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IMPRESSION TECHNIQUES IN FIXED PROSTHODONTICS - A REVIEW

Dental Science

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ABSTRACT

A successful dental restoration is mainly dependent on the accuracy of the dental impressions. An impression is an imprint or negative replica. There are several impression techniques developed to produce duplications as accurate as possible. The accuracy of an impression depends on the materials used for impression making as well as the techniques. Each technique has got its own advantages and drawbacks. There are many studies being conducted to develop more accurate techniques with various combinations of materials. The aim of this paper is to review all the techniques of impression making in fixed prosthodontics.

KEYWORDS

Fixed Prosthodontics, Impression Techniques, Putty Wash Impression, Dual Phase Impression, Monophase Impression.

Introduction.

A successful dental restoration is mainly dependent on the accuracy of the dental impressions. An impression is an imprint or negative replica. The indirect technique for fabrication of inlays, onlays, crowns, and fixed partial dentures has been a boon to the dental practice. It is neither possible nor desirable to make patterns for fixed partial dentures directly in the mouth. Therefore it is necessary to obtain a cast or model of the tissues, which must be accurate replica of the prepared tooth in the mouth.[1]

For a dentist it is very important to select a suitable impression technique using appropriate materials to get a model as accurate as possible. Therefore it is important to know the properties of various impression materials and their effect when used with different impression techniques. This will help to select a technique, which will give the maximum benefits within the available materials, and techniques.[3]

There are several impression techniques developed to produce duplications as accurate as possible. The accuracy of an impression depends on the materials used for impression making as well as the techniques. Each technique has got its own advantages and drawbacks. There are many studies being conducted to develop more accurate techniques with various combinations of materials. But the technique that gives 100% accuracy is yet to be developed.[1, 2] This present paper aim at reviewing all the available techniques of impression making in fixed prosthodontics.

Impression Techniques

There are various techniques for making fixed partial denture (FPD) impressions, those are:

I. Putty-wash impression
II. Dual-phase impression
III. Mono-phase impression
IV. Hydrocolloid laminate technique
V. Copper-band impression technique
VI. Impression using vacuum-adapted splints
VII. Impression using preformed crown shells
VIII. Dual-arch impression technique
IX. Functional check bite impression
X. Matrix impression system
XI. Cast impression coping technique
XII. Digital impressions

For a dentist it is very important to select a suitable impression technique using appropriate materials to get a model as accurate as possible.[1]

I. Putty-Wash Impression

This is a stock tray impression technique. There are two methods to make a putty wash impression

1. One step/ Single mix putty-wash impression
2. Two step/double mix putty wash impression.[2]

One step/ Single mix putty-wash impression

In this procedure both the materials (light body and putty) are used simultaneously. The putty material is loaded into the stock tray. The light body material is syringed around the tooth preparation. A full mouth Impression is made using the loaded stock tray.[2]

Two step/double mix putty wash impression

In this procedure putty impression made in suitable stock tray and then the light body material is syringed over the putty impression and also over the tooth preparation. Space for the light body material is created by placing the polyethylene sheet as spacer before making putty impression or by scraping the material using BP blade or round bur.[2]

Advantages:

1. Eliminates the time and cost of fabricating custom tray.
2. Metal stock trays are rigid and are less susceptible to distortion.

Disadvantages:

1. More impression material is required.
2. Metal trays must be sterilized.
3. The thickness of impression material will be uneven, and hence uneven polymerization shrinkage may occur.[2]

II. Dual-Phase Impression:

Also called as " custom tray impression technique" or "laminate single impression technique". The most accurate impression is usually achieved using heavy-body and light-body addition silicone in conjunction with a rigid custom tray and a meticulous clinical technique. However, these materials can be used in a rigid stock tray.[1]

In this technique, the light body (wash type) material is laminated in a thin layer on the surface of the heavy body material and immediately positioned upon the preparation. The purpose of this lamination is to prevent the direct contact of the heavy body with the preparation surfaces, which may produce roughness of the cast surface. The heavy body material also drives the light body material into the gingival sulci

and preparation details without the use of a syringe, although a syringe is sometimes used for injecting light body into blind portions of the preparation.[4]

Advantages:
1. Less impression material is needed than with stock tray technique.
2. Sterilization is not a problem as the tray is used only for one patient.
3. A uniform thickness of the impression material minimizes the distortion due to the uneven polymerization shrinkage.
4. Patient will be more comfortable with this technique.

