

dorsed it. With these agents as thus locally applied, incisions, in the way of the removal of sebaceous and other superficial tumors, the opening of abscesses, carbuncles, and similar operations, are assuredly to be made with fair satisfaction; but in their application to the teeth the obtunding of the sensibility has not by any means been so marked, and particularly has this been found the case where rhigolene was used.

The process of freezing a part through the known refrigerant power of evaporating ether seems first to have suggested itself to Dr. Richardson, of London. An instrument invented by this gentleman for the accomplishment of such an end is here exhibited, forms of bellows for both hand and foot being represented (Figs. 316 and 317).

For the spraying of any plain surface, a simple straight tube is all that is necessary. For the teeth, the double sprayer, as seen in the drawing, is used; with this instrument a continuous vapor is cast upon both the outer and inner face of the gum, congelation being rapidly induced.

In using the hand-instrument the operator should not himself work the pump. A very few moments' compression of the ball renders the hand shaky and unmanageable.

Upon this instrument of Dr. Richardson's many modifications have already been made. Of these, one by Messrs. Codman & Shurtleff, of Boston, has perhaps attracted most attention. It certainly seems to divide the ether more infinitesimally, thus insuring complete vaporization; but it has a weak point, in that the tube frequently freezes or chokes up,—an accident that does not occur with the Richardson apparatus.

An objection urged to the use of extreme cold, as above induced, is injury done to the soft parts. That such objection is valid seems, however, not to be satisfactorily proven; if anything, parts thus operated upon unite better and with less inflammatory reaction than obtains where the spray is not used.

Rhigolene, or hydrocarbon, manufactured from coal-oil, and much vaunted by some, has not proven so satisfactory as ether. It certainly freezes a part more quickly than this latter agent, but the anæsthesia is not so complete.

## CHAPTER XXIX.

### PROSTHETIC DENTISTRY.

PROSTHETIC dentistry treats of the replacement of lost natural teeth by artificial ones set upon a plate. It is what is generally known as mechanical dentistry.

A full set of artificial teeth is called a denture. A plate having one or several teeth attached is commonly called a piece.

**Preparation of Mouth.**—The preparation of a mouth for the reception of a plate implies that the operator consider in the relations of each case the hygienic, mechanical, and artistic considerations therewith necessarily associated: one mouth, the lips being long; the process full, the arch markedly concave, and of some depth; the gums solid and resisting; the submucous structure neither deficient nor excessive; the teeth all absent, or such as may remain having harmonious relation; temperament lymphatic,—such a mouth the merest tyro will accommodate. On the contrary, lips short; process absorbed to a line; arch flat; gums irregularly flaccid and hard; teeth all gone or, where some remain, inharmonious to a common articular relation; temperament nervous,—such a mouth the most skilful will scarcely serve to satisfy.

A mouth before prepared to receive a denture, full or partial, is to be free from all roots which may have association with the parts to be occupied; teeth irregular to the arch, and thus the source of deficient symmetry, or such as may interfere with a successful fitting of the artificial piece, or such as may be diseased and lacking in promise,—these are to receive attention and judgment.

As a rule, a plate is not to rest upon a root, healthy or unhealthy. The retention of an isolated tooth in the dental arch (all the others having been lost), however healthy and symmetrical, except it be in a position where a plate is not to go back of it, will be apt to antagonize the merits of any denture, however perfect its construction. Soft teeth are not to be clasped. A cachectic mucous membrane is to be covered alone with a gold plate which has been alloyed with platinum, the baser materials being irritative. A turgid congested membrane is not capable of affording an impression which will allow a denture to be useful. Scorbutus, ptyalism, all unhealthy conditions are to find correction before an impression is taken. Clasp teeth are to be freed from tartar, and (except when the denture is to be temporary) alveoli are to be absorbed.

