Impression Techniques in Implants

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Abstract
The main goal of an impression implant restoration is to accurately relate an analogue/abutment of the implant to the other structures in the dental arch. This review focuses on the components, impression materials and the various impression techniques that can be used in implant restorations with note on recent advances in implant impressions.

Introduction:
Implants are one of the successful options for prostodontic rehabilitations. Thus making the global statement “Any edentulous space is a potential implant site” pertinent¹. Implants in dentistry requires a multidisciplinary team of expertise that lead to an aesthetically pleasing and biologically acceptable final restoration.² Prosthodontic planning plays a pivotal role to achieve results that satisfies both the patient and the clinician.

The success of implants depends on its osseointegration and the passive fit of the prosthesis. Osseointegration is multifactorial, depending on precision of surgical and restorative techniques, soft tissue management, along with the general and oral health of the patient.³⁻⁵ As implants are functionally ankylosed with direct contact to the bone they lack the inherent mobility of the periodontal ligament hence they cannot accommodate distortion or misfit at the implant–abutment interface.⁶ Long term clinical success of implant supported prosthesis is depended on passive fit. The discrepancies in the passive fit of the prosthesis may lead to complications such as screw loosening, screw fracture, occlusal discrepancies, increased plaque accumulation, resulting in loss of osseointegration and implant fracture.⁷⁻⁸ Implant impression is one of the most important steps in achieving passive fit by accurately relating an analogue of the implant or implant abutment to the other structures in the dental arch. Further the accuracy of impression is affected by the selection of impression tray, impression technique and type of impression material, number and angulation of implants.⁹⁻¹³

Impression Materials:
A primary concern when dealing with the impression restorations is accurate transfer of the relationship of the implant and /or any remaining dentition to the master cast. Several options exist when dealing with the impression in implant prosthodontics. The implant analog or the abutments analog may be transferred to the master cast. An impression may be made of the prepared implant abutments and these are reproduced in the master cast each of these options require careful consideration in the choice of the impression material and the technique used.¹⁴

If the transfer of the analog is not accurate it will affect the passive fit of the prosthesis, for this the impression material used should be resilient enough to spring out of the undercuts and stiff enough to allow for accurate seating.
of the components in to the impression. It should also prevent dislodging of the components during the pouring of the impression and avoid the fracture of the stone when the prepared abutments are small. Thus the impression material should be sufficiently flexible and rigid. The most commonly used impression materials in implant dentistry are vinyl polysiloxanes and polyether rubber base impression materials. In general the impression material that use a putty like heavy body component which gives rigidity to the impression and less viscous wash impression material are preferred to avoid incorporation of air bubbles around the abutment.14

Vinyl polysiloxane impression materials are often used as they have excellent dimensional stability, superior deformation recovery and accurate reproduction of details. The mechanical properties of the siloxane impression material are adequate to withstand various stresses upon removal and maintain dimensional stability.15

There are numerous studies done to investigate the accuracy of impression materials for implant impression and it was found that polyether and vinypolysiloxane impressions provided superior reproduction in comparison with other impression materials. The most important property of an impression material is its wettability which helps provide detail reproduction in wet oral surfaces and also reproduces the details accurately with gypsum slurry. As vinyl siloxane is a hydrophobic material manufactures have added extrinsic surfactants to improve its wettability both intraorally as well as with gypsum slurry,thus making it hyrophilized Vinyl Polysiloxone and similar to Polyether.However many studies show that there is no difference in accuracy of impression made from polyether or vinyl Polysiloxane.16-23

A newer impression material Vinyl polyether silicon (VPES) which is a combination of vinylpolysiloxane(VPS) and polyether(PE) has been introduced which according to the manufacturer has intrinsic hydrophilicity and high dimensional stability. However the data regarding its accuracy is very limited and studies done using VPS,VPES and PE to evaluate the accuracy and reproducibility by 3D analysis does not show significant difference in terms of spatial deviation.2,24,25

Components
The success, function and aesthetics of an implant restoration are dependent on the proper treatment planning and through knowledge of components and instrumentation. Some of the commonly used components are drivers, healing abutments, lab analogues, screws and impression copings. 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. Healing abutments are available in varying heights and diameters which are selected based on clinical situations. Laboratory analogue are metal replicas that duplicate the implant head or abutment connected to the implant which are used in laboratory to construct working model. Impression copings have been designed for making final impression after the soft tissue has matured. These copings have the same flare as the healing abutments and should fully support the soft tissue around the head of the implant. They are various types of copings available which are selected based on the impression techniques.(Fig:1)In transfer type the coping is retained in the mouth when set impression is removed. In pick up type the coping gets incorporated in the impression and it is removed from the mouth with the set impression.25

Abutments are components that substitute for missing coronal structure that attach directly to the head of the implant and extend through the gingival into the oral cavity. Abutment selection depends on many clinical factors and soft tissue maturation after second stage surgery. The abutment must take a count of the position and angulation of the implant, height and thickness of the surrounding soft tissue, the interocclusal space and the type of restoration to be placed. Additional considerations include the height of the lip line the occlusal scheme and position of the tooth in the arch. The abutment types are standard abutment, angulated abutments, UCLA abutment (preparable abutments), provisional...
abutments, titanium abutments, ceramic abutments, prefabricated conical abutments and custom machined abutment.\textsuperscript{2,26}

Impression Techniques: Implant impression techniques can be classified as either direct (open, pick up) and indirect (closed tray, transfer).\textsuperscript{5,7}

