

as indicated, may be compelled to the employment of specifics, nervines, alteratives, astringents, and antiseptics. In one sentence, we are to recognize and appreciate the indications, local and general, and to meet them. When this has been done, and yet a cure is not secured, the only remaining question is between the extraction of the affected tooth or teeth, and the risk of such consequences as osseous caries or necrosis.

CHAPTER XV.

THE TEETH AND THEIR DISEASES.

THE PULP-CHAMBER AND CANALS.

At this point is properly to be studied the treatment of teeth containing dead pulps; the relation of the condition with periodontitis and with alveolodental abscess being fresh in mind from comprehension of the two immediately preceding chapters.

The pulp of a tooth dead, and the intention being to save the organ, appreciation is to be had of the means tending to such end. The performance is one of full surgical import, demanding both skill and physiological understanding. It is, indeed, within the memory of the present generation when a dead pulp was synonymous with the loss of a tooth. Now, however, it has come, happily, to be recognized that such attendant loss is the exception,—observation eliciting the fact that the almost universally associated destructive sequelæ depend on the presence of the putrid mass in the cavity rather than on the fact of death of the pulp. Death of a pulp is recognized in loss of translucency by the tooth containing it.

With such understanding, the first step in the treatment of the pulp-chamber and canal is found to consist in the thorough cleansing of them from substance which has become foreign.

To remove a dead pulp, the operator commences by creating an opening into the chamber, or in enlarging to convenient size one that may already exist;* this accomplished, it is not infrequently the case that the part may be caught and lifted away with a pair of delicate finger-forceps. A more common mode of procedure, however, consists in the employment of a barbed broach; this instrument being passed into the canal, and, when rotated, catching and twisting into its teeth the organ, its withdrawal brings with it necessarily the structure. Fig. 96 represents such a broach, a variety of blades being shown adapted to a common handle.

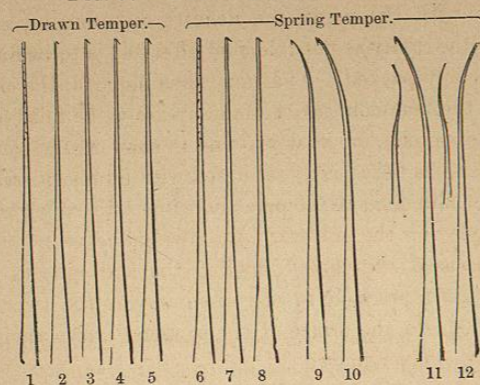
In attempting to remove a pulp entirely dead, it is occasionally found that considerable pain attends the operation. This pain is seen to arise out of the manipulations. A broach thrust directly upon a dead pulp will carry necessarily the impression to the living structure still in relation with it at

* While the present chapter finds proper place in relation with the studies which here immediately precede it, the student will be advantaged if he defer its reading until he has familiarized himself with the more ordinary performances of operative dentistry.

FIG. 96.

Nerve
Extractor,
with
holder.

FIG. 97.—NERVE EXTRACTORS.



the foramen of the canal. A proper plan is to enlarge the opening to such extent as allows the introduction of the instrument between the wall of the canal and the organ. Delicately insinuated in this manner, the rotation being commenced only when the instrument has reached the bottom of the canal, a pulp may commonly be removed without even discomfort.

In teeth having more than one root, it is generally found necessary first to extract the pulp of the chamber proper. This is to be effected through the use of a common excavator, simply cutting it away; the continuations occupying the canals, are next withdrawn by the use of the broach, as described.

An indication following immediately the removal of a dead pulp consists in such sealing of the emptied chamber and canals as shall prevent occupancy by foreign matter, whether from within or without. This embraces the process of preparation and filling,—a subject to which attention may now be directed.

