Whitening.—Integrity of relation being disturbed by the use of chlorine preparations, the peculiar and marked harm arising out of their employment where caries has undermined the enamel of a tooth is evident enough. Taking as an example a front tooth where decay, running in from an approximal face, has decomposed much of the underlying substance, the injudiciousness of the use of chlorine needs not to be discussed. Whitening in this and similar cases is to be effected by removal of the discolored dentine and the replacing of it by oxychloride of a shade to suit. Here injurious result is to be obviated by complete neutralization of the chloride by the oxide of zinc; such neutralization rendering the filling entirely inert from a chemical standpoint. Free chlorine being no longer existent in it, the plug is one that has in it the meaning alone of color.

A manner of whitening employed with fair satisfaction in particular cases consists in underlaying a plug of gold by a sheet of plaster of Paris. Another manner employs a mat of white paper, which, being put in place, is immediately overlaid by a second made of gold. Still another manner is to take a scale of porcelain and mould it as a support to the wall to be whitened; plaster of zinc chloride being used as the plastic. Another manner still shows a brushing of zinc or lead paint through the discolored face, the paint being covered by zinc phosphate or other plastic material. Preference is to be given to the zinc chloride plastic.

Hæmatin.—Immediate discoloration of a tooth sometimes arises out of a pulpitis so severe as to rupture the red corpuscles of the blood, permitting thus escape of the hæmatin and its speedy absorption by the dentinal tubules. A tooth so disturbed is the subject of such discomfort to a patient that the practitioner is apt to be brought very quickly in contact with it. Treatment consists in opening at once into the pulp-cavity and by means of warm water thoroughly cleansing it. So almost certainly is the death of such a pulp assured that it will commonly be found the best practice to quiet by use of obtunders and afterward apply the arsenical paste; or, if the organ have been freely exposed, its destruction is to be instantaneously assured by means of London paste, a small portion of which, if laid directly in contact with it, kills the part in a moment. Subsequent treatment is as directed in previous cases. Hæmatic discoloration, having the expression of purpura, may take place slowly; the condition is very uncommon.

Discoloration being dependent on absorption of a liquefied dead pulp, or constituents of a pulp, it follows that inter- and intra-dentinal calcification are antagonistic to discoloration; hence, shadings of vascular excitement, existing to an extent promotive of calcareous expression in the dental pulp exudate, are prophylactic of absorption. Teeth naturally dense darken slowly or little at all.

It is not amiss to add in conclusion of the subject that experience leads to much stronger dependence being placed on processes of whitening than of bleaching.

CHAPTER XVII.

REPLANTATION AND TRANSPLANTATION OF TEETH.

By replantation is meant the return of a tooth to its socket after extraction.

By transplantation is meant the transferrence of a tooth from its original to some other locality.

The initiative of these operations lies in experiments performed by John Hunter, in which that famous anatomist transferred teeth taken from the human mouth to slits made in the combs of cocks. These transferred teeth were found not only to become fixed and tolerated in their new position, but subsequent examination of the relation showed that teeth and combs were attached after a manner similar to that which exists between teeth and their natural alveoli.

Replantation.—The frequency with which this operation has now been performed and the success attending it in the hands of a capable practitioner justify the placing of it in the category of operations to be recognized and commended.

It is to be assumed as a start-point that any healthy tooth can be lifted from a healthy socket and returned within reasonable time with an almost absolute certainty of reunion. Per contra, it is to be deduced that in proportion as parts are unhealthy probabilities of reunion are lessened.

Mistakes in Extraction.—A wrong tooth being accidentally removed, the parts being healthy, it is to be returned to its socket immediately on the cessation of bleeding; this cessation to be expedited by means of cold water held in the mouth. To retain the organ in place silk or thread ligatures will most likely be required.