Direct Impression techniques (Open tray, Pick Up): A custom or stock open tray with access to the impression coping screws is required, which exposes the coronal ends of the impression coping.\textsuperscript{5} Impression material is syringed around the impression coping and filled tray is then inserted into the mouth, ensuring that guidepin of the impression coping is visible and protrudes through the hole in the tray. Impression copings are unscrewed and they are removed from the mouth together with the set impression.\textsuperscript{5} The implant analogues are connected to the copings using the same screw.\textsuperscript{5} Some precautions to be taken are: radiographically confirmed seating of impression coping to the implant and use vinyl gloves when elastomeric impression material is used.\textsuperscript{14,15} This technique can be used for single tooth restorations, multi-unit restorations and implant over dentures for either cement retained or screw retained prosthesis.\textsuperscript{26}

An advantage of this technique is the dentist can confirm the laboratory preparation and contour of the provisional prosthesis to achieve the desired healing and soft tissue contour before final crown fabrication.\textsuperscript{26}

The direct technique can be further subdivided into splinted and non-splinted techniques. The splinting procedure is recommended in case of multiple implants to decrease the amount of distortion and to improve impression accuracy and implant stability.\textsuperscript{27,31} Splinting of the transfer copings prevents rotational movement of impression copings in the impression material during analog fastening, which provides better results than not splinting.\textsuperscript{16}
Accuracy of a splinted impression technique depends upon its resistance to deformation under the forces of impression material; hence the use of rigid splint material is essential for accurate master cast.

Materials used to splint impression copings include light-curing composite resin, impression plaster, thermoforming material, acrylic resin, and autopolymerizing acrylic resin.

Indirect technique (closed tray): An indirect technique is also known as closed tray impression technique. The copings are connected to the implant (fig:5) and after the removal of impressions they are retained on the implants. These copings are then removed from the implant, attached to the implant analogues and reinserted in the impression. (fig 6&7). Clinical situations which indicate the use of the closed tray technique, such as when the patient has limited interarch space, a tendency to gag, or if it is too difficult to access an implant in the posterior region of the mouth.

Snap-fit (press fit) plastic impression coping: This technique uses press-fit impression coping which is connected to the implant by pressing instead of screwing (fig:8) and the plastic impression copings are picked up in the impression. (fig:9) This technique is not a pick-up impression because it does not require an open tray, but instead uses a closed tray. It is not a transfer impression, either, because the plastic impression copings are picked up in the impressions.

Advantages
1. Helps to overcome the movement of impression coping inside the impression material
2. Time saving
3. Has the advantage of both the open and closed tray implant impression techniques
4. More comfortable for both the clinician and the patient
5. Easy to manipulate

The snap-fit technique may be a reliable impression making technique but regarding accuracy of this technique none of the study is available for investigation.
Fig: 4 Placement of Implant Analogs.

Fig: 5 Placing of impression coping on the implant.

Fig: 6 Impression making with closed tray copings in place

Fig: 7 Orienting the impression coping with lab analog into place.

Fig: 8 Snap fit impression coping placed on implants

Fig: 9 Implant analogue attached to the picked snap fit impression coping
Digital Implant Impression

More recently, one of the major developments in implant prosthodontics has been the adoption of engineering principles in the form of computer-aided design and computer-aided manufacturing (CAD/CAM) to construct implant prosthesis. This technology utilizes 3-D intraoral scanners which has revolutionizing the way we take impressions. The digital implant impression technique has proven its possibilities as an effective alternative for the analogue impression-taking technique.

Advantages of the digital impression are as follows:

1. Improved patient acceptance, (2) Reduced distortion of impression materials, (3) Pre-visualization of the preparation three-dimensionally (4) Virtual assessment of the implant prosthetic space (5) Depth of restorative interface (6) Emergency profile configuration before proceeding with laboratory steps and (7) Potential cost and time effectiveness.

Requirements of a digital impression

The main requirements for the CAD/CAM are the (1) digital scanner, which scans and transforms the geometry into the digital data which can be processed by the computer (2) software that processes the data and creates a CAD model (3) a production technology that transforms the data set into the desired product by means of CAM

Scanning principle

The intraoral scanning devices utilize a sophisticated optical surface scanning technology that works similarly to a camera, but instead of simply capturing lights and colors, the sensors measure light reflection times from various surfaces through processes to capture the object three-dimensionally. This information is then captured by the three-dimensional software that utilizes specific alignment algorithms to allow for registration of the object. Three of the common scanning principles used today by intraoral dental scanners on the market are triangulation, active wave-front sampling, and parallel confocal laser scanning. Each of these techniques utilize a combination of these various imaging capturing methodologies to collect the surface data of the teeth and mucosa so that the information can be registered and “stitched” together through an alignment process in order to create the virtual three-dimensional model.

Disadvantages

(1) Its more easy to carry out in the maxilla due to direct view. (2) In case of multiple implants difficult to identify the position of the abutments. (3) Inability to scan the proximal area of the neighbouring tooth when situated too close to the abutment.

Digital Implant Dentistry will have an enormous impact on the dental implant market in the near future because of the predictable results, more predictable cost, save time for both the patient and the dental team. Digital planning and processing will also make the dental implant treatment option much less burdensome and easier to deliver for the dental implant team and patient, thus improving acceptability and utilization globally.

Conclusion

One of the critical factors which affect the long term success of the implant is its passive fit of the implant prosthesis. In order to achieve this a clinician should have sound knowledge regarding the components used during impression, the choice of impression materials and the selection of suitable impression techniques based on clinical situation.
References


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