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Implant Impressions

[1]Dr. Poonam Bali, Department of Prosthodontics, Christian Dental College, Ludhiana, Punjab

[2]Dr. Rhea Mary John, Department of Prosthodontics, Christian Dental College, Ludhiana, Punjab

[3]Dr. Rahul Verma, Department of Prosthodontics, Christian Dental College, Ludhiana, Punjab

[4]Dr. Prathibha Mariam Thomas, Department of Prosthodontics, Christian Dental College, Ludhiana, Punjab

[5]Dr. Anamika Abraham, Department of Prosthodontics, Christian Dental College, Ludhiana, Punjab

Corresponding Author: Dr. Rahul Verma, Department of Prosthodontics, Christian Dental College, Ludhiana, Punjab

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Introduction

For both fully and partially edentulous patients undergoing rehabilitation with Osseo integrated implants, precise impression-making is a critical component for the long-term effectiveness of dental implants.[1]

The long-term viability of an implant depends on a number of factors. Incompatibility between the prosthesis and implant components, which can arise from an inaccurate impression, can lead to issues such as implant fracture, loss of osseointegration, screw fracture, and loosening of the screws.[2] Fabrication of an accurate cast is significant for proper prosthetic reconstruction. Impression accuracy is the key factor for this. The choice of impression tray, impression technique, impression material, number and angulation of implants have an impact on the correctness of the impression.

The accuracy of impressions is affected by[3]

- Impression technique,
- Polymerization shrinkage of the impression material,
- Number of implants,
- Implant angulation,
- The design and rigidity of the impression tray
- Splinting and non-splinting of impression copings

The passive fit of the implant prosthesis is one of the most important aspects of implant longevity that depends on a good impression technique. Variations in the prosthesis's passive fit can cause occlusal discrepancies, screw loosening, screw facture, increased plaque buildup, and implant fracture in addition to other issues including osseointegration loss.[4]

With reference to earlier research on the topic, the goal of this review is to draw attention to the challenges that physicians could face while taking an implant impression and to offer details on the right tools and methods for taking impressions that require the least amount of error.

A number of impression procedures have been suggested to produce a cast that guarantees a precise fit for prostheses on implants that are osseointegrated.

Classification of Implant Impressions [7,8]

Based on the type of tray / coping used

- Open tray impression
- Closed tray impression

Impression level

- Fixture level
- Abutment level

Open-Tray Impression Technique

The open-tray impression technique facilitates the accurate transfer of implant position, hex orientation, and soft tissue profile. In this method, the healing screw is removed 7 to 10 days after placement. The transfer coping, along with the abutment screw, is threaded into the implant body. The tray is carefully adjusted to ensure proper positioning of the screw within the opening.

The impression is taken using polyvinylsiloxane impression material. Once the material has set, the dentist first removes the abutment screw through the opening in the tray before extracting the impression. As the impression is removed, the transfer coping remains embedded within it. An implant analog is then attached to the impression post using the abutment screw before the impression is poured. Special attention is given while securing the abutment screw to the implant analog to prevent any displacement of the transfer coping within the impression.[5] The impression is then poured, and a working model is fabricated[6].

The direct or open-tray technique can be performed using either:

- Splinted implant impression copings
- Non-splinted implant impression copings

Advantages

This technique allows easy access to the screws and ensures precise transfer positioning. A key benefit is that the transfer coping is removed along with the impression, minimizing disturbances to the position transfer.[7] It is particularly useful for cases involving multiple nonparallel implants, as it enables easy retrieval of the impression without distorting the impression material.[8]

Disadvantages

The open-tray impression technique involves handling multiple components, requiring either a custom tray with access to the impression coping screws or a metal tray with windows. The accuracy of the impression is influenced not only by the technique used but also by the type of tray selected. Both custom and stock trays can be utilized for this technique. However, studies suggest that rigid custom trays provide greater accuracy compared to plastic stock trays. Impressions made with stock trays were found to be less precise, with a recorded difference of 10 µm in accuracy for analogs separated by 20 mm.[9]

Open tray technique is more accurate than closed tray technique. Open tray technique eliminates the errors during removal and replacement of transfer copings.[10]