Taking as a first example a tooth from which, after the arsenical application, the devitalized pulp has been removed, the operator is to consider that the surface of separation at the foramen of the tooth cures itself either by the process of immediate cicatrization, or by granulative effort. Could assurance be entertained of the first result, then no better practice might be pursued than the immediate introduction of a permanent filling. As this may not, however, be the case, what is termed a test stopping is to be used. Disinfecting thoroughly the canal, or canals, as the tooth may be single or of several roots, using for such purpose plain water thrown forcibly into the cavities by means of a tooth-syringe, the test is to be made by preparing a most delicate twist of cotton, which in length may double that of the tooth. This twist, being moistened in a very weak dilution of creasote, in phenate of soda, oil of cloves, or in glycerine,

and then thoroughly dried by a free use of bibulous paper or by other means, it is taken up with the point of a delicate root-plugger, and, being carried as deeply into the cavity as possible, fold after fold is to be forced upon it until the space is solidly packed. The canal thus plugged, the chamber proper of the pulp and the common cavity of decay are to be filled either with white wax, with gutta-percha, or, what is found to answer most satisfactorily, a tuft of cotton which has been partly saturated with gum sandarac.

A manner of filling canals temporarily, which will be felt to commend itself, consists in employing the ordinary cotton wrapping twine of the grocer. A canal being cleansed, the thread, holding the antiseptic, is carried into the cavity, and packed precisely in the same way as the twist; an end being allowed to extend to the orifice of the common crown cavity, that thus the packing may be easily removed.

The length of time that a test filling is to be retained varies with almost every case. As a direction which may serve for a principle, it is to be remarked that when, after a single day, a closed cavity remains comfortable,—the patient affected by no consciousness of the presence of the tooth,—and when, on the withdrawal of the test, complete cleanliness is to be recognized in the absence of offensive odor, such a pulp-cavity is to be esteemed in condition to receive the permanent filling. Very often, however, it is found to happen that a test filling is so poorly endured that its presence for a single half-hour will develop symptoms of periodontal irritability, the tooth becoming sore to the touch and sensitive to all impressions. Here we have nothing to do but remove the test and resort to required applications. Quiet restored, the cavity is to be loosely filled with cotton, or it may be left open, and allowed to rest until the irritability has subsided, when, a few days, or a week, having elapsed, the test filling is to be again tried.

In cases where in single-rooted teeth irritability is continuous, it is implied that a suppurating surface exists on the external face of the root, and that the discharge, or oozing, finds its vent through the canal. In these cases, while the operator may, if he please, try stimulating injections forced through the foramen, trusting thus to find himself able to break up the morbid action, a plan which is practised with much more satisfaction consists in the immediate permanent filling of the canal with gold, and the making of a counter-opening through the alveolus, such opening being kept patulous by the use of a tent of cotton. No better plan of treating a suppurating periodontium is to be adopted than using injections through a counter-opening as thus made.

In the case of multi-rooted teeth resisting the test filling, trial is to be made until the particular fang diseased is discovered. Such information is quickly elicited by treating each canal separately.

The treatment of an irritable root here offers itself for consideration. First, the cause of the irritability is to be appreciated. A common one exists in the unhealed condition of parts about the apical foramen. To jam against such a sore part cotton wet with creasote, carbolic acid, and perhaps rolled as

well in iodoform, tannic acid, chalk, or other powdered substance, is to certainly increase the trouble it is the intention to avoid; doing too much is the fault. A well part does not need to be cured. An unhealed part, if progressing favorably, wants simply to be let alone; the requirement of such a condition is protection, not medication. In place of filling such root or roots, as directed, place as closely in contact with the sore part as possible particles of common zinc ointment; nothing is to be found that is more protective than this. A few days and the wound more than likely will be found cicatrized.

A second common cause lies with irritability of periodontal membrane, existing by reason of excess of nutritional work thrown on it. Here time alone can do good; nothing is to be done but wait; every extraneous source of irritation is to be avoided.

A third cause lies with decomposing debris occupying the dentinal tubules, a source of trouble common enough to teeth of loose structure. Here the indication points in the direction of antiseptics. Free, and oft-repeated washings with water forcibly thrown into the canal by means of a syringe is means to the end. Filling a canal with calcined magnesia, repeating the performance daily, is an admirable proceeding. Another means is found in a mixture of iodoform, yellow cinchona bark, and chalk powders; one part of the first, two of the second, and three of the third; this, like the former, is used as a daily dressing until absolute cleanliness is secured. Still another medicament seen to be of value exists in a combination of zinc sulphas with bismuthi subnitras, the proportions being 3ss of the former to ʒj of the latter; this is used precisely as the others. Creasote, carbolic acid, phénol sodique, permanganate of potash in solution, Watson's chlorinated water, iodoform rubbed up with glycerine, with oil of eucalyptus, or, best of all, with cacao butter, are alike agents used as disinfectants, and may be employed.