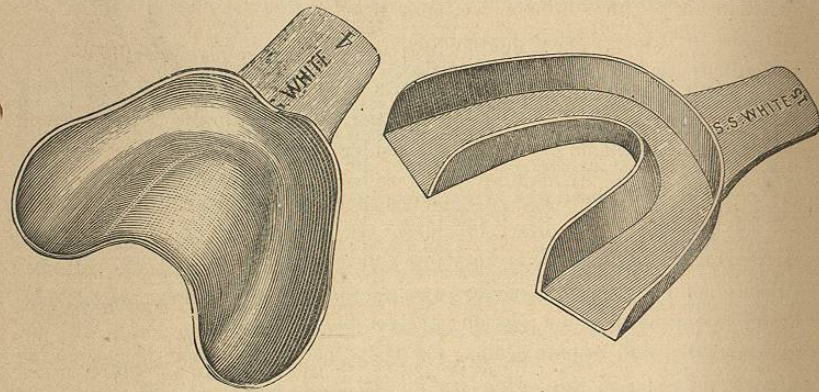


**THE IMPRESSION.**—The first step in the construction of an artificial denture or piece is the taking of an impression, or measure. This consists simply in filling a tray (of which every size and variety is supplied at the depots) with softened wax, plaster, or other impression material, and pressing it over the parts to be modelled.\*

Trays are of two general forms, the one being designed for the superior arch, the other for the inferior.

In selecting one for use in any special case, regard is to be had to the

FIG. 318.—TRAY FOR SUPERIOR JAW. FIG. 319.—TRAY FOR INFERIOR JAW.



requirements. First, such a tray is to be employed as shall admit of easy passage through the labial commissure. If an arch be deep in its palatal aspect, the one used will require to have marked convexity; otherwise a common cup may be made to answer equally well for deep or shallow arches by means of a false bottom. For application to the lower arch, a deep or narrow rim is demanded, as the alveolar process may happen to be prominent or the reverse. In many mouths the site of the original process is found to have entirely disappeared, leaving a perfectly flat surface that will require a tray without any flange.

A tray is to be large enough to embrace the alveolar arch, leaving a space between gum and rim of about a quarter of an inch: it is to be deep enough to include the tubers of the upper jaw, or to touch the rami of the lower. If teeth long and prominent stand in either jaw, particularly the anterior in the lower, as is very common, it may be found more convenient to use a tray so cut as to admit of such teeth passing through it (Fig. 320); this, however, is not a necessity, and not always even a convenience.

\* A case presenting where irritability is so great as to cause retching and sick stomach is commonly to be corrected by means of a gargle made by mixing two drachms of bromide of potassium with an ounce of water. Another plan is to prepare the parts by practice of irritation, anticipating the impression by at least a week.

Modifications on these common trays are numerous; few practitioners, however, recognize sufficient merit in them to feel their consequence, finding rather in skill, the result of practice,

that which meets the various requirements. An impression, good as requisite, has been taken with a piece of shingle whittled for the occasion; but the hand that secured the cast was experienced. The author has never, in his own practice, employed other than the character of trays here shown, and takes it for granted that his trouble in getting satisfactory impressions has been about of a common experience with others. As suggested, however, it is well to employ for the palatal arch

the tray with a false bottom. Any one can make such false bottoms for himself by replacing, with pieces of tin or other metal, bent into shape, the centre which is to be cut from the tray. Having a number of these bottoms (which should be somewhat larger than the piece removed), an operator finds himself requiring very few cups; half a dozen, or certainly a dozen, will be sufficient. This false bottom may be duplicated by building the centre of a tray to the required height by means of wax or plaster.

FIG. 320.—TRAY FOR PASSAGE OF TEETH.



Materials elected for taking impressions are wax, plaster of Paris, gutta-percha, and modelling compound, either being used alone or in combinations. The inexperienced should begin with wax, as this is most simple and easy of manipulation, and at the same time quite capable of meeting all indications.