Figure 1: Open tray transfer coping

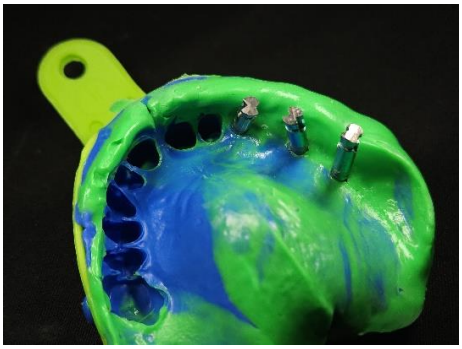

Figure 2: Open tray impression with analogs

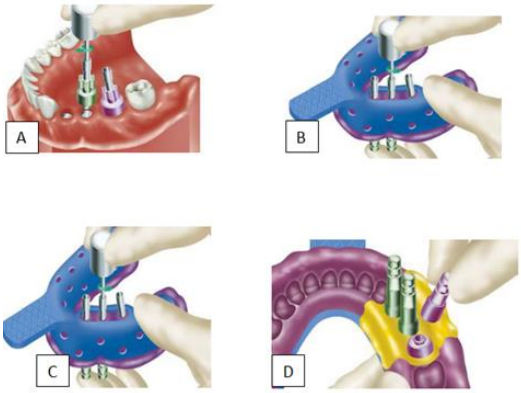

Figure 3:

A. Placement of impression copings

B. Unscrewing the impression coping

C and D Placement of lab analogs

Closed-Tray Impression Technique

The closed tray impression technique, also known as the indirect or transfer technique, is a widely accepted method for recording the spatial orientation of dental implants, particularly in cases involving single-unit or short-span implant restorations with favourable angulation This technique involves the intraoral placement of transfer copings, followed by impression making with an elastomeric material in a closed custom or stock tray. After the impression is removed, the copings are unscrewed from the implants and repositioned into the impression before attachment to implant analogs.

A radiograph is taken to confirm the tight and perfect joint of the impression post and implant.

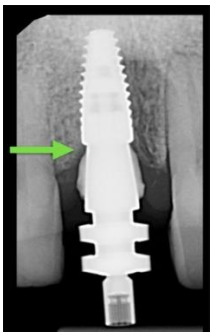

Figure 4: Radiograph showing open tray impression coping attached to the implant fixture (arrow depicts complete seating of the impression analog to the implant fixture

The screw hole is blocked with the help of blocking wax to avoid the material to flow into the hole. The impression is made. As the material sets, the impression is removed from the patient's mouth, and the transfer coping remains in the patient's mouth.[11] The dentist removes the transfer coping/impression post from the implant body, attaches it to the implant analogue, and then reinserts it into the desired position after proper orientation.[12] Proper care has to be taken that the implant analogue along with the transfer coping should be properly oriented and inserted.[13] Once the position has been finalized, the impression is poured and the working model is fabricated.

Snap-fit or press-fit impression copings are designed to engage implant platforms with a tactile "click," eliminating the need for screw retention during impression-making. They simplify clinical procedures by reducing chairside time and improving patient comfort. However, their retention may be less secure in cases of angulated implants or full-arch impressions compared to screw-retained copings.

Advantages

Closed tray technique is indicated in cases with limited mouth opening and in patients with exaggerated gag reflex.

Disadvantages

There might be coping dislodgement during impression removal.

Analogs have to be fixed onto the copings, which may lead to an error at this stage.

The type of transfer coping used in the closed-tray technique is usually tapered in shape and shorter than those used in the open-tray technique.

Figure 5: Close tray impression copings

Impression for implant overdenture

An implant-retained overdenture gains tissue support from the denture base and it is imperative to ensure correct impression of all the denture borders to capture the peripheral extensions and primary support areas.

An overdenture implant impression consists of recording the soft tissue with the correct positioning of the implant components.

The functional impression technique records the mucosa in a functional state and simultaneously records the implant components in relation to the alveolar tissues.

The functional movements of intraoral musculature are captured through border molding.

Impression transfer copings are seated properly and can be splinted. Radiographs can be taken to verify correct positioning of copings.

Custom trays can be relieved to provide access for transfer copings. Impression material is then applied around transfer copings and on the tissue surface of tray.

Once the setting of material is complete, the transfer copings are unscrewed and the impression is removed.

