close to the top of the bottle, which is then inverted, and set aside for

a week or ten days. The chloroform dissolves out the gutta-percha, leaving nearly the whole of the colouring matter behind in the bag. When the liquid is poured off, a second portion of chloroform may be added, and the bottle set aside for a week or two longer; the whole of the soluble matter will then be extracted. The solution is then placed in a bottle with a small aperture near the bottom closed with a plug, a small quantity of water added to it, the whole well shaken up together, and set aside for some days; the water causes a slight separation of gutta-percha in a flocculent state, which gradually rises to the top, carrying with it the small portion of opaque insoluble matter which had found its way through the pores of the bag; the clear liquid may then be drawn off from the bottom, leaving the scum behind. The chloroform is distilled off by a simple apparatus and preserved; and the gutta-percha, after remaining an hour or two in an open vessel at about the temperature of boiling water, to drive off the remains of the chloroform, is then rolled out on a warm slab into a thin sheet.

With regard to the material to be mixed with the gutta-percha, I was for a long time at fault. I thought at once of pure silica, as likely to possess the desired qualities, but nowhere could I procure any that was of a pure white colour, or in impalpable powder; every specimen that I tried proved a

failure: I therefore, in the mean time, made trial of a variety of other substances, which it would be now superfluous to enumerate; for, although I made some tolerably good specimens of cement, none of it came up to my idea of what it might be. At last I succeeded in getting some silica prepared for me from the fluoride of silicon by Messrs. Morson, of Southampton-row, which, after being subjected to a careful purifying process (for it was very dirty as sent to me), I found to be just what I required. Messrs. Morson, however, refused to supply me with any more of it, on account of its being so troublesome to prepare, and I was equally unsuccessful with other parties. In the mean time, I prepared some silica from the silicate of potash, which answered pretty well, being very pure and white; but it was too compact and gritty to please me, and did not whiten the gutta-percha sufficiently. Hopeless of procuring it from others, I at length resolved to prepare some myself, from the fluoride of silicon, and I find it by no means a difficult process, although requiring considerable care and attention.

As I take especial pains to keep it free from all impurities, I find that what I prepare myself is a much better article than that which I obtained from Messrs. Morson; in fact, it surpasses my most sanguine expectations. I need not describe the process for obtaining it, as it may be found in works on chemistry; but I would recommend no one to

attempt it who has not had some little experience in chemical manipulation. There is one essential point, however, that I must mention, which is not likely to be found in books; this is the necessity of exposing the silica when thoroughly dry to a red heat, in order to bring out the pure white colour; when simply dried, it has a bluish or greyish hue. The heat must not be allowed to rise too high, or the silica will shrink up to a much smaller bulk, becoming semi-crystalline and gritty, like that prepared from the silicate of potash. This has happened once or twice to myself, to my great chagrin. If the silica has been properly prepared, it is almost inconceivably light and bulky, of snowy whiteness, perfectly soft and impalpable when tried between the teeth, and so efficacious in whitening the gutta-percha, that cement can be made with it to match in colour with teeth of every hue, from the pearly white to the dirty brown.

The cement is made by thoroughly incorporating the ingredients in a hot mortar, in the proportion of one part by weight of silica to four of gutta-percha. Care must be taken to prevent the access of dust, &c., during the process. The cement when cold is extremely hard and firm, and yet so tough that it cannot be disintegrated by any amount of mastication, which has only the effect of extending it into a thin membrane.

In using it, the cavity should be prepared as for

gold stopping, and care taken to exclude all moisture, especially *blood*, during the operation of filling. It should be slightly warmed before introduction, and nicely packed and moulded in with warm instruments, the edges being accurately finished off, the surface smoothed, and all superfluous portions removed. It is best, where the cavity is not very easy of access, to use a piece at first barely sufficient to fill it, as it is easy to add a small portion afterwards, if necessary, and a superfluous quantity would only hamper one in one's manipulations, and be troublesome to remove. In finishing off, the instruments should be made hotter than boiling water, the cement can then be made to adhere thoroughly all round the edges. The forms of instruments for the purpose will readily suggest themselves; they should be smooth and polished—*burnishers*, in fact; rounded, wedge-shaped, thin and flat, straight, right-angled, and oblique. The cases where it will be found most useful, are cavities which are in sight, which are sensitive to pressure, heat, or cold—those the walls of which are thin and weak, which are in relation with an artificial piece, &c.; and also where the pulp is exposed, should it be deemed advisable to have recourse to stopping at all, as it would be easy, by careful manipulation, or by the use of a metal cap, to prevent the cement from touching the nerve, and at the same time to *seal* it completely round the

sides without disturbing the tooth by the exercise of pressure, &c., while its being so light, and a non-conductor, would probably render it more tolerable to the tooth than a metallic stopping would be.

In cases where it is exposed to mastication, it will probably become countersunk or moulded into a hollow on the surface after a time, but I have never found it in these cases forced away from the sides, showing that it must adhere well to the edges and walls of the cavity. This adhesion to the tooth is a point which I was at first very doubtful about, and I did not anticipate that it would take place so completely as I have found it to do. Theoretically speaking, there should be no limit to its durability where it is not exposed to mastication, and where it is, it may be readily added to from time to time, should it become hollow.

In my experiments with gutta-percha I had another object in view besides the stopping cement; I wished to obtain a material for artificial gum, and particularly for the purpose of coating over bone pieces to protect them from the chemical action of the mouth; in this case it is perhaps more essential even than in that of the stopping, to get rid of the natural colour of the gutta-percha, or otherwise the delicate tint of the gum could by no possibility be imparted to it; but now, by a little of this silica, the colour may be made as pale as we please; and as it is light, and so little of it required to produce the

necessary effect on the gutta-percha, the coating adds but little to the weight of the piece, which is a considerable advantage; however, time will not permit me to enter into this matter now. I fear that my remarks have already been wearying from their length; permit me, in conclusion, to express a hope that this humble contribution to dental surgery may prove of service to the profession at large, and that my labours have not been altogether thrown away.

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