Teeth that have been extracted many hours are found capable of re-fastening. Example: Some fifteen or eighteen years back a young gentleman applied to the author about six o'clock of an evening with a view to having an impression taken for the purpose of replacing with an artificial substitute a central incisor that had been extracted very early in the morning of the same day. Inquiry elicited that the tooth had been removed by mistake. Replantation being proposed, the organ was found, after some search, in one of the pockets of the patient, being mixed up with keys, pieces of money, a knife, and the varied et ceteras of that receptacle, not to exclude the mention of a fair amount of dust. A first step was to throw the tooth into warm water, to which was added about ten per cent. of tinctura iodinii. A second

was to remove the plasma, with which the socket was filled, and to touch the circumference with the iodine tincture. A third consisted in replacing the tooth in its alveolus and in binding it firmly as possible in place by means of silk ligatures. A fourth implied the combating of an active inflammation which showed itself by the next morning, and of a chronic form into which the first degenerated, the latter continuing its discharge of pus, in defiance both of local and constitutional stimulation, for a period of over two weeks. RESULT: The patient was last seen some twelve years after his accident; the tooth was then about as firmly implanted as its fellows. Very trifling change in color was present.*

Extraction and replantation of teeth for the cure of dental abscess is now claiming attention. It is to be appreciated that a tooth is endowed with a twofold source of nutrition: namely, pulp and periodonteum; that vitality is preserved commonly where the first of these has ceased its office; that necrosis certainly ensues where both are dead. With such understanding it is recognized that a necrosed tooth is fit only for the first operation, not for the second.

A tooth in a state of abscess is a tooth lacking pulp vitality; it is an organ chronically inflamed in its periodonteal structure. Chronic inflammation of a periodonteum implies disease of part, perhaps of all, that membrane. A tooth so diseased is found on extraction to have what is known as a pus-bag attached to its root. The cure of abscess implies removal of this pus-bag. In the chapter on alveolar abscess what is to be accepted as the most rational mode of treating that condition is to be found fully considered.

In making up a prognosis as cure, by extraction and replantation, of an abscessed tooth is concerned, an important factor to be taken into considera-

* A plan of retention suggested by Dr. Herbst is not less ingenious than suggestive; the accompanying cut shows it. First, a piece of rubber-dam material, oblong square in shape, with four holes punched in it. Second, this piece applied as exhibited; the lateral incisor is the replanted tooth.

FIG. 100.

Another manner of holding takes an oblong strip of red base-plate gutta-percha that shall be of a form and size, when cut into shape, to reach and cover several neighboring teeth on either side of the one replanted. Softening this gum by use of warm water, it is laid over the arch and moulded back and front. Next, and while it is still soft, the teeth of the opposing jaw are closed against and slightly into it. Articulation being maintained, the splint is hardened by means of cold water thrown about it from a syringe. Finally, a strip bandage is applied with a view of preventing movement.

In the use of means of retention delicacy of arrangement is a necessity. Added to this a mouth-wash, to be used several times a day, and which has seemed to the author never to be lacking in desirable effect, is made by mixing a teaspoonful of the tinctura capsicii et myrrhæ with a goblet of water.

tion is the extent to which periodonteal denudation has progressed. The periodonteum is to be recognized as the life, the only source of supply to the tooth; if there be no periodonteum then the replanted organ occupies a relation with its alveolus differing in the single respect from that which would be held by a plug of ivory or wood that it is a something that once was in physiological harmony. The author is not prepared to deny that such harmony is of favorable import; it is not to be objected to, however, that the history of dead parts, or sequestra, exhibit them as things offensive to nature and which are thrown off. It is a just deduction that a necrosed tooth is not suited for replantation.

A tooth, in the mouth of a healthy person, having alone the extreme end of the fang in a state of abscess, the remainder of the periodonteum being in health, is in favorable condition for treatment by extraction and replantation. The process is as follows:

1. The tooth is to be removed with all delicacy and care, thrown at once into warm water which has been previously medicated with tincture of iodine, the socket, in the mean time, being stuffed with cotton or lint alike medicated.

2. The pus-bag is to be removed from the root. If the underlying cementum be vital in appearance it is left undisturbed; if it be dead, as shown by blackness or by evidence of absorption, it is to be cut away with as little disturbance to adjacent parts as possible.

3. A third step considers treatment of the pulp-cavity. In a tooth where the apex of the root has been retained, the cavity is opened from the crown, and after being thoroughly washed out and profoundly disinfected it is filled solidly to the extreme end of the canal with gold. This being done it is ready for replantation. A root with a necrosed apex demands different treatment. The periodonteum is to be dissected back to an extent which shall insure the covering of the tip of the fang by it when the diseased part has been removed. Next, the pulp-canal is to be exposed from the apex portion of the tooth and filled with gold as in the first instance; great care to be taken in the finishing and polishing of the part lying about the extremity. The filling accomplished, the periodonteum is made to cover the gold; a delicate catgut ligature being used if necessary.

