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A Comprehensive Review of Impression Techniques in Oral Implantology

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ABSTRACT
Dental implants are fixtures that serve as replacements for the root of a missing natural tooth. Dental implant therapy has been widely used for the restoration of partially and fully edentulous patients. Implantology currently consists of a reliable oral treatment that follows scientific and clinical evidence. Despite the proven success of rehabilitations with implants throughout a long period of time, many difficulties still persist without solution. The objective of the impression procedure in implantology is to obtain the most accurate copy of the implant analogues and the surrounding oral tissues, avoiding instabilities in the prosthetic device. Precise fit between dental implants and the superstructure is important for the long term success of implants and implant-supported prostheses.Taking this factor into consideration, the present review article emphasizes on the different types of impression techniques used in implant dentistry.

Keywords: Impression techniques, Implant dentistry, Impression coping.

I. INTRODUCTION

Implants, defined as "to graft or insert a material such as an alloplastic substance, an encapsulated drug, or tissue into the body of a recipient," have reshaped modern dentistry to the point where they are now considered a hallmark in daily clinical practise.[1-3] When compared to conventional complete and partial frameworks, implants provide excellent support, function, and aesthetics for fixed as well as removable prosthesis.[4,5] The future success and sturdiness of an implant are determined by a passive and precise match of the implant suprastructure to the implant abutment, which reduces prosthetic complications.[6] The implant impression technique used is therefore responsible for this exact transfer. Hence, utmost importance should be placed on the accuracy and technique used in implant dentistry.[7,8]

The three-dimensional orientation of the implant that is present intra-orally is a critical factor to consider. With the advancement of impression techniques and materials, it is becoming increasingly important for a prosthodontist to select the appropriate impression technique and impression material for a given case based on scientific knowledge.

Despite the fact that a variety of techniques for creating impressions for implant-retained prostheses have evolved, each one has its own set of challenges. As a result, deciding on an impression technique, which has a significant impact on the treatment's outcome, is still a time-consuming process. Position, depth, axis/angulation, rotation-hex position, and soft tissue contour are all recorded using impressions in implant dentistry (Emergence Profile).[9] This article highlights the various techniques of implant impressions as well as modifications pertaining to cases which require special demand in specific situations.

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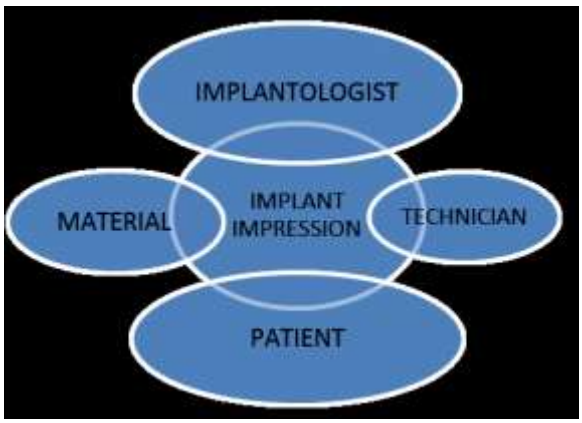

Fig. 1 Successful implant impression criteria

Implant components

The success, function and aesthetics of an implant restoration are dependent on the proper treatment planning and through knowledge of components and instrumentation commonly used components are drivers, healing abutments, lab analogues, screws and impression copings.

a) Drivers

Drivers are designed to carry different types of components of implant to the mouth for easier placement and removal. The driver head design can be square, hexagonal and abutment driver and contra-angle torque driver.

b) Healing abutments

Based on clinical situation healing abutments available in different lengths and diameters

c) Laboratory analogues

Laboratory analogues are metal replicas that duplicate the implant head or abutment connected to the implant which are used in laboratory to construct working model.

d) Impression copings

When the soft tissue around the healing abutment has matured completely, impression copings have been used to make final impressions. The soft tissue around the head of the implant should be fully supported by these copings, which have the same flare as the healing abutments. Different types of copings are available, and they are chosen based on the impression techniques. When the set impression is removed, the coping is retained in the mouth. The coping is incorporated into the impression in the pick-up type, and it is removed from the mouth with the set impression.

e) Abutments

Abutments are components that attach directly to the head of the implant and extend through the gingiva into the oral cavity to replace missing coronal structure. The height and thickness of the surrounding soft tissue, the interocclusal space and the type of restoration to be placed, the height of the lip line, the occlusal scheme, and the position of the tooth in the arch are all factors to consider when choosing an abutment.[10,11]

Techniques for implant impressions

1) Fixture level impressions

The impression coping is attached to the implant fixture's top (body of the implant). The abutment can be selected right on the model, where the superstructure can also be fabricated, after a fixture-level impression is taken. The model can be connected to the screw retained type abutment in particular; the superstructure is then fabricated. (fig. 2).