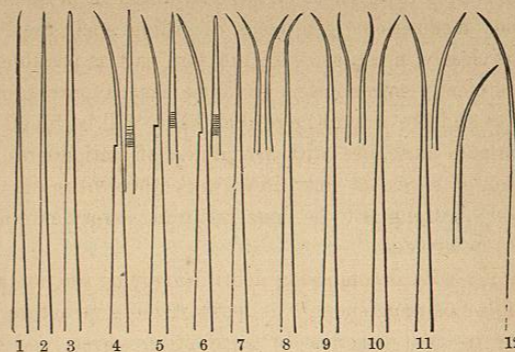
A canal thoroughly cleansed and an irritable one made quiet, a common practice repeats the test plug, and in this direction there is to be found nothing better than the cotton string or twist prepared and introduced dry as directed.

Assured permanency of quiet existing in a pulpless tooth, the filling of the root-canal is to follow, and is accomplished as follows. Take a sheet of gold (say, for illustration, No. 5); cut it into four strips. Take one of these strips, and, folding it once upon itself, run it into a spiral upon a broach or a common pin. Take now this spiral, and carry it by means of a foil-carrier into the canal; if it have been solidly rolled, it may be forced at once quite to the apex of the cavity. Following the carrier with a root-plugger (Fig. 98), the spiral is condensed by forcing turn into turn, spy-glass fashion. Of the remaining pieces of foil, cylinders are to be made of such varying sizes as seem required for the operation.

Another method of using gold in root-filling consists in taking a strip of heavy foil (say No. 20), and, cutting off a delicate thread, carrying it by a point to the apex of the canal. The plugger, fixing thus the initial extremity,

is to be slightly withdrawn, and the thread, portion by portion, crimped upon itself until the canal is full.

FIG. 98.—NERVE-CANAL PLUGGERS.



Still another manner of treating a canal, being that one which is most frequently practised, consists in filling first the apex of the canal with a twist of cotton which has been impregnated with creasote or oil of cloves. Upon this cotton gold is packed. To introduce the cotton, a twist is made, the initial extremity of which is to be of great tenuity. This initial end, or as near it as may be possible, is caught by the end of the root-plugger, and, being carried to the apex of the canal, the remainder of the twist is crimped upon it. Operators of repute are found whose commendation of the cotton plugs extends to the employment of the material for permanently filling the whole canal. Such free use, however, of so loose a material is not to be indorsed except for teeth of most solid structure. Gold is, without doubt, the very best material to be used in the direction, sealing as it does the cavity with an imperviousness which is the highest requirement of all such cases. A common fault with canal-fillings of gold is that the operator fails in carrying the metal to the apex of the cavity, thus permitting the existence of a receptacle in which accidental deposits at once become foreign. A canal solidly full to the very foramen, any exudate which may occur must be associated necessarily with absorbent vessels which adjoin, no road of ingress into the tooth-canal being open.

A source of disease equally to be guarded against exists in the accident of forcing a root-filling into and beyond a foramen. This may occur only where the openings are enlarged, either because of natural condition or from absorption. Such an accident the practitioner is to guard against by informing himself as to the condition of the apex through exploration by a broach. If the part be normal, the sense of touch will discover a closed cavity; if abnormal, the instrument is felt impinging upon soft parts. The latter condition existing, the filling is influenced in the depth to which it is to be carried, by a measurement secured by the broach.

In the use of so delicate an instrument as a broach, great care is to be exercised that the steel does not become jammed in the canal,—perhaps, as has been the case, in the foramen,—and, breaking, leave a cause of offence which may result, not alone in the loss of the tooth, but which, in more than a single instance, has caused loss of life from tetanus. Should such accident occur, every effort is to be made to remove the fragment; the desired result being generally attained by catching the piece in a wisp of dry cotton revolved about it by means of a second broach. Where a broach has been caught and broken in the foramen, it may be found necessary to enlarge the opening by means of a spear drill,—a practice the necessity for which will be found unfortunate, as almost invariably does it result in necrosis of the root so treated. The magnet is another means of getting rid of a broken piece.

