

MECHANICAL
DENTISTRY

E. Samson

MECHANICAL DENTISTRY

*A PRACTICAL TREATISE ON THE
CONSTRUCTION OF THE VARIOUS
KINDS OF ARTIFICIAL DENTURES*

Based on the Eighth Edition
of Charles Hunter's work of
the same title

RE-EDITED

By

EDWARD SAMSON

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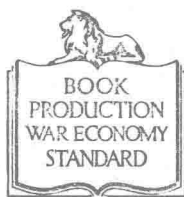
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FOREWORD

IN re-editing this textbook, which has successfully survived so many editions, it was particularly gratifying to discover that the principles upon which skilled prosthesis are based, are still the same, however some may attempt to ignore them. Moreover, it may be confidently stated that herein the author laid down a set of rules which at all times must inform conduct in any workroom where the highest standard is the only aim. To-day, when the dental mechanic enjoys the use of many inventions and labour-saving devices to circumvent so many of the processes essential to the successful work of his predecessors, it is pleasant to read of the skill and knowledge necessary to our earlier prosthetists. It is even more pleasant to be able to bring them to the notice of contemporary dentists to whom they are equally important.

It may be that few of us swage our gold plates to-day ; spoilt, as we are, by the easier methods of casting. It may be, too, that innumerable synthetic resins and quickly applied gum-facings are causing us to forget the knowledge and skill required to effect continuous gum-work, finely fitted tube teeth, and exactly employed pin teeth with backings. And no doubt the celluloid denture and the dowel crown have passed into the limbo of a glorious past with the foot-lathe. Nevertheless, such things demanded a dexterity and application which were the very substance of sound mechanical dentistry. Though the more elaborate and often more lengthy methods may not be popular to-day, an intimate association with their theory and practice is as essential to the conscientious dentist and mechanic as is the alphabet to the author or reader. For that reason I make no excuse for retaining these subjects in this splendid little book. In fact, rather than excuse myself, I would give these observations as sound reasons for their inclusion. Whatever changes may overcome the nature of prosthetic work, however the standard of our procedures might be lowered by economic considerations or labour-saving devices, no dentist can begin to understand or perform his workshop technique unless he comprehends fully the basic principles of his work. The fact that this opus has lived through so many editions is sufficient to prove that it embodies

these principles; indeed, one may well say that herein are the fundamental formulæ upon which prosthesis stands, and to comprehend them is to comprehend all else.

I am particularly indebted to the Amalgamated Dental Co., Ltd., for the generous way in which they have allowed me to use illustrations to supplement many parts of this book. My acknowledgments are also due to the authors of "Notes on Porcelain Jacket Crowns and Dental Ceramics" from which work I have quoted fully and the illustrations of which I have employed.

EDWARD SAMSON.

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MECHANICAL DENTISTRY

CHAPTER I.

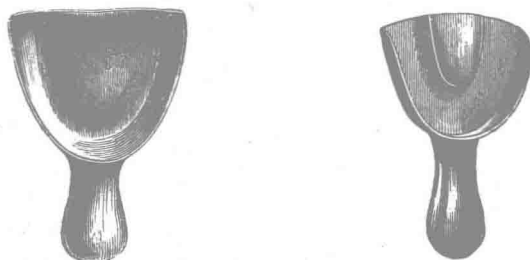
IMPRESSIONS AND PLASTER MODELS

The method of practice adopted by the earlier dentists in the construction of artificial teeth was, as may be supposed, very different and much less satisfactory than that which is pursued at the present day. Measurements by means of compasses were first taken of those parts of the jaw for which the artificial teeth were required, and by the indications thus obtained a piece of bone was cut into an approximate adaptation to the space to be filled. The natural gums and teeth were then coloured—as we might colour a plaster model now—in order that fine fitting might be accomplished. Such was the method adopted by Fauchard and explained in his work published in 1728; and it was not till many years afterwards that the practice of measuring was superseded by that of obtaining an impression of the jaw by means of softened beeswax. At first the piece of wax was held by the fingers and pressed by them into the form of the gum; but it was afterwards discovered that when the soft material was placed in a metal tray of such shape as freely enclosed the parts of which an impression was desired, and pressed by means of this tray into the shape of the jaw, much more satisfactory results were obtained. Wax as an impression material is now seldom if ever used, though it has certain advantages as an impression material in the making of splints for fractured jaws, Dentocoll, plaster of Paris, or compounds (Paribar, Stents, Kerr) or Zelex being now almost invariably employed for general purposes in impression taking.