*Wax.*—Two kinds of wax are employed, the white and the yellow: of these, the white is, on some accounts, to be preferred. It will take a sharper impression, and has not its shape so readily deranged. An objection, however, is a lack of plasticity as compared with the yellow, much more time and trouble being required to prepare it for the tray, while corresponding increase in pressure is demanded to force it into place,—the latter being a matter of importance where there is excess of the submucous cellular tissue.

Yellow wax, when pure, will, under all ordinary circumstances, afford a satisfactory impression. To soften it to a required consistency, which is about that of dough, it is only necessary to work it at the fire, or over a spirit-lamp, or in hot water. Having selected a tray and observed the requirements of a special case,—that is, having considered the matter of depth of mouth, position of remaining teeth, and character of mucous membrane, whether this latter be hard or soft, yielding or unyielding,—the wax is piled into the tray, being heaped in the middle if the mouth be deep, smoothed, and flat-



tened, on the contrary if it be shallow; the wax to be very soft if the membrane be flaccid, of greater consistence if it be firm. The operator, if to take an impression of the upper jaw, stands behind, leaning over the head of the patient; if of the lower, a position is assumed in front and to the right. Tray and wax being in the mouth, observation is demanded to see if such correspondence of relation exist as will allow the cup being carried into place. If care be not exercised in this direction, it will frequently be found that the cup is not far enough back in the mouth, or perhaps it is too far back, or too much to one or the other of the sides, so that, as this last is concerned, in pressing it into place, the sharp edge of some portion of the ridge comes down upon the gum, producing not only much pain, but rendering the impression good for nothing. A proper correspondence existing, it only remains to press the tray gently and steadily upon the arch, throwing the lip off should it interfere,—a manipulation, this last, easily accomplished by running a finger between lip and wax. A tray is never to be rocked into place, but rather carried with all steadiness until it is felt to be fixed and firm. Such a bearing obtained and preserved, the finger of the operator is to press the wax around the external face of the alveolar process, and where the false bottom has been used this is to be forced into the roof of the mouth. If the impression be of the lower jaw, the wax is to be pushed with the finger against the internal face of the process as well as against the external. Before removing an impression of wax from the mouth, it is to be allowed to remain a few minutes to harden. If, in the withdrawal, suction is recognized, the impression will almost certainly prove a good one. A tray is held most steadily in the mouth by being supported on either side.

Some operators, skilful in the use of wax as an impression-material, find it necessary to employ a strand of silk or thread run through the material just before introducing it into the mouth, that, after securing the cast, they may get it away by letting in air through withdrawal of the string; the accuracy of the fit they obtain resulting in a suction so powerful as to make it difficult to get away the tray without derangement of the plastic.

Before taking an impression, a mouth is to be cleared of saliva and mucus. This is most conveniently accomplished through rinsing with water and cologne, a teaspoonful of the latter to half a goblet of the former, or, if more convenient, the cologne may be replaced with alcohol.

It is occasionally found recommended that immediately upon withdrawal of a wax impression from the mouth it be plunged into ice-water, or otherwise that it be laid upon ice. This is a practice scarcely to be endorsed, the varying thickness of the wax rendering some change not unlikely. Unless hurry exist, it is best to leave the cast to the existing state of the atmosphere.

*Sulphate of Lime—Plaster of Paris.*—Plaster of Paris mixed with water into a paste, or batter, is very widely employed as an agent for taking impressions. Plaster to be useful for such purpose must be of the very best

quality; this implies that it has been well calcined and thoroughly pulverized. To employ it, the operator selects a tray, and, filling it with the plaster batter, it is passed into the mouth in such manner that bubbles of air shall not be caught in the depth of the arch,—that is, the pressure which carries the mass into place is to be exerted gradually from the front backward.

For plaster (employing it with the upper arch), cups or trays, as portrayed in Fig. 318, are commonly used. These cups are made of britannia and are easily forced into any change of form required. A plan preferred, however, by many, consists in first taking an impression in wax, precisely as has been directed. This secured, the surface of impression is indifferently cut away, simply with the view of securing what might be termed a fairly-fitting wax tray. Into this is now poured the plaster batter, and the whole is reintroduced into the mouth. Put batter first in concavity of arch where very deep.