Fig. 2 Fixture level

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2) Abutment level impressions

The abutments are connected to the top of the implant fixture (body) and then the impression copings are connected to them, resulting in an abutment level impression. The abutment-level impression does not remove the connected abutment in the oral cavity. To avoid any discrepancy in the impressions, the healing cap/gingival former should be used until the superstructure is completed to protect the connected abutment and prevent gingival growth (fig. 3).

Fig. 3 Abutment level

It has been reported that when the pick-up technique is used instead of the traditional crown and bridge impression technique, the accuracy of the implant-abutment level impression is higher.[12] In terms of angle accuracy of implants, the fixture-level technique fell short of the abutment-level technique, with mostly linear errors. In the case of highly diverged posterior implants, the abutment-level method showed better linear accuracy. When using abutment-level impressions, increasing the angle of implant divergence from 40° to 60° may not result in a significant increase in errors.[13]

3) Open tray/ direct/ pick-up impressions

One of the most common impression techniques is the open tray impression. This method aids in the connection of the impression coping to the oral cavity fixture. Remove the impression coping's screw procedure from the open tray once the impression material has hardened. The impression body is removed from the oral cavity, along with the impression coping. (fig. 4)

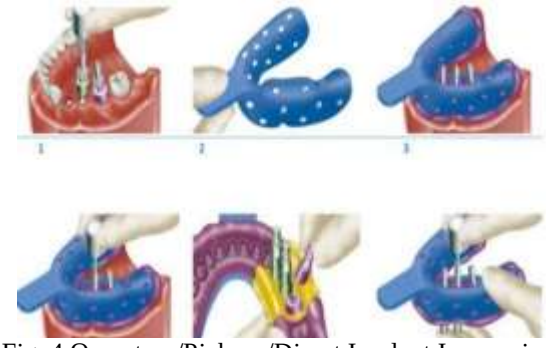

Fig. 4 Open tray/Pick-up/Direct Implant Impressions

The open tray technique eliminates the extra worry of replacing the copings into the impression and reduces the effect of implant angulation, which deforms the impression material upon recovery from the mouth.[14] The pick-up impression gets its name from the fact that after the impression hardens, the impression coping is removed along with the impression body.

Splinted and non-splinted techniques are sub-divisions of this technique. The underlying principle of splinting the impression copings is to use a rigid material to connect all of the impression copings together, preventing individual copings from moving during the impression-making procedure.

The transfer copings are splinted to prevent rotational movement of the impression copings in the impression material during analogue fastening, resulting in better results.[15]

Light-curing composite resin, impression plaster, thermoforming material, acrylic resin, and auto-polymerizing acrylic resin were used to splint impression copings, with dental floss serving as a scaffold. Titanium bars were recently used to weld the abutments or impression analogues intraorally,

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resulting in a novel implant splinting procedure. (fig. 5)

Fig. 5 Splinting of Impressions using auto-polymerizing resin and dental floss as scaffold

4) Closed tray/ indirect/ transfer type impressions

A closed tray impression for a fixed complete denture can be made using a stock tray or a custom tray. Impression copings for a closed tray technique are placed on implants or multi-unit abutments, and an impression is taken. The impression is dislodged from the closed tray impression copings as the impression material polymerizes. The impression copings are also removed, and implant or abutment analogues are attached to the copings. During the transfer process, this is then inserted into the impression body. The final step is to insert the coping-analog assembly into the definitive impression. It is called the closed tray technique since impression is taken through the existing tray or based on the indirect method. Mostly these impressions are utilized for preliminary impressions.[9] (fig. 6)

Fig. 6 Closed tray/Transfer/ In-direct Implant Impressions

Type of implant impression technique	Indication
1) OPEN TRAY/ PICK-UP/ DIRECT IMPLANT IMPRESSION	1.Non parallel implants 2.Screw retained restoration 3.Multi-unit restorations. 4.Full fixed arch mandibular impressions
2) CLOSED TRAY/ TRANSFER/ IN-DIRECT IMPLANT IMPRESSION	1.Parallel level of fixture insertions 2.Single tooth cemented type restoration 3.Fabrication of provisional restorations 4.When the superstructure is built with non-hexed components 5.When the patient has limited inter-arch space 6.Gagging tendency