Disadvantages:
1. Construction of the custom tray is a time consuming procedure.
2. The tray must be constructed **24 hours** before use to minimize the distortion.
3. The residual monomer form special tray may cause tissue irritation for some patients.

III. Mono-Phase Impression

The procedures for monophase impression are same as for the dual-phase impression except that **medium-viscosity material** is used both as the tray material and the syringe material.

A medium viscosity (regular body) elastomeric impression material in a custom tray with **3mm** spacer is used. The surface reproduction may not be as good as that of light body material in this technique. Also the medium viscosity material will show a greater amount of polymerization shrinkage than compared to that of heavy body materials because of the lesser amount of filler content.[2]

IV. Hydrocolloid Laminate Technique:

The hydrocolloid laminate technique makes use of the combination of reversible (agar) and irreversible (alginate) hydrocolloids. The agar is used in the form of syringe material and is injected onto the area to be recorded, and chilled alginate mix in the stock tray is positioned on it. The alginate gels by chemical reaction, where as the agar gels by means of contact with the cool alginate rather than a water circulated tray. Since the hydrocolloid in contact with the tissue surface is agar, it reproduces maximum surface details.[2]

The advantage of the laminate technique is that it is more economical than compared to the newer elastomeric impression materials. The surface reproduction is satisfactory than that with an impression using only alginate. But there may be some distortions as the agar gels from the outer surface towards the prepared teeth and this may be minimum because of lesser thickness of the agar material.

V. Copper-Band Impression Technique

The copper-band or tube is used to obtain an impression of multiple preparations when there are only vague margins on one or two preparations that are not adequately replicated in the impression. The patient's condition, the extent of the aberration evaluated, and judgment determines whether the copper band technique saves time or a remake of the original impression is more appropriate.[2]

The copper band or copper tube impression in made with following combinations of techniques.
1. The original copper tube and modeling compound method
2. A variety of copper tube and elastomer combinations
3. Resin copings and elastomer
4. Polycarbonate crowns and elastomers
5. Resin (provisional) crowns or fixed partial dentures with elastomers

All the above techniques make use of a rigid carrier for the impression material and the carrier typically becomes the part of the impression. The registration of the finish line is initially achieved in the carrier. The displacement of the gingiva is usually accomplished as the modeling compound or elastomer is delivered to the sulcus.[5]

VI. Impression Using Vacuum-Adapted Splints:

Antony LaForgia (1970) has given a simplified procedure for making impressions of multiple abutments, using vacuum adapted temporary splint material as a tray former. In this technique using temporary splint material tray former is fabricated. After the preparation of teeth is completed, cold-curing resin is mixed and inserted into the tray former to fill the space created by the preparations and the edentulous spaces. The resin loaded tray former is then seated onto the arch and cold-curing acrylic is allowed to polymerize. The internal surface of the tray is relieved except one stop that is retained on the occlusal area. Thinner rubber base adhesive is applied to all surfaces of the tray and allowed to dry. Tray is then loaded with heavy body rubber base impression material and a primary impression is made. All the internal surfaces are relieved for final impression and perforations are made on the occlusal and incisal surfaces to provide escape vents for the impression material. The tray is filled with a mixture of equal parts of light and regular-body rubber base impression materials by means of a syringe or spatula and placed into position on the abutments in the mouth. After the material sets, an overall impression is made in an oversized stock tray or an individual acrylic resin tray using regular-body rubber base impression material.[6]