Employing plaster for the lower arch, the tray as shown in Fig. 319, uncut, is found entirely applicable. The requisites of a tray holding the plaster batter are, depth of flange sufficient to invest the alveolar face to an extent required to be covered by the paste, and a relation to the arch which insures the plaster reaching every position of the part to be modelled.

To take an impression in plaster, a patient is to be seated upon a low chair, and the head inclined forward at an angle sufficient to prevent the falling of particles back into the throat. The batter is to be of a consistency which does not allow it to run from the tray, nor, on the other hand is it to be so stiff and hard that it may not take the desired cast. The time required for setting is about three minutes; it may be shorter or it may be longer,—this depending on the character of the plaster used. The proper time for the removal from the mouth of a plaster impression is designated by the sharp, abrupt break to be seen by fracturing any inconsiderable and unimportant fragment, or by testing such portion as may be left in the mixing-vessel. The matter of the time for removal is of very marked importance; should the batter not have set, the impression is of course worthless. Should it, on the contrary, have become too solid, it may bring a portion of the mucous membrane with it; particularly in the case of the superior arch. Plaster known in the market as "superfine" is the best.

Plaster that is slow in setting finds the defect removed by the addition of a small portion of common table salt, or, what is thought by some to be better, the sulphate of potash.

Plaster of Paris as an agent for impressions finds its most convenient application to edentulous arches; that it is used, however, with all success for partial sets of teeth is daily demonstrated. To take a partial impression it is found convenient to have a tray with a false flange. After the batter has set, this flange is to be withdrawn, the bottom part of the tray being separated from the mass by means of the point of the knife-blade. Next, the impression is broken into pieces, each fragment being removed carefully and



preserved. When all are away, each piece is coaptated with its fellow, thus restoring the cast.

A second mode of taking a partial impression is found in the use of a wax cast; the cup thus detached, the wax is quickly and easily removed from the plaster; the exposed cast is now broken and treated as before described.

Occasionally, indeed frequently, it happens that if the proper moment be secured, a plaster cast, even although it enclose several teeth, may be removed with reasonable facility without occasion for the fracturing as suggested. It is a point with many operators to try and save themselves the trouble arising out of breakage, and with a reasonable experience this is oftentimes to be accomplished.

*Modelling Compound.*—This is a preparation composed of French damar, Venice turpentine, talc, coloring matter, and aromatics. As an impression material it is sharp and of firm fixation. The manner of use is the same as for wax.

*Gutta-Percha.*—This material, used alone, has never impressed the author as an agent of sufficient merit to warrant, in this direction, any special commendation. It is not only troublesome to manipulate, but from its tendency to undue hardening, as influenced by circumstances, is tedious to look after; it may not have comparison with either the wax or the plaster. As an agent of admixture with wax, however, it is at times found a not unsatisfactory adjunct, insuring, as it does, an accuracy and sharpness in outline which is the highest recommendation of an impression. Gutta-percha alone, or in combination with wax, is used precisely the same as the pure wax, being softened by moist or dry heat, placed in the cup, and thus applied. When the gutta-percha alone is used, trouble may be experienced in getting it from the mouth, particularly in cases where teeth stand in an irregular relation to one another in the arch.

*The Model.*—An impression of the mouth secured, a succeeding step is the making of a model. This model is to be a fac-simile of the parts taken in the impression, and is made in a very few moments, as follows: If the impression be of wax, or gutta-percha, or of the mixture of wax and gutta-percha, or modelling compound, the surface is to be thoroughly smeared with oil, the tray is placed upon a table, a strip of paper, or lead, or waxed cloth, —any convenient thing, being of a length sufficient to encircle the circumference of the impression, and of a width not less than one and a half inches, —is to be placed around the tray, forming thus a temporary cup, the bottom of which is the impression. Taking now plaster of Paris sufficient in quantity to fill this cup, it is mixed with water into a batter of the consistency of very thick cream, and in this state it is poured, with care, beginning at one corner, into the cup. When set solid, which will require two or three hours, the strip is to be taken away, the tray removed by heating it slightly, and the wax, being further warmed and softened, is picked off little by little, any convenient instrument being used, an ordinary pocket-knife answering the

purpose quite as well as anything else. This model is the cast to which the mechanic works; it is a perfect likeness of the mouth to which the teeth are to be fitted.