Table no. 1 showing indications of open and closed impression technique.[16]

5) Digital impressions

With the growing use of digital/computerized impressions, implant systems now include scan bodies that use sensors to capture the relationship between the implant and adjacent structures more precisely. The use of traditional impression materials is eliminated or reduced as a result. (1) a digital scanner that scans and converts

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the geometry of the tooth into data that can be read by a computer, (2) a software that acquires the data and converts it into a 3D model, and (3) a production technology that uses CAM to transform the data set into the desired product.

The first step in taking a digital impression of an implant is to obtain the appropriate Intra-oral scan-body. Scan-bodies are unique to each implant brand. They attach to the implant in the same way that traditional impression copings do, and they're visible during the digital scan. (fig. 7)

The intraoral scanning devices make use of a cutting-edge optical surface scanning technology that works similarly to a camera, but instead of capturing lights and colours, the sensors capture lightweight reflection times from a variety of surfaces using processes that capture the article three-dimensionally. This information is then captured by the three-D software package, which uses specific alignment algorithms to allow the article to be registered. Triangulation, active wave-front sampling, and parallel confocal optical device scanning are the most common scanning principles used by intraoral dental scanners on the market. All of these methods combine a variety of imaging capturing methodologies to gather surface information from the teeth's associated tissue layer or mucosa, which is then registered and "stitched" together using an alignment method to create a virtual three-dimensional model.[17]

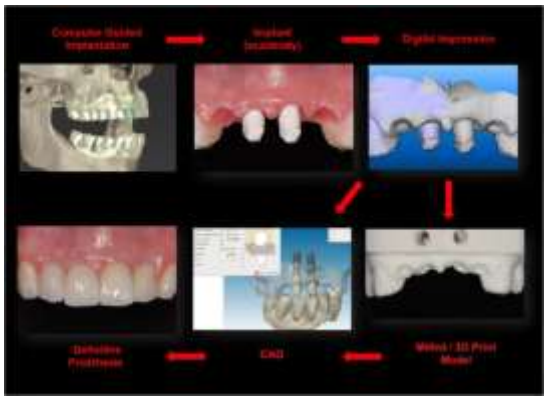

Fig. 7 Digital Implant Impressions

Modified impression techniques according to specific situations

1) Snap-fit technique.[11]

This method employs press-fit impression copings that are attached to the implant by pressing rather than screwing or cementing, and are picked up in the impression. Because it uses a close tray, this technique is not a pick-up impression. These impressions are not called transfer impressions because the synthetic plastic copings are picked up during the procedure. (fig. 8)

Fig. 8 Snap-fit Implant Impression Technique

2) Implant and surrounding soft tissue contours – after stage ii surgery.[18]

To create an aesthetically pleasing soft tissue architecture around implants, several soft tissue procedures such as subtractive, additive or a combination of both could be used before stage II is uncovered.

Subtractive Technique: A subtraction technique could be used to help in reproducing and recontouring the cervical emergence contour of the required restoration with the desired labial contouring and interdental papillae when there is sufficient quantity and quality of soft tissue along the edentulous crest. (fig. 9)

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Fig. 9 Subtractive technique

Addition Technique: An additive technique could be used to increase the thickness and height of soft tissue when the quantity and quality are insufficient. An incision in the palatal aspect along the palatal line angle of each tooth, followed by elevation of the tissue until the crest of the ridge, until the cover screw is identified and uncovered, is one of the techniques. The implant is covered with a healing cap or gingival former, and a removable prosthesis is recontoured for weeks over the healing cap. The per mucosal device causes tissue maturation and an increase in tissue quantity. The final crown is then restored 6-8 weeks after the tissue has matured (fig. 10)

Fig. 10 Addition technique

To improve the soft tissue architecture, several additive techniques to increase the soft tissue height around the implant have been proposed. Using a deepithelialized connective tissue graft, a roll technique for pontic regions of a fixed partial denture was first proposed.