4. The bony cavity in which is accommodated the sac of a dental abscess being covered by an adventitious membrane, a fourth step considers the destruction of that membrane. To accomplish this, after the best surgical manner, the operator employs a delicate spear drill, passing it through the alveolus into the cyst, tearing the parts away. Another, and commonly a necessary, plan of treating such cyst and membrane is to make an opening through the alveolar wall, proceeding with the drill as before. The membrane torn away a twist of cotton saturated with iodine is to be introduced, thus furnishing a drain which serves to void any excess of exudation, or it may be, pus.

5. Relation of tooth and cavity is renewed by simply pushing the first into its socket and confining it in place by tying to neighboring teeth. At this

stage in the operation it is that both danger and trouble are to be, not unlikely, encountered; danger from nervous relations which may, and has, resulted in tetanus; trouble from vascular perversion which over and again has made necessary the re-removal of the tooth, and which, unless skilfully looked after, may very possibly lose for a patient his jaw-bone.

When a tooth is removed from its socket an immediate sequence is the filling up of the alveolus with lymph, which lymph, as a rule, progresses to speedy organization. When, on the contrary, any body, be it foreign or only semi-foreign, is put into the cavity, such lymph does not advance to organization, but, on the contrary, degenerates to pus. Pus in a closed cavity means irritation, associated with much pain. The pathology of such a trouble is not involved by obscurity.

A replanted tooth closes an outlet; one of two things surely follows. It may be, and often is, the case, that a cyst fills with a character of lymph so plastic and coagulable in disposition that organization is effected without the formation of a single drop of pus. This is analogous to the healing of a wound by what is known as "first intention." It is not impossible that degeneration of so limited extent occurs that liquefaction is coincidently followed by absorption; this in like manner is fortunate and conduces to immediate cure. A rule, however, allied with the practice here considered is, that pus forms in the alveolar cavity, finding vent for itself by pushing the replanted tooth from its socket. To obviate or overcome this trouble two means present themselves: one considers an opening through the alveolar plate, as suggested, a second implies a drain-tube preserved in the canal while that cavity was being filled.

To create a drain in the bone nothing more is necessary than to pass a spear-pointed drill through gum and alveolar plate; keeping this opening patulous by means of a cotton twist as heretofore suggested. Than such manner of caring for the necessities of a cyst none other more philosophical is to be adopted.

Drain-tubes used in teeth need little description: they consist of channels of gold passing from apex to crown; being firmly built into the root-canal by means of cohesive gold.

A practice to be mentioned, one highly commended by respectable authority, consists in replacing with gold the removed apex of a tooth to be replanted, the contour to be a fac-simile as to length and circumference of the original part. To do this one of two plans is to be adopted: The part may be built out, as before suggested, cohesive gold being used, or, adopting the manner of capping crowns, a similar gold cap may be applied to a root, the delicately-thinned edges being worked up to a slight distance beneath the periodonteum. To hold such cap firmly in place it is to be attached to the drain-tube, or, if it be proposed to use the bone as a vent, the cap may have its fixedness secured by a pin soldered upon its cap-face, which pin shall pass into the canal, being there retained by the root plug.

Transplantation.—This refers to the use of the teeth of humans or brutes. The most simple illustration of transplantation considers the removal of a tooth from the mouth of one person and its immediate transferrence to that of another. This, *cæteris paribus*, differs little from replantation, and is a practice which assuredly will become widely practised as operators become confident and society grows æsthetic.

The conditions necessary to success in this immediate expression of transplantation pertain to selection of teeth and to the health relations of the two individuals concerned in the transfer. Sale and price enter too into the consideration. One person disposes of charms to another. A surgeon takes the place of a broker.

As an illustration, a defective central incisor may be instanced. One person has such a defective tooth, the renewal of which he or she is very willing to pay for. A second person has a perfect organ which will be gladly parted with for a price. Two matters only remain: Is the tooth on sale of a form perfectly in accord with the requirements? Is it free from objectionable associations?

A transfer being decided on, the parties meet the surgeon, who extracts first the defective tooth, and, when all bleeding has ceased, lifts the second from its socket, which, after immersion for a few minutes in a weak solution of carbolic acid, he plants in the new alveolus made for its reception. Subsequent attention required relates to fixation by means of ligatures and to the combating of vascular perversion provoked.