Impression Trays.—The ordinary trays in which the material is placed when an impression of the mouth is taken are made of nickel-silver, and are obtainable in a great variety of shapes and sizes for both complete and partial impressions. Trays made of “softer” metal are also obtainable. These can be easily bent, cut, or twisted to meet the demands of abnormal cases,

though they are tough enough to withstand the pressure of ordinary usage without being distorted.

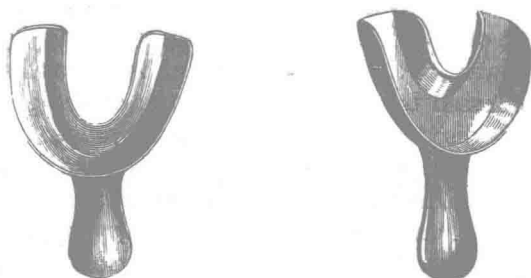
For complete upper impressions, trays similar to those shown in Figs. 1 and 2 are used. For edentulous jaws, and for lowers



FIGS. 1, 2. Complete Upper Impression Trays.

in which the front six or eight natural teeth remain, a tray such as Fig. 3 is used.

When only a small, partial impression of the jaw is required—as is often the case when a denture consisting of a small number of teeth is to be provided—the tray represented in Fig. 5 is used if the deficiency occurs in the front of the mouth, and those

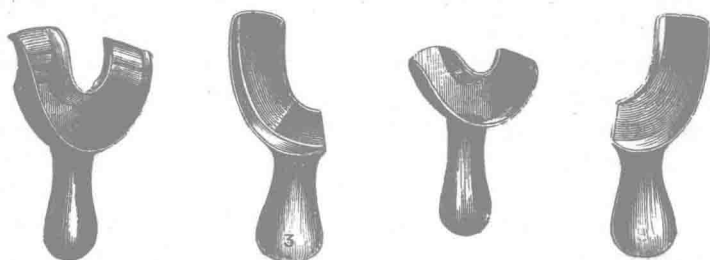


FIGS. 3, 4. Complete Lower Impression Tray.

represented in Figs. 6 and 8 are employed if the denture is required for either side. The choice of trays for these partial cases, however, depends not only upon the position of the space to be filled, but also upon the position of the natural teeth which will best support the denture in the mouth; therefore it is frequently necessary to use a large tray, in order that the accurate impression of all teeth may be obtained. A selection of about fifteen trays, differing in dimensions, is necessary in order that the practitioner may be provided with such as are required in

everyday practice. Most dentists, however, use a much larger selection.

For special cases where a good impression cannot be obtained by the ordinary means, trays are sometimes made by the dentist himself in the following way. An impression of the jaw is taken with composition, in an ordinary tray. Into this impression plaster is run, and a model made.¹ Upon the plaster model softened wax, about an eighth of an inch thick, is pressed, covering both teeth and gums, and extending in all directions as far as the more perfect model may be desired to reach. A zinc die and lead counter are then obtained, and a plate of Britannia-metal or sheet zinc is struck to the full size indicated by the wax covering



FIGS. 5, 6, 7, and 8. Partial Impression Trays.

on the model. A piece of metal is then soft-soldered to the bottom of the tray to serve for a handle. This may be done with the blowpipe flame, touching the joint with the soldering liquid described under "Soft Soldering." The amount of impression material which should be placed in a struck tray is, of course, very small compared with what is required for the ordinary kind. The material, in fact, should be in the form of a layer but little thicker than the covering upon the model. By this means very accurate impressions may be obtained in difficult cases with the composition.

A struck tray is not essential when plaster of Paris is the impression material. In these circumstances, if it be desirable to use a special tray, one may be made from gutta-percha which has been pressed into shape on the plaster model, a piece of iron wire bent into suitable shape being heated and imbedded in the gutta-percha to serve as a handle. "Special" trays may also

¹ If this paragraph should not be quite clear, Chapters I and II should be first read, and this matter reverted to.

be made by making a plaster of Paris mould from a wax model and then pouring into it a "soft" metal mixture, usually of tin and lead. A tray of this description can easily be made in an hour or less.