In the case of a plaster impression the manipulations for securing the model differ somewhat from the above. The impression is first to be thinly varnished, and when dry is to be oiled, and the cream batter poured as before. When solid, the plaster impression is to be broken by the taps of a mallet, and thus, in pieces, lifted away. Another plan is to put the cast and impression in water, where the impression, by reason of its greater dryness, will absorb the fluid and expand more rapidly than the cast, so that it can be lifted away without injuring the model, and in many cases saving the impression for secondary use in case accident should render this desirable.

To insure a plaster model against chipping it is commonly coated with shellac varnish; this is accomplished by repeated brushings, one coat being dry before another is applied. Where it is important to insure much resistance on the part of a model, it is a practice adopted by many to boil it for about half an hour in a strong solution of alum; the officinal, or potassa-alum, is the variety used.

*The Denture.*—At this point is to be considered the mechanical performance of making the denture. The student whose purpose it is to practise dental art exclusively will have to duplicate the present work by one on mechanism. Out of such a work, of which there are several to be had of the booksellers, he will find himself able to secure the proper details.

The procedure of an oral surgeon in this connection is as follows: Taking the model which he has made, he transfers it to the hands of a mechanical dentist, being judicious in selecting one who possesses an art appreciation of his work. This latter now makes what is known as a trial plate,—a plate made to prove the correctness of the impression,—which, being delivered to the surgeon, is placed in the mouth, and, if found right, receives the articulation. To make a trial plate is nothing more difficult, however, than taking a piece of sheet gutta-percha or modelling composition and, warming it into ductility, spread it over the face of the model. Sheet-lead, wax, or any convenient means may be used. One is to be moulded and trimmed into shape in five minutes.

Plates for the denture are of two kinds,—those supported by clasps, or bands, which pass around certain teeth, and those which depend on atmospheric pressure for support. Whether the one or the other of these is to be employed depends entirely on the state of the mouth. Where all the teeth are gone, there is, of course, but the single resource: the plate must be made to cover the full arch, and, if the case is for the superior jaw, a cavity, occupying the centre of the palatine face, is to be made in it. Where certain teeth are present, these being of good shape to support bands, and of vigorous health and solid structure, it may prove a matter of comfort to the patient to take advantage of such means to give him a plate which allows exposure



to a greater extent of mucous membrane,—a matter of little consequence to the comfort of the lymphatic temperament, but of much concern to the nervous.

The matter of holding a plate by means of atmospheric pressure demands both experience and thought. The usual manner consists in cutting from heavy sheet-lead a half-moon-shaped piece, which piece is moulded upon the palatine face of the plaster model, with a view of securing a similar elevation in the zinc cast to be made from it, and a counter-depression in the lead mould prepared upon this latter. As will be inferred, a metal plate struck between such casts would contain a cavity corresponding in shape and depth with the piece of sheet-lead. If a denture plate be celluloid or gutta-percha, the moulding of the plastic over the prepared face of the plaster model secures the same cavity.

The shape and characteristics of a palate have much to do with success in suction cavities. The best kind of a palate is one that is reasonably deep and not too soft. Sometimes it is found desirable to use no vacuum plate, but to cover the oral roof fully and accurately. On the other hand, cases are met where the plate is to relate solely with the alveolar arch, the suction cavity occupying the whole hard palate.