Figure 6: Open tray impression for over denture

The Osstem Port Male Kit is a specialized prosthetic accessory set designed for use with Osstem's Port Abutment and Port Angled Abutment systems. It facilitates the retention and stability of implant-supported overdentures, offering a comprehensive solution for clinicians aiming to enhance prosthetic outcomes.

Components of the Port Male Kit

The kit includes the following components:

- **Port Male Cap**: A titanium alloy component that secures the retention male within the denture base.
- **Port Provisional Male (Black)**: A nylon element used during the provisional phase to assess fit and function.
- **Block-Out Spacer**: Used to prevent acrylic resin from flowing into undercuts during the processing of the denture.
- **Replacement Port Males**: Three nylon males with varying retention strengths—blue (6N), pink (12N), and clear (22N)—allowing for customized retention based on patient needs.
- **Clinical Application**
- Ensure implants are well osseointegrated and peri-implant tissues are healthy.
- Remove healing abutments and torque locator abutments as per manufacturer’s instructions.
- Block out undercuts around the abutments using rubber dam or block-out rings.
- Seat locator impression copings (snap-on type) firmly over the abutments.
- Select a custom tray or modify a stock tray to ensure space for copings and material.
- Perform border molding if required to enhance soft tissue capture and denture fit.
- Inject light-body PVS or polyether around the copings and load tray with heavy-body material.

- Seat the tray and allow the material to set fully before removing it carefully.
- Ensure copings remain embedded in the impression and attach locator analogues
- Pour the impression with high-strength dental stone to obtain the master cast

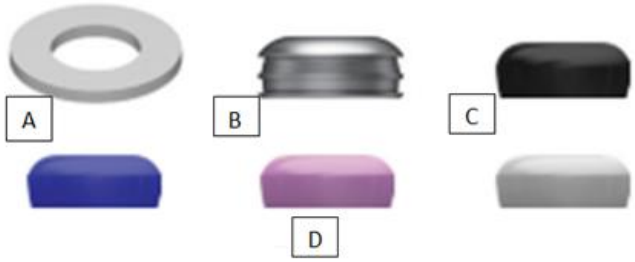

Figure 7: components of a port male kit A. Block out spacer B.Port male cap C. Port provisional Male black D. Three nylon males with varying retention strengths—blue (6N), pink (12N), and clear (22N)

Figure 8: Locator impression kit

Figure 9: A. Locator abutment B. Locator impression copings

Impression for Full Mouth Rehabilitation

The primary objective of multiple-unit impression taking is to achieve a passive fit of the final prosthesis, ensuring precise adaptation to prevent bone strain caused by uncontrolled implant loading through the superstructure.[14]

For full-arch implant impressions, a primary impression is taken using alginate impression material approximately 7 to 10 days after the placement of healing screws. A custom tray is then fabricated on the primary cast with appropriate spacers to allow sufficient access to all transfer copings. The tray's occlusal surface is designed to remain open, enabling the transfer copings to extend through it.

To enhance the accuracy of the implant impression, the transfer copings are splinted together using resin. Radiographic verification can be performed to confirm the correct positioning of the impression copings. Once the tray's extensions are evaluated, it is positioned in the patient's mouth, and the open surface is sealed with hard wax. This step aids in cast orientation and prevents impression material from flowing through the opening.

The final impression is then made using elastomeric impression material. After setting, the impression is poured to obtain the definitive cast

- Primary impression – open tray impression

Selecting multi unit abutments

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Secondary impression – After selecting multiunit abutment, open tray impression (Abutment level)

Figure 10: Scaffolding for Splinting With Floss

Figure 11: Splinting With Pattern Resin

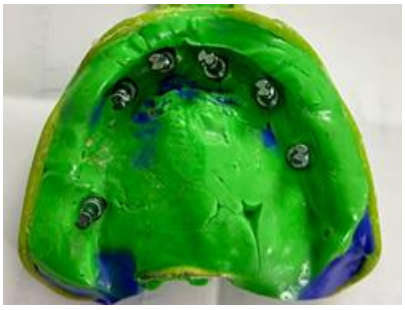

Figure 12: Final impression technique

Digital impressions

Digital impression systems, which utilize intraoral scanners, have significantly improved the accuracy and efficiency of implant impressions.[15-18]

Digital impressions eliminate many of the variables associated with conventional impressions, such as material shrinkage and distortion, by capturing a 3D digital model of the oral cavity directly.