Impression Materials.—(a) *Dentocoll*. Probably one of the best impression materials is *Dentocoll*. It is a hydrocolloidal material, possessing, according to the manufacturers'¹ literature, "unique qualities of elasticity and slight impressibility, sufficient to enable good impressions to be obtained under the most difficult conditions." When heated it is plastic and flows into place with slight pressure. In the chilled state it permits easy withdrawal from the mouth, irrespective of the number of teeth standing, and despite any number of undercuts, yet it does not "creep" or distort. It has an agreeable flavour, and its use is characterised by a complete absence of nausea. It does not heat the oral tissues like plaster, nor cause the patient any discomfort either in the taking of the impression or its withdrawal from the mouth. Manipulation is simple; impressions can be taken in one piece; no separating medium is necessary; duplicate models can be made from the original impressions and it remains always sterile because, to prepare it for use it has to be boiled.

Originally, special perforated impression trays were necessary, but with the development of the so-called *Dentocoll* "wash method" these are no longer required. Directions for taking an impression with *Dentocoll* by this method are as follows:—

Place a tube of *Dentocoll* in a suitable vessel and boil for 8 minutes; the tube should be totally immersed.

With a suitable impression tray take a snap impression; using *Paribar* impression compound.

There is no time period for this snap impression; straight in and out is recommended in order to retain the full plasticity of the *Paribar*.

With the finger depress more deeply the tooth impressions in order to make room for the *Dentocoll* wash.

Replace the impression in the mouth to restore the shape which may have been over-distorted in the preceding stage. With a heated knife, remove the excess *Paribar* from the border of the tray, including back of palate, and place the impression in cold water for at least 2 minutes. It is important

¹ The Amalgamated Dental Co., Ltd.

that this preliminary Paribar impression should be thoroughly chilled.

The above processes can all be carried out while the Dentocoll is being boiled.

Remove preliminary impression from cold water and dry.

After boiling the tube of Dentocoll, remove and place in cold water for 2 seconds, after which hold lightly in the hand until the tube becomes too hot to be comfortably held, when again immerse in cold water for a further 2 seconds. It is not necessary to knead the tube during this cooling operation. The temperature must be reduced in the manner described until the collapsible tube can be handled.

Remove cap from the collapsible tube and carefully eject material into the preliminary impression, working from left to right, around the border of the tray. A second roll should be ejected into the tooth recessions or sulcus of tray and a third roll around the palatal surface of the impression.

Provided the preliminary impression was well up in the palate it is not necessary to cover this with Dentocoll. The material will flow over uncovered areas at the time of insertion in the mouth.

The nature of the impression does not permit of much Dentocoll being employed, and by limiting the quantity in the above manner it prevents excess of material squeezing past the palate and so embarrassing the patient.

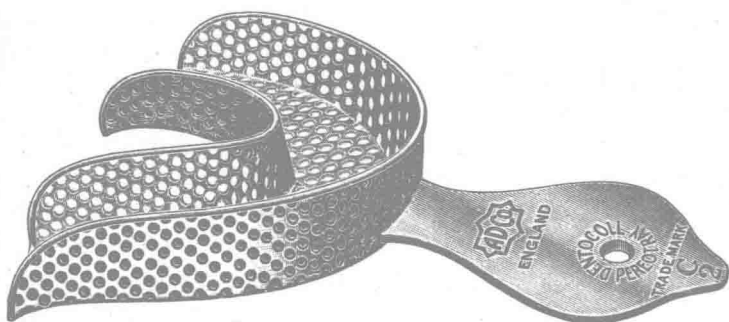


FIG. A. Perforated Impression Tray for the use of Dentocoll.

Insert tray into the mouth and syringe with cold water for 3 minutes. Actually, provided the compound impression is thoroughly chilled 2 minutes' syringing will suffice.

Remove the impression with care and place in a humidor ; or cast immediately.¹

(b) *Plaster of Paris*. This substance is not too easy to use, and is not very pleasant for the patient, but it has the advantage of producing impressions of great accuracy. The plaster should be new and of the best quality. It must be carefully mixed, and this should be done in or as near the operating-room as possible. It is generally found necessary to mix with the water, before adding the plaster, a small quantity of salt or other substance which will accelerate the setting. The quantity of this setting-mixture to be used altogether depends upon the condition of the plaster at the time of mixing. New plaster, for instance, requires more "hastening" than that which has been some time in use. Where there is any doubt about the setting-time of plaster, a small quantity should be mixed as a test, and the time noted that it takes to change from the consistence of molasses to the condition when it will *break*. The mixture can then be applied in order to accelerate up to the desired time.