VII. Impression Using Preformed Crown Shells

M R Dimashkieh & Steven M Morgano(1995) have developed a procedure in which prefabricated temporary crown shells are used for each tooth preparation and a final over impression is then made using a stock tray.[7]

1. Select a preformed polycarbonate crown (Ion Polycarbonate Temporary Crowns, Dental Products/3M, St. Paul, Minn.) and adjust the gingival margin to extend slightly to the finish line of the preparation. The crown should fit loosely over the tooth. Adjust the proximal contacts to avoid binding on contiguous teeth. Do not remove the tab.
2. Coat the internal and external surfaces of the provisional crown shell with the adhesive recommended by the manufacturer for the planned impression material.
3. Mix a regular-body elastomeric impression material and fill the provisional crown shell. Avoid air entrapment when the crown is filled.
4. Seat the crown shell onto the prepared tooth until it covers the finish line and the material is allowed to set.
5. Finally make a pick-up impression using regular-body impression material in a complete-arch stock tray.[7]

VIII. Dual-Arch Impression Technique:

The simultaneous recording of tooth preparation(s), the opposing antagonistic teeth, and the inter-occlusal relation of the relative opposing dentition within a single impression for the fabrication of one or two indirect restorations was first introduced by ***Wilson & Werrin*** in **1983**.[8]

Werrin designed the dual-arch impression tray in **1979** and registered the design in **1980**. The tray consists of a plastic framework with a plastic sieve and a handle. The tray should be first tried on the patient so that he is able to approximate his teeth after placement of tray. The crossbar of the tray should be distal to the last tooth of the arch.[8]

Technique.[8]
1. The syringe material is injected into the area to be recorded.
2. The high viscosity material is mixed and placed in excess on both the arches.
3. The tray is placed in between the arches.
4. Patient is asked to occlude (bite) slowly
5. After making the impression, the patient is instructed to open his mouth slowly.
6. As the patient opens his mouth, the tray will adhere to one arch.
7. Bilateral pressure (right and left) should be applied to remove the tray as it helps to minimize distortion .
8. Die stone is poured into the impression of the tooth preparation.
9. The impressions are boxed and casts of both arches are poured.
10. Articulation should be done on a hinge articulator with an incisal pin to maintain vertical dimension.

Advantages
- Less impression material is required as only one part of the arch is recorded.
- Less time is taken as both the arches are recorded simultaneously.
- Maximum intercuspation position can be recorded more accurately as it is recorded during function.

Disadvantages
- Distortion is possible because the tray is not rigid
- Cannot be used for more than one casting per quadrant.

- Uneven distribution of impression material may occur.

IX. Functional Checkbite Impression:

Edwin H Getz (1971) has described a procedure to combine the functional impression with the checkbite impression so as to benefit from the best of each.[9]

Conventional Checkbite impression is made using a unilateral Checkbite impression tray with medium body rubber-base impression material. But a functional Checkbite impression is made after fabricating a temporary fixed partial denture of acrylic resin. It is best to allow a few days between the preparation and the impression procedures.[9]

The temporary restoration is removed from the mouth and occlusal surface is reduced to allow addition of 1 to 2 mm of wax. Then centric relation record is first well established with a generous amount of wax. Then right and left lateral movements are carefully added, one at a time, followed by a final verification of the centric relation position. When finished, the chew-in record made on the reduced temporary restoration should reproduce, in smooth contours the clearance for the cusps of the opposing teeth in all of their functional movements. Next, the opposing teeth used in developing the wax chew-in record are dried and painted with a sheet of thin, wet cellophane, and the patient is instructed to close the jaws in centric position. The acrylic forms an accurate impression or index of the chew-in. then the temporary restoration with the attached chew-in record is removed from the mouth. The gingival retraction procedure is undertaken. The acrylic index adhering to the opposing teeth is left undisturbed. Once the gingival displacement is achieved the syringe and tray are filled with rubber-base impression material. The retraction cord is removed and syringe material is injected around the prepared teeth and the tray is seated and patient is asked to bite in centric position. Now the completed impression contains the impression of abutment preparations and edentulous ridges on one side and an impression of the functional index
on the other side.[9]