Another additive technique adopted by Dr.Carl Misch[1,18] was a Split-Finger technique. This used when the papilla height is less than 2 mm from the end goal. (fig. 11)

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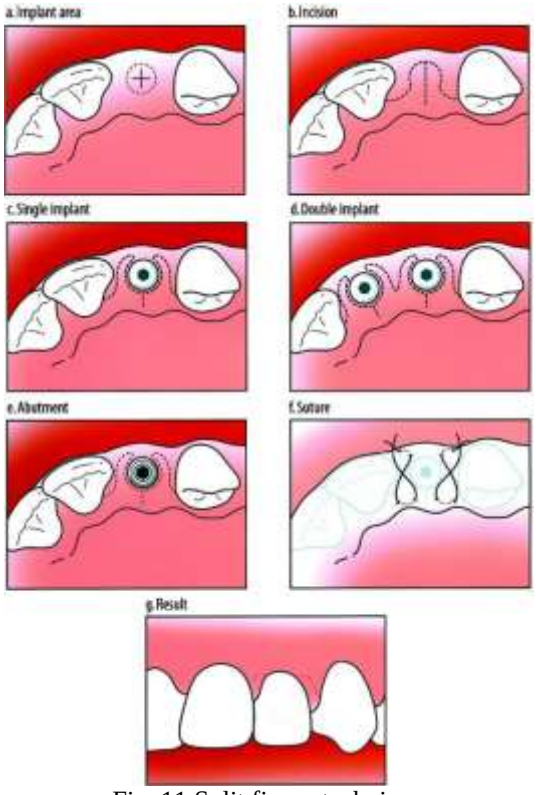


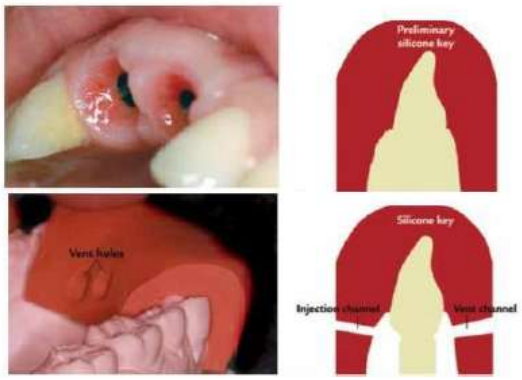
Fig. 11 Split finger technique

3) Enhancing anterior esthetics

Following the maturation of soft tissue around implant-supported restorations, a variety of techniques have been developed to aid in the transfer of peri-implant soft tissue, allowing us to achieve the best restoration results in anterior cases.

Enhancing the anterior aesthetics can be accomplished in one of two ways: using a temporary restoration as a coping for the pickup in final impression, or using a customised coping that anatomically replicates a part of the implant..

a. This procedure uses both the indirect and direct impression techniques to record and transfer the soft tissue profile around provisional restorations to a master cast.[19] (fig. 12)



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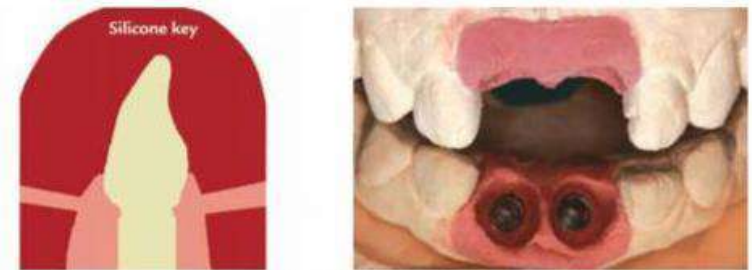

Fig. 12 Accurate transfer of peri-implant soft tissue contours

b) Using provisional restorations[20]

The main concept of this technique is to identify the crown margins through the custom abutment that has been used and record the soft tissue at the same time, it helps accurate transfer of details through the provisional restoration. (fig.11)

Fig. 11 Using provisional restoration

c) Customized impression copings[21]

After the tissues have been shaped with a provisional restoration, the custom implant impression coping technique is used to record the gingiva around the implant and pontic-receptor site. The technique entails recording the gingival mucosa around the implants with a dual polymerizing composite resin that is adapted to the impression copings used for open tray impressions, contouring it with instruments, and taking care to avoid material intrusion on the implant side. This helps in increasing the accuracy of recording the soft tissue and reducing any difference between the clinical condition and laboratory cast, making it easier for technicians to sculpt the restorations well. (fig.12)