It may very well happen, however, that in attempt to introduce the tooth into its new socket there is found lack of correspondence. This proves a sad complication, and lessens, in proportion to its demands, the chances of a successful result. The operator making himself acquainted with the unduly impinging relations has nothing to do but at once give up the case or otherwise proceed to trim the root to suit. Where it is possible to effect it, this trimming is always to be done after the enveloping membrane has been lifted from the part to be removed.

Transplantation of brutes' teeth into human sockets is professed to have been accomplished with satisfactory results. The author has had no experience in the direction. The principle of procedure would differ, however, in no respect from that now understood. Able to accomplish the one, an operator would have no hesitation in passing to the other.

Quoting from cases reported in the literature of the subject, it would seem to make little difference whether a root correspond or not with an alveolus. Thus, in one cited by M. Pietkiewietz, that surgeon claims to have extracted an anomalously related lower lateral incisor and to have successfully planted it in the alveolus of a lateral incisor removed from the upper jaw. In this case the circumference of the root planted did not at all correspond, it is said, with the cavity in which it was placed, being very much smaller, while at the same time it was so out of proportion in length that a piece

had to be cut off. Notwithstanding all this difference a perfect success is reported.

Dr. David, a pupil with M. Pietkiewietz of M. Magitot, reports sixty-two cases, fifty-seven of which are claimed to have been successful. In these cases are found included varying ages in patients and all the variety of single and multi-rooted teeth. Reasons for the operations are named as follows: 1. For the adjustment of anomalies of direction. 2. The treatment of caries where situation did not admit of the pulp being reached in order to destroy it, and the practising *in situ* of a satisfactory filling. 3. The treatment of that form of alveolo-dental abscess in which this affection is limited to the summit of the root. 4. Getting at a cavity on another tooth not otherwise to be reached.

A singularity in this matter of tooth-planting relates to the length of time that an organ can be out of the mouth and yet preserve vitality, as manifested by later attachment to an alveolus into which it may be transferred. A case illustrative is reported in the *Dental Cosmos*, where a practitioner having removed a sound eye-tooth from the mouth of a lady in preparation for an artificial denture, planted it four weeks later in the mouth of a gentleman who had applied to him with the view of having a crown pivoted upon the root of a similar class tooth. In place of pivoting, the root was extracted by means of a screw-instrument, and the lady's tooth inserted in the gentleman's jaw. "I opened," says the operator, "into the canal and pulp-chamber from the apex of the root, cutting off first from it the eighth of an inch, it being that much too long; reduced the size somewhat in the centre, it being a trifle larger than the root extracted, filled and placed it in position." Such a success is claimed for this particular case that it is asserted that dentists were unable to distinguish the foreign from the natural organs.

An advantage lying certainly with root-canals filled after extraction of the teeth is the perfection with which the operation is to be accomplished. It is undeniably the case that canals treated after the ordinary manner are almost sure to be unoccupied about the extremity, thus affording a receptacle for decomposing fluid, which proves one of the severest sources of irritation to which a tooth can be subjected. Howsoever manipulated, a pulpless tooth-canal is put in its best condition when solidly and completely filled with gold. If necessary to avoid thermal changes, such root-filling is to be separated, as before suggested, from that required in the crown through interposition of a layer of gutta-percha or oxychloride.

A tooth replanted in restitution—that is, put back into a socket from which it has been removed—may be expected to become reasonably fast in the course of a week. If, in place of a cure that is continuous and progressive, degenerative changes supervene, stimulation is to be resorted to. Cure here may be delayed for weeks.

A tooth transplanted by transposition—that is, removed from one alveolus to another—will seldom unite with any degree of firmness before end of the

second week. It will be found that such teeth seldom or never perfectly harmonize with their new relation. A cold taken, vascular perversion quickly distinguishes them.

Danger from tetanus is never for a single moment to be absent from the mind of an operator who attempts either replantation or transplantation. Nervous irritability is to meet with instant combatal; if it succumb not quickly, the offending tooth is wisely taken from the socket. Tincture of belladonna administered in doses of ten to fifteen drops each three or four hours is found the best remedy. Poisonous effects showing from the use of the medicine, an antidote is found in opium.

CHAPTER XVIII.

DISEASES OF THE TEETH.