The proper quantity of water and setting-mixture having been placed in a rubber mixing bowl, the plaster is added in a careful and equal manner with a plaster server until it reaches the surface of the water ; it is then mixed thoroughly and filled into the tray. The plaster should be left higher in the centre, so that on introducing it into the mouth it will come first in contact with the palate. When it shows a disposition to retain the form given to it with the knife or spatula, it is ready for placing in the mouth and taking the impression. Another indication of its readiness is when the tray can be turned over without spilling the plaster. For very high palates a little plaster is sometimes taken from the bowl on the point of the forefinger, and placed directly on that part of the palate just before introducing the tray.²

With regard to taking the impression, Mr. Coles says : " The great secret of saving your patient any discomfort is just to have the right quantity of plaster in the tray to suit the case, and then with a steady hand place it well back in the mouth before

¹ "Zelex," produced by the manufacturers, has now, in the editor's opinion, superseded Dentocoll, being as perfect in results and far easier of manipulation.

² Calspar is a superior form of dental plaster, prepared especially for impressions. It has a consistent and convenient setting-time ; it breaks with a clean fracture, and the pieces can be accurately reassembled. Its pink colour is a distinct advantage when separating the impression from the model. It does not set too hard, and is easily removed from the mouth or model.

you let it touch the teeth. After this bring the free borders of the back of the tray into contact with the superior part of the palate, and then press upwards from behind forwards until the whole of the tray embraces the dental arch. Adopting this plan secures two points: it prevents the plaster falling backwards and falling upon the base of the tongue to produce retching, and also brings the overplus to the front of the mouth, where it is visible and therefore more manageable. When the plaster that remains in the bowl will break with a clean sharp fracture the impression must be removed from the mouth. Air having been let in at the sides by drawing away the cheeks and lips, steady downward pressure must be applied to detach the mould from the teeth and gums. At this part of the process there must be no hesitation on the part of the operator, as every moment the hardness of plaster is increased and the difficulty of safe removal becomes greater." For edentulous and many partial cases the ordinary tray, filled in the manner described, will give the best results. Where the teeth standing in the mouth are leaning towards each other, however, or are what is called under-cut, a plaster impression so taken would occasion much trouble, so that it is advisable to provide in a special way for overcoming these difficulties.

We may do this either by altering the arrangement in the tray, so that on withdrawing the impression, the plaster will readily break at the difficult points, and in such a manner that it can easily be joined again, or we may make such a temporary change upon the standing teeth themselves as will enable the impression to be readily withdrawn.

The first can be effected in the following manner. Take a compound impression in the usual way, and scoop out this over palate and gums to the depth of at least an eighth of an inch, and freely about the teeth, leaving, however, the border of the impression standing to the breadth of about an eighth of an inch. This forms a shallow box, into which—the surface having been roughened—plaster is filled, the narrow border which has been left across the palate being a guide as to the quantity required, and also serving as a dam to prevent the escape backwards of the plaster. The model is taken in the manner already described for this material, and, when withdrawn, the plaster will readily break at the under-cuts. The pieces are then collected, placed back in position, and fastened with cement at the bench.

Professor Austen advocates another method, but on the same principle: "Take a compound impression and make a model; in partial cases brush over the teeth of the model one or two layers of thin plaster, to fill up all under-cuts, and to make the plate fit loosely; saturate the model with water and mould over it a gutta-percha cup. It should be on the inside from $\frac{1}{4}$ to $\frac{1}{2}$ an inch thick, so as to be stiff and unyielding; but on the outside, next the lips, not more than $\frac{1}{8}$ or $\frac{1}{16}$ thick, so as to be slightly elastic and yielding. The inside of the cup must be roughened so that the plaster can take firm hold. In most partial cases the impression must be removed in sections, the inside remaining entire, but the outside and the parts between the teeth coming away separately. In very difficult cases it is necessary to partially cut into the cup, so as to permit its removal in sections with the plaster adherent. These cups have no handle, but are removed by inserting a blunt instrument into a small hole previously made in the back part of the cup where it is thickest."

The other principle upon which these difficulties are overcome is to make such alterations in the mouth itself as will permit the withdrawal of the impression. This is done by first of all drying the parts, and filling in the under-cuts with softened wax or clay; the impression is then taken with an ordinary tray filled with plaster.

The construction of special metal trays to such a shape that the plaster will fracture at the most suitable places is also a simple method of overcoming difficulties with plaster impressions.

(c) *Impression Compound*. When the state of the tissues is such that slight pressure may be applied, impression compound, or modelling composition as it is also known, reproduces in the most minute detail all the finest lines and markings of the oral mucous membrane.