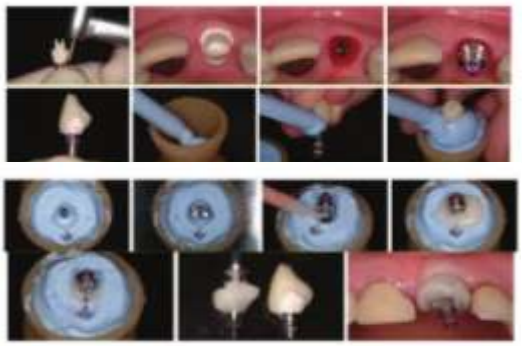

Fig. 12 Using custamized impression coping

4) Implant retained overdentures

a) Functional impression technique:

The soft tissue is recorded along with the correct positioning of the implant components in an overdenture implant impression. The characteristics of an implant retained overdenture are similar to those of a complete denture, with the addition of tissue support and implant retention. As a result, the difference in resilience between the implant and the mucosa should be considered when making

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implant tissue-retained overdentures. The functional impression technique captures the mucosa in its natural state while also capturing the implant components' position in relation to the alveolar tissues.

A combination of open-tray and functional impression techniques is described in this method. Border moulding and functional impression procedures are made at the same time with the use of a vinyl poly-siloxane (VPS) impression material. (fig.13)

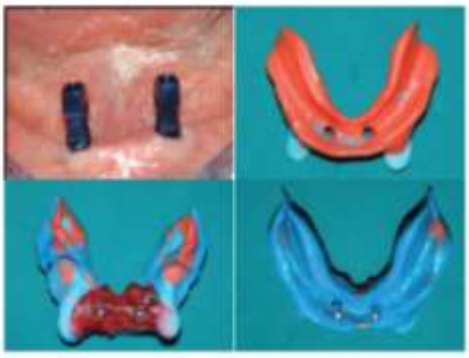

Fig. 13 Functional impression technique

b) Two step pick up impression technique[22]

The passive fit of components is thought to be crucial to implant treatment plans' long-term success. Biologic complications and component failure have been linked to poor fit. The positional discrepancies in fit may be caused by each laboratory and clinical stage. As a result, attenuating variation at each step of the restorative process is critical. The impression-making process for a mandibular overdenture situation may be susceptible to a number of factors that contribute to distortion in the final master cast. Flexure of the mandible, distortions in the impression material, and issues with the impression procedure are all examples. Traditional border moulding and impression in an individualised tray that fits over the implant abutments is the first option. Attaching the impression copings to the tray and picking up the copings from the mouth into the impression is the second step. (fig.14)

Fig.14 Two step implant impression technique

c) Dual Impression Technique:

Dual impression techniques were used to create a "corrected cast," which records the teeth in anatomical and residual ridge positions. SinaJannesar et al.[23] have described a two-stage selective pressure impression technique for implant-retained overdentures using a custom tray. (fig.15)

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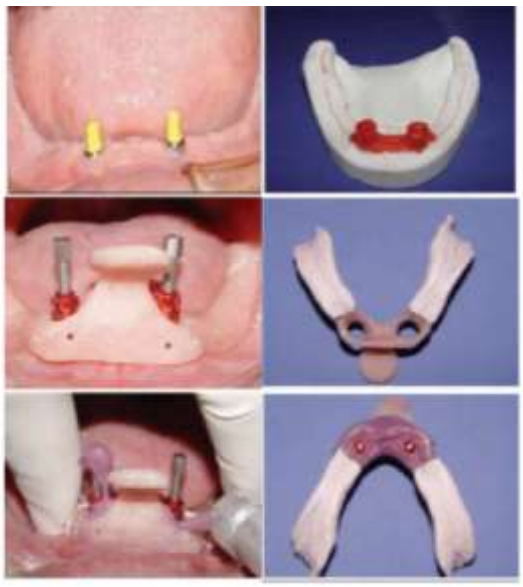

Fig. 15 Dual impression technique

4) Deeply placed implants

To properly get the surrounding soft tissue for deeply placed implants, use a longer impression coping, which also increases the surface area. Few implants, however, consider coping with a longer impression.

In a direct implant impression, Tomas Linkevicius et al.[24] described a simple technique involving a roll of composite resin, tray adhesive, and a small amount of occlusal registration material applied around a transfer coping.

Because occlusal registration material has a higher hardness than vinyl polysiloxane (VPS), it is the preferred material for use around the impression coping to increase stability. The use of a chunk of composite to surround the impression coping aids in the production of undercuts and increases the surface area, which aids in the adhesion of the impression material.