Cavities made on the principle of the leather sucker, a plaything familiar to every school-boy, are favorites with many; these being used alone or as adjuncts to the kinds described. A form of these is known as the Beer's disk. Attached to a plate prepared with a cavity, it requires alone to be pressed against the roof of the mouth in order to hold. Being made of pure gum, consequently being soft, any rocking occurring with the plate does not detach it. The manner of holding is absolutely that of the leather sucker, while it differs nothing in form from that toy, being round, saucer-shaped, with its middle occupied by a rivet instead of by a string, which rivet relates disk and plate.\*

A disk of this same meaning has been shown the author by Mr. I. E. Clifford, of Windermere, England; it differs, however, from the Beer instrument in being circularly corrugated, some on one, others on both faces. This disk, attached to a plate after the manner of the American device,

\* "Some members of the profession consider the disk a valuable invention for extremely difficult cases, but not necessary in the majority of mouths. In this they are seriously mistaken, for it is really of great utility in almost every case, and all who are compelled to wear artificial teeth should have the benefit of it. The large majority of plates made with the ordinary 'suction chamber' are likely to tilt during mastication, thereby admitting air beneath them and destroying the vacuum, and very often they are thrown down in coughing, sneezing, etc., to the great annoyance and embarrassment of the wearers. With the disk attachment it is impossible to dislodge a set of teeth by any movement of the mouth, and the wearer has a sense of security and satisfaction which cannot be enjoyed with a set made by the old method. We therefore claim that a set of artificial teeth is unfinished unless it has this improvement, which adds so much to the comfort of the patient."—From advertisement of inventor.

catches the oral roof with considerable tenacity. The pieces corrugated on both surfaces adhere alike, on pressure, to plate and arch of palate.

A manner of supporting dentures, now almost obsolete, consists in the use of spiral springs.

**The Articulation.**—Articulation considers bite,—that is, it is necessary to know how the natural teeth stand in order that the artificial shall be in harmony with them. To secure articulation the procedure is as follows:

*The Partial Denture.*—We take, as the most simple illustration, a plate upon which is to be placed a partial denture, say the six central teeth of the upper jaw. Try the plate in its place, and see if a fit has been secured; fit is adaptability; every part of a plate is to rest evenly and solidly upon its base. If bands have been used, these are to enclose with the nicest accuracy the special teeth to which they are related,—they are to hug the teeth. Where atmospheric pressure is the means of support, the relation of parts is to be so intimate that withdrawal of air from beneath the plate—effected through suction by the tongue—causes it to adhere to the parts with more or less tenacity.

Satisfied of the adaptability of the plate, a succeeding step consists in softening a piece of beeswax precisely as was done for the wax impression, and, moulding this upon that part of the plate to be occupied by the new teeth, the patient is directed to close his mouth. This, as is seen, bites the lower teeth into the wax, thus affording knowledge of how the artificial teeth are to be set; leaning the head far back insures against false bite. Associated with this step is the trimming of the wax while in the mouth, into what shall seem the required length of the new teeth; also the wax overlying that portion of the plate which covers the external face of the alveolar ridge is to be so trimmed and moulded as to give proper contour, or expression, to the overlying lip. In such partial cases, however, it is not at all a necessity that anything more be done by the surgeon than secure the bite as directed. The mechanic, if at all an artist, has every required guide in the surrounding relations; the trimming and modelling he can do to suit himself. What is called a shade, is required, however, by him; this is secured by matching in color the natural by an artificial tooth, of which latter the surgeon is to have at his command quite a number.

*The Full Half-Denture.*—A full half-denture implies the complete set either of the upper or the lower arch. We consider first the upper. Try the plate in the mouth to test its adaptability. If this be satisfactory, let the patient close the teeth of the lower jaw upon it. This affords information as to a general line at which these teeth will strike the plate. Take now the plate from the mouth, and build upon it a rim of wax of a height which, when in the mouth, will represent the required length of the new teeth. Such height is readily distinguished by trimming the wax little by little, until, in the various movements of the lips, as in talking, laughing, etc., it is seen to afford the promise of a natural expression. This secured, let the patient make a line of the impression of his lower teeth by slightly biting