The conducting facility of gold being well recognized, the value of a non-conducting substance placed between a plug in the canal and one which is to occupy the crown, is appreciated. Teeth not so treated are subject to a source of continuous irritation to which many succumb; a chronic inflammation, resulting in necrosis, being not infrequently the result of varying thermal impressions. Founded on such experience, the practice is pursued of filling the pulp-chamber proper—that is, the cavity out of which the canals run—with such preparations as the oxychloride of zinc, gutta-percha, Hill's stopping, etc. Lead is sometimes used: preference resides with the oxychloride of zinc. (See chapter on *Filling Teeth*.)

The canal and the pulp-chamber of a tooth filled, observation demonstrates the desirability of a few days' rest to the organ before performing the crown operation; the cavity to be temporarily filled with a sandarac and creasoted cotton plug.

Filling over Exposed Pulp.—So common has the practice become of attempting the performance of the filling of complicated cavities and, at the same time, the saving of pulps, that in the operation dental writers, in their multitudinous suggestions, are too frequently found forgetful of general principles which underlie necessarily all such character of manipulations.

On a former page, mention was made of three sequelæ associated with exposure of the pulp. These three conditions are as naturally conjoined with the relation as is the immediate union of a wound with plastic blood, or non-union with the cacoplastic. Whether or not, therefore, it be worth while to attempt the saving of an exposed pulp, is found to depend exclusively and strictly on the common condition of the individual.

That the vitality of an exposed pulp may be preserved, and a tooth so affected be successfully treated and filled, is a fact attested by every-day record; but that such success is associated more closely with physiological relations than with mechanical skill requires only experience to become to every observer a self-evident fact.

Assuming the existence of such conditions as justify the attempt to save an

implicated pulp, attention is to be invited to methods of practice found by demonstration to be most applicable.

Taking, as a first illustration, a case where the pulp should be scarcely uncovered, but be found overlaid by a layer of devitalized dentine, it has become the quite common practice to trust such layer to the offices of nature, allowing it to remain, rather than expose the pulp-chamber, trusting that through some means the foreign body may be taken care of;—a desired result which frequently occurs, as case after case on record satisfactorily exhibits. In placing a filling, however, over such diseased dentine, it is desirable first to put the tissue in a state of neutrality; that is, tests are to be made for acid or alkaline conditions, and, if either state be found, it is to be antagonized; fungi, an almost constant inhabitant of such devitalized dentine, are to be destroyed: in short, if vitality is not to be restored, causes of change and disintegration are to be removed.

A plate of living dentine, be it ever so thin in the centre, but having circumferential relations sufficient for the maintenance of its vitality, is to be viewed as in a condition which, properly assisted, will tend to grow better rather than worse.

A plate of dentine, on the contrary, with very limited parietal relations, will be found much more disposed to degenerate than to maintain or increase its resistive force.

Cavities of decay opening into the pulp-chamber are treated in a variety of ways. Of the means adopted, the various modes employed may be studied with advantage; it being a common experience that the unsatisfactory and unreliable character of any or all of them tempts the practitioner to try each in its turn.

A means at the present time enjoying large favor is the employment, as a capping, of the preparation described, in the chapter on tooth-filling material, as the oxychloride of zinc. It has, however, become a too common habit to treat of this substance as a specific in the direction, and with such false impression it is every day used by many with a recklessness which has no excuse. That oxychloride of zinc is an admirable agent in the direction, when employed with judicious care, is not to be denied; no substance introduced into a tooth seems to exert greater influence in the excitation of that action which produces secondary dentine, but injudiciously employed, no compound more quickly provokes antagonistic inflammatory action.