When the implant analogue is attached and the cast is poured, the chunk of composite helps the impressing coping resist movement. There is no risk of the occlusal registration material and vinyl poly siloxane material detaching because they are made of the same material, A-silicone (fig.16)

Fig. 16 Impressions for deeply placed implants

5) Full arch implant impression technique[25]

An implant prosthesis is made for the edentulous mandibular arch, which is opposed by a maxillary denture in this case. 4 implants were placed between the mental foramina to support the prosthesis, and 2 implants were placed distally in the molar region to act as stops. This technique is based on the shim technique, which reduces lab time and allows for the construction of prostheses with fewer components and lower costs. The other technique requires fewer implant components because it only uses one set of implant impression copings and analogues. (fig.17-21)

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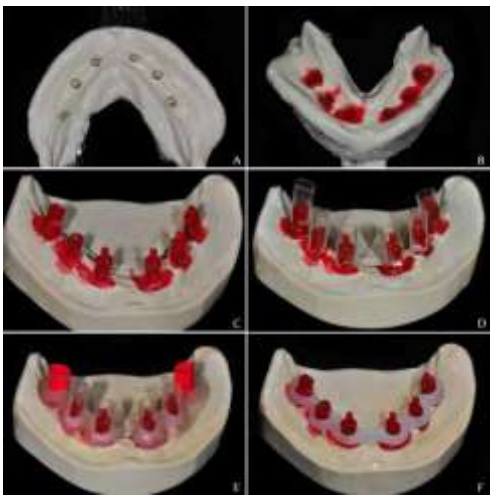

Fig. 17 Full arch Implant Impression technique – Using shim method.

6 implant impression Copings with preliminary irreversible hydrocolloid impression and Inject a thin layer of acrylic resin into the coping sites of the impressions. Initial casting, Cover impression copings loosely with vinyl tubing, Shim fits around impression copings passively by wrapping vinyl tubing with light polymerizing acrylic resin material and light polymerizing it.

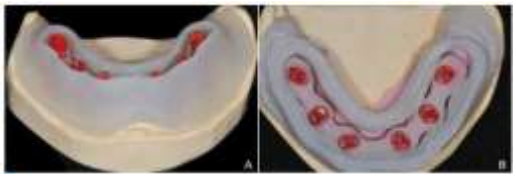

Fig. 18 Facial view of open-top custom tray, Occlusal view of open-top custom tray. Shim, custom tray and impression copings fit passively

Fig 19 Place rubber dam and shim around impression copings, Lute shim and impression copings with acrylic resin, All impression copings luted to shim, Reinforce shim splinting framework after initial acrylic resin has polymerized

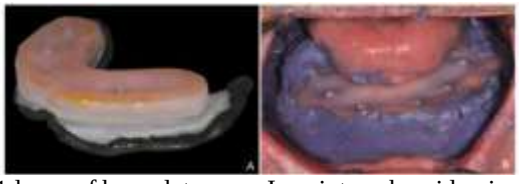

Fig. 20 Seal open-top tray with 1 layer of baseplate wax. Imprint each guide pin on wax lid, Seat impression tray such that all guide pins contact underside of wax lid

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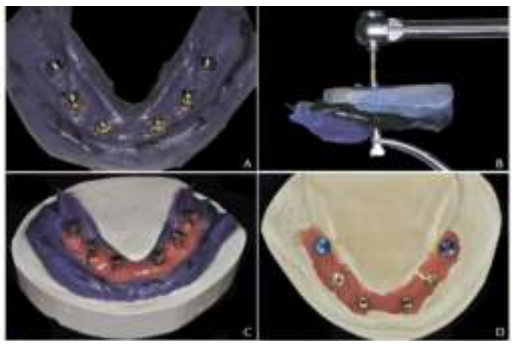

Fig 21 Intaglio surface of impression, Torque each implant replica onto impression copings to 15 Ncm while using hemostat to counter torque, Place silicone soft tissue moulage around each implant replica, Definitive cast

II. CONCLUSION

With the introduction of modern dental implants and the anticipated integration, a focus on restorative techniques with increased precision in the creation of tooth-like restorations for missing teeth has emerged. Good impression techniques are essential for a successful implant-supported prosthesis. The position, depth, angulations, rotations of the hex positions, soft tissue contours, or emergence profile are all recorded in an ideal impression.

A highly trained and proficient clinician is aware of the many indications, contraindications, materials, and methods of each impression technique that would lead to better results. As a result, the purpose of this article is to provide a basic understanding of basic protocol and procedures, as well as technologies used in the construction and design of implant impressions.

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