SALIVARY CALCULUS.

Salivary Calculus, or tartar, as it is commonly called, is that limelike material so often seen collected upon the necks of the teeth. Observation elicits the fact that the primary seat of deposit is about the posterior or lingual faces of the inferior incisors and the buccal aspect of the superior molars. As in these situations exist the outlets of the salivary secretions, an inference is that from these secretions comes, in part at least, the deposit.

Analysis of Saliva.	Analysis of Salivary Calculus.
Water.	Carbonate of lime.
Ptyalin.	Phosphate of lime.
Fat.	Fat.
Chloride of sodium.	Mucus.
Chloride of potassium.	Accidental matter.
Phosphate of lime.	
Sulpho-cyanide of potassium.	

When the salivary secretions are sluggish, the inorganic material, not being held in solution until fairly ejected into the mouth, becomes deposited about the roughened and inviting surfaces of immediately neighboring teeth. A nucleus once formed, aggregation goes on, until serious secondary lesions are apt to result.

The first and most marked effect of salivary calculus is upon the teeth themselves; beginning about one face, it soon involves the whole organ, and, if undisturbed, envelops, sooner or later, in an imperfect sheath, the whole denture. A mouth so filled with tartar is not only disgusting, but necessarily in an unhealthy condition. Salivary calculus soon destroys the integrity of the teeth. It does this by its effects on the secretory crypts about their necks and by compelling a gradual diminution in the periosteal supply; that membrane receding little by little as the foreign body encroaches on it. As a result of such abstraction of nutrition, the tooth soon dies, and is exfoliated like any other sequestrum; tooth after tooth necrosing, and each month or year one or more dropping from its socket.

Not infrequently there may be seen standing, isolated and alone, on some portion of the dental arch,—most frequently, however, either on the anterior portion of the inferior arch, or the posterior portion of the superior,—a yel-

lowish-looking tumor, which might not inaptly be compared to a shellbark covered with inspissated mucus. Sometimes this tumor will be found quite firm in its position, seeming, indeed, as if it might have sprung from the socket of some long-ago-extracted tooth; at other times you will be able to move it quite freely, as if it had a fleshy peduncle. These tumors give to the mouth a most disagreeable appearance, are oftentimes insufferably offensive, and so detrimental to health that five or six grains of their substance, given to a small animal, will not infrequently cause its death. The composition of such collections consists of phosphate and carbonate of lime, epithelial scales, inspissated mucus, and the various detritus of a cavity devoted to mastication. The nucleus of the growth is of course a tooth. The manner of formation is too evident to need description. The author has removed these calculi, where the nucleus had become so encysted, from crown to apex, that no trace of it was to be discovered without dividing the mass. Where, however, the encystment has advanced to this extent, the tumor is about ready to drop from the mouth. A calculus of this kind has been met with where the six lower front teeth were encysted, making as strange a looking tumor as could be well imagined.

Similar calculi develop, as may be inferred, in other parts of the mouth. Thus, just within the orifice of the duct of Steno they are occasionally found; the tumor, in such a case, bulging out from the cheek against the second molar tooth of the upper jaw. The formation of such a tumor in this situation does not necessarily imply the closure of the orifice of the duct; it forms when the gland is sluggish. The secretion not being in sufficient abundance to hold the lime of the saliva in solution until it is ejected from the duct, that substance falls upon the floor of the duct, and, lodging, makes the calculus.

An instance is recalled where a mass of this calcareous matter, fully the size of the largest almond, seemed to be growing from all that portion of the sublingual region anterior to the gland of that name; one-half the tumor looked as if it might be below the level of the floor of the mouth, the mucous membrane enveloping the mass with a ragged and an ulcerated fringe, the condition presenting a strange and threatening look; there was no apparent direct association between the tumor and the neighboring teeth, and it was as firmly fixed as though it might be a growth springing from neighboring bone. Yet this was a salivary calculus and nothing else, the only question being as to its cause and fixedness.

Looking about the mouth, it was perceived that the patient had certain artificial teeth on the left side of the arch; these teeth were all coated with tartar, and so associated thereby with the natural teeth as to be only distinguishable by that difference in the translucency so immediately noticeable by any one experienced in such direction. Knowing well that it is a plan with many dentists to secure such teeth by passing a strong gold wire across the mouth, and which wire not infrequently buries itself within the mucous mem-