The late Dr. J. W. Greene developed a highly efficient system of impression taking with Kerr's Impression Compound, and the following is a description of his method extracted from his work on the subject.¹

Place a cake of Kerr's Impression Compound in a pan of hot water, nearly hot enough to burn the hands (120° to 130° F.), using rubber-dam under the material to prevent it sticking to the vessel.

With warm wet fingers, thoroughly work and knead some of

¹ The Greene System of Advance Test Methods in Impression Taking.

the warmed compound until there are no hard spots, then form it into a ball as large as an average-sized walnut and place it in the prepared tray. Now hurriedly fashion the material with thumb and fingers to conform somewhat to the shape of the gums, keeping it well forward in the tray, and making it high in the centre, according to the height of the vault, with plenty of material over the edge to form the rim of the impression. Then slightly and quickly heat the entire surface of the fashioned compound with the mouth blowpipe until it glosses. To guard against burning the patient, the flame-heated surface can be dipped in the warm water just before entering the mouth.

With the left arm around the patient's head and the head inclined forward rather than backward, insert the tray with its contents quickly into the mouth and with the middle finger on the under-side centre of the tray, gently push upward with a wave-like pressure.

When the impression is in place, the material that overlaps the rim of the metal tray is pushed upward by applying pressure to the cheek from the outside. Chill and remove. Trim off excess material, leaving the correctable impression or compound tray.

The first operation on the correctable impression or compound tray is to heat the entire inner surface to a semi-flowing condition, using the mouth blowpipe. Quickly dip in warm water and seat in the mouth with a light upward wave-like pressure.

Now let go of the tray, and if the impression stays in place, without any movement of the cheeks or lips to dislodge it or without being held by the rim, it is proof that the impression fits on the roof and on the ridge. If it does not stick, re-heat the entire inner surface of the impression with the mouth blowpipe, and return it to the mouth for a little more wave-pressure, until it does remain in position. Cool thoroughly and remove.

The roof and ridge now being equalised, there are no hard or soft parts to the impression, and so no "reliefs" are needed.

In order to prepare the rim of the impression for the steps that follow, the surplus material must be trimmed off the outside, leaving it slightly thicker than the finished rim is to be. It must also be made slightly higher, which can be effected by warming the edge and pinching it up with the fingers, or by tracing on more material with a Kerr's Compound Stick.

To trim off the surplus with the least amount of effort, slightly warm the spot to be cut, and use a sharp knife.

The surplus material should also be trimmed off the rear, leaving it about one-eighth to three-sixteenths of an inch in thickness. If the impression does not reach back far enough, more material can be added with the compound stick.

The next step is to get the proper height of the rim and proper fit to the lip and cheek muscles, so that they may work freely and yet with valve-like piston tightness, to prevent air leaking. This is accomplished wholly by "muscle-trimming"—by the muscles and moving tissues themselves.

Correct "muscle-trimming" can be done only on a soft surface over a hard background, as follows:—

The edge of the extra high rim is made very soft to a very shallow depth (approximately to a depth of about an eighth of an inch) with the mouth blowpipe. The impression is then slipped very quickly into the mouth, held firmly to place, and the patient instructed to make all movements of the lips and cheeks that would ordinarily be made in wearing a denture. This step is often called "very-edging," because the edge of the rim must be *very* soft to a *very* shallow depth, and the work done *very* quickly (three *verys*). When the impression is removed, the surplus material should be trimmed off. Sometimes the process has to be repeated, and particular points, where the rim might indicate muscle strain, may require re-warming to get the trimming exact. The impression must always be cooled before each re-heating.

It is now necessary to equalise the pressure on the outer side of the alveolar ridge so as to stop all air leaks on the inner upper edge of the impression, and cause it to press against the soft parts to get an air-tight fit on the soft places as well as on the harder ones.

To accomplish this, slowly and slightly warm, from the outer side inwardly, that part of the impression that is above the metal tray until it will yield a little to pressure. The heat must be applied slowly (using the mouth blowpipe) in order to give it time to penetrate into the material without making the rim too soft, which would spoil the muscle-trimming. Carefully slip the impression into the mouth, hold it up with the long finger of one hand, and press gently with the thumb and fingers of the other hand, horizontally against the cheek and on the lip, and hold it so for a minute. By this time the Kerr impression compound will have "set" enough to prevent rebounding. Cool