In using oxychloride, it certainly is not to be understood that it may be plastered over an exposed pulp *ad libitum*; on the contrary, if it is to be used with prospect of satisfactory result, every consideration must be had to the delicate and susceptible nature of the organ treated. Oxychloride of zinc placed directly upon an exposed nerve can only have good results by an acci-

* A layer of devitalized dentine may be liquefied and absorbed, or it may become encysted; that is to say, between it and the pulp there may be deposited a layer of secondary dentine.

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dent which should just level the break in the continuity of the roof of the cavity, and which should have alone that most happy vascular response which tends to the formation of secondary dentine. These results, however, are precisely what are claimed as the rule by the supporters of the practice; the proof or disproof of the claim the student will, without doubt, incline at some time or other to make for himself.

Oxychloride is recommended in this volume as a capping; indeed, the experience of the author would lead him to esteem it as the most valuable of the agents employed,—and thus far does he fully agree with its enthusiastic admirers; but whether it is to be used with an excess of the chloride, or with this powerful excitant neutralized as much as possible by the inert oxide, depends entirely on the character of the tooth treated. Again, the preparation is not to be brought, in its plastic state, into direct contact with the pulp, but always is it the safer practice to have an interposed plate. As the material of such a plate, oiled paper may be used, or what is still better, caps of platinum as prepared and sold at the dental depots. Fig. 99 shows such caps.

Again, in the use of the agent it is the best plan to feel one's way; success will not infrequently be secured by letting the application, as first made, be so thin a film as may alone prove self-supporting. Upon such film, if no response be made, a second is to be placed, and upon this second a third; the cavity being finally filled complete, and thus allowed to remain until, from continued or accruing comfort, there is reason to infer that the pulp has entirely accommodated itself to the new condition of things.

Perhaps always is it the result that pain, more or less severe, is experienced by a patient upon the introduction of zinc chloride; particularly is this found to be the case where the mixture has been prepared watery, or where a local anæsthetic or a cap has not preceded the application. When such pain continues longer than a few minutes, it is found the safer practice to remove for the time being the filling, or otherwise it is necessary to call off the persistent irritability through means of counter-irritants applied to distant parts; also to diminish circulatory force by the exhibition internally of veratrum viride. By such means it is not infrequently the case that quiet may be restored and the desired protective conditions secured. In the case of a pulp-chamber fairly exposed the process of capping particularly commends itself.

A simple mode of capping an exposed pulp consists in taking a piece of clarified quill, and, after cutting and scraping it into a required shape and thinness, lay it over the break, the circumference being supported by the surrounding hard parts. While held in place with a delicate instrument, it is to be fixed by a plug of oxychloride placed upon it, this material being afterward removed in part for the accommodation of the permanent filling.

Still another manner of accomplishing the proposed protection is found in the use of a layer of oiled silk, or of vellum. These are most suitable as non-



FIG. 99.

conducting qualities are considered, but are objectionable as permanency is concerned.

Other preparations used for capping are lead, tin, asbestos, and the Hill stopping. A plan which many think to be commended by results consists in inclosing asbestos between layers of gold foil, arching metal thus stiffened over the exposed pulp.

Dr. Allport, of Chicago, a skilful dentist, has proposed—and professes to have practised with a success entirely satisfactory—the following delicate operation: Exposing fully the pulp, he takes out of the body of the organ a V-shaped piece, bringing afterward the lips together, and so retaining the apposition as to secure an immediate union. The necessity for such an operation, however, may only occasionally apply.

In the case of a pulp exposed, with the orifice of the exposing cavity jagged, sharp, and irregular, necessity exists for such enlargement and dressing of the same as shall insure the organ—enlarging from time to time, because of functional office—from irritation and strangulation. To accomplish such dressing, it is desirable to constrict the pulp by such means as are found best to answer the end. Tannin in a menstruum of glycerine is a favorite in the direction. Alum-water is an excellent application; tincture of nut-galls is another. The prick of a very sharp instrument, resulting as it does in depletion, is an admirable procedure.

A very effective plan consists in conjoining with the local means hot foot-baths, calling the excess of blood away from the head; also the administration of medicines which tend to diminish the propulsive force of the heart,—the tincture of veratrum viride being perhaps the best of such agents.

An orifice, as described, being enlarged and dressed, capping completes the operation.