X. Matrix Impression System

The matrix impression system uses three impression materials:

1. A suitable elastomeric semi-rigid material required to form the matrix
2. A high viscosity elastomeric impression material, which will preferably bond to matrix-forming material, and
3. A stock tray with a medium viscosity elastomeric impression material to pickup the matrix impression and the remaining arch not covered by the matrix.[1]

XI. Cast Impression Coping Technique

The cast impression coping technique allows the use of stock trays without serious consequences, even when a putty wash impression is not preferred. Although the cast impression coping technique requires a second impression appointment because of the laboratory phase, the waiting period results in healthier periodontal tissues and better impressions. Also, this technique negates the need for gingival displacement; it results in a better impression environment and does not result in postoperative sensitivity. The technique can be performed without local anesthesia in the majority of cases.[12]

Technique:

After the completion of teeth preparation an alginate impression is made. The impression is immediately poured with die stone. Provisional restoration is cemented on to the prepared teeth and the patient is called for another appointment to make the final impression.

Dies are prepared and coated with several layers of die spacer so that the copings will have a space of at least 0.7 mm for the light body impression material. In addition, blockout material may be used under the margin areas so the casting can be of approximately 1.0 mm past the margin so as not to engage any undercuts. It is advisable to mark the buccal surface of each coping so they can be oriented correctly during the impression procedure. The internal surfaces of the copings may be roughened with a coarse diamond. Sandblasting, holes prepared with round bur, or appropriate adhesives also may be used to secure the impression material within the coping. A polyether material is suggested, as it is accurate enough for the wash and strong enough for the pickup phase.

At the final impression appointment, all temporaries are removed and all cement and other particulate matter is removed from the abutments. The clean cast copings are tested to ensure the proper fit and preparation coverage. The cast copings are filled with light body impression material using a impression syringe and placed carefully on each prepared tooth. It is best to keep the copings slightly under filled for improved visibility. Then a stock tray is filled with heavy body impression material and positioned onto the arch. Upon complete setting of the impression materials, the tray is removed in a snap fashion and the temporaries are recemented. The impression is poured with die stone and further laboratory procedure is carried out to fabricate the restorations.[12]

XII. Digital impression

With the techniques of computer-aided design and computer-aided manufacturing (CAD/CAM) being applied in the field of prosthodontics, a concept of intraoral digital impressions was put forward in the early 1980s. It has drawn comprehensive attention from dentists and has been used for dental prosthesis fabrication in a number of cases. This new digital impression technique is expected to bring about absolute digitization to the mode of prosthodontics.[12]

CAD/CAM systems are composed of three major parts: (1) a data acquisition unit, which collects the data from the region of the preparation teeth and neighboring structures and then converts them to virtual impressions (an optical impression is created at this moment directly or indirectly); (2) software for designing virtual restorations anchored in virtual impressions and setting up all the milling parameters; and (3) a computerized milling device for manufacturing the restoration with solid blocks of the chosen restorative material.[1]

The main digital impression systems those are available on the market include CEREC, Lava C.O.S. system, iTero, E4D, and TRIOS. They vary from each other in terms of various features such as working principle, light source, the necessity of powder coat spraying, operative process, and output file format.[12]

Conclusion

The accuracy as well as dimensional stability of an impression may be depending on the type of the material used, type of the tray selected, and the technique followed. With availability of various techniques and advancements the operator should select a material and technique which suits best for the particular situation. The intraoral digital impression technique aids the CAD/CAM process. As a relatively new technique, dental products fabricated with intraoral digital impressions have presented accuracy as compared with conventional impressions.

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