Scan bodies are essential components in digital implant workflows, functioning as optically recognizable markers that allow for accurate digitization of implant position, angulation, and orientation during intraoral scanning.[19] These devices serve as a bridge between the intraoral environment and CAD/CAM systems by enabling the precise alignment of scan data with corresponding virtual implant components from digital libraries.

They are typically fabricated from materials such as polyether ether ketone (PEEK), titanium, or a combination of both. PEEK is widely favored due to its radiolucency, scan-friendly surface, and excellent dimensional stability.[20-22]

Figure 13: Various types of scan bodies manufactured by different companies that are compatible with different implant systems and have different attachment designs

Step by step procedure for implant impression -

1. Begin by scanning the soft tissue profile after temporarily removing the healing abutments to capture the peri-implant contours.
2. Ensure all surrounding anatomical landmarks are accurately recorded for proper prosthesis design.
3. Trim the implant areas in the software to prepare for the scan body integration.
4. Replace healing abutments with correctly sized scan bodies, ensuring a clean implant site and secure fit.
5. Switch to implant scan mode and scan the scan bodies from multiple angles for optimal accuracy.
6. Capture the opposing arch to record occlusion and anatomical references.
7. Perform a buccal bite scan with the patient in maximum intercuspation.

Confirm that all scans are free of voids, artifacts, or missing data.

Make necessary edits or corrections to ensure accuracy and completeness.

Export the verified scan in STL format for CAD/CAM or lab fabrication.

Figure 14: Digital impression with intraoral scanner with scan bodies

Conclusion

An accurate impression is the cornerstone of a successful implant prosthesis, as it directly influences the fit, function, and longevity of the final restoration. Any error in capturing the implant position or surrounding tissues

can lead to misfit, biological complications, or prosthetic failure. Both conventional and digital impression techniques have their own merits and limitations, and each can produce clinically acceptable results when performed correctly. Therefore, it is essential for clinicians to master both methods. Ultimately, it is the skill, judgement, and experience of the dentist that determine which technique is best suited for each clinical situation.

To conclude, the following table provides a comparison between conventional vs digital impression techniques and open tray vs closed tray implant impression methods, highlighting their key differences, advantages, and clinical considerations:

Conventional Implant Impression	Digital Implant Impression
This method uses impression copings and elastomeric materials to record implants.	This method uses intraoral scanners or photogrammetry to digitally capture implants.
It requires trays, impression copings, implant analogs, and impression material.	It involves an intraoral scanner, scan bodies, and implant-specific digital files.
The technique is operator-sensitive and prone to material-related distortions.	It is less operator-dependent with minimal distortion if protocols are followed.
Patients may find it uncomfortable due to bulky trays and longer procedure time.	Patients generally experience more comfort due to the absence of trays and faster scanning.
The process takes more clinical time and has longer lab turnaround.	It enables quicker chairside work and faster digital transfer to labs.
There is a higher risk of cross-contamination from materials and trays.	Infection control is better due to its contactless digital nature.
Errors may arise from material distortion or incorrect coping placement.	Errors can result from reflective surfaces or incorrect scan body seating.
The setup cost is lower, but recurring material costs can be high.	The initial cost is high, but long-term costs are reduced with digital efficiency.
Impression is taken physically and transported to labs.	Digital files are directly sent to labs for CAD/CAM fabrication.

Open Tray Technique	Closed Tray Technique
Impression copings are picked up within the impression material and removed together.	Impression copings remain in the mouth and are repositioned into the impression later.
A custom or perforated tray with screw access holes is required.	A stock or custom tray without perforations is typically used.
This technique is preferred for multiple implants or when implants are angulated.	This method is suited for single implants or when implants are parallel.
The procedure is more technique-sensitive and requires precise execution.	It is simpler and less technique-sensitive.
There is minimal risk of	There is a higher risk of

Open Tray Technique	Closed Tray Technique
positional error as copings are picked up directly.	error due to manual repositioning of copings.
Chairside time is longer because of additional steps like screw access.	Chairside time is shorter with fewer clinical steps.

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