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ACCURACY OF IMPRESSION TECHNIQUES IN IMPLANT DENTISTRY

Bader Abdullah Alrumi[1], Randah Abdulrhman Alghamdi[2], Ibrahim Mohammed al Yami[3] ,Ali Mohammed Aldajani[3], Hussein Mohammed Alhelaly[3], Abdulrahman Thabet Mohammed[3], Mohannd Talebalrahman Abotaleb[4], Mohammed Mbearak Aljuaid[4], Jamal Mousa Alotaibi[4], Mohammed Dakhil Alelyani[5]

[1]majmaah university, [2]Al farabi College, [3]Ministry of health, [4]Ibn Sina National College, [5]Medical Services in Public Security

Abstract

background: *One of the successful methods of prosthodontic rehabilitation is Implants. Implant dentistry requires a multidisciplinary approach and proper prosthodontic planning to achieve a satisfactory result. Thus, the successful outcome of treatment largely depends on the accuracy of various impression techniques, materials used and osseointegration of implants. The main aim of implant impression is to accurately place implant analog/abutment corresponding to other structures in the dental arch without stressing the adjacent supporting tissue and teeth.*

The aim of work: *This review aims to understand the accuracy of various important techniques regarding accurate reproducibility, dimensional stability, and material aspects.*

Methodology: *The review is a comprehensive search of PUBMED from the year 1992 to 2016. The following search terms were used: Implants impression techniques, Direct impression technique, indirect impression technique, Impression material*

Conclusion: *The passive fit of implant prosthesis is the ultimate factor in the long-term success of prosthesis. To achieve it a clinician should have sound knowledge of component and the impression material used, the impression techniques for a suitable impression procedure based on a clinical situation. Among impression material, vinyl polysiloxane is found to be most accurate compared to other impression material such as polyether, polysulfide, etc. More precision is seen with direct impression technique than indirect impression techniques.*

Keywords: *Implants impression techniques, Direct impression technique, indirect impression technique, Impression material.*

Corresponding author:

Bader Abdullah Alrumi,

Intern student in Dental collage of majmaah university,

Email: B-alrumi@hotmail.com,

Mobile: +966 544336988.

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INTRODUCTION:

IMPRESSION MATERIALS:

The success of implants depends on the passive fit of the prosthesis and osseointegration which in turn depends on the precision of restorative and surgical technique, impression techniques, impression materials and soft tissue management along with general and oral health of the patient. [1.2]

Various impression materials were used and tested but most commonly used are

- Polyether
- Vinylpolysiloxanes (VPS)

For transfer of implant analog/abutment analog to master cast, an impression is made of prepared implant abutments which are reproduced in the master cast. This requires careful consideration in the choice of impression material and technique used. [3]
The passive fit of the prosthesis will be affected if the transfer of analog is not accurate. In this scenario, the impression material used should have following ceratin characteristics. [3]

- The material should be resilient enough to spring out undercuts
- Stiff enough to allow accurate seating of components.
- Prevents dislodging of components during impression pouring and avoid fracture of stone.

Thus, a material should be sufficiently flexible and rigid. In general, the impression material uses putty like heavy body component and less viscous wash impression which provides both rigidity to impression and avoid incorporation of air bubbles around the abutment. [3]
According to Lee et al. [4] putty and light-body combination, VPS impression material was more accurate than medium-body polyether impression material when the implant was placed deep subgingivally. [4]

Wenz et al. [5] studies different mixing methods of impression material, the 2-step, and 1-step method. According to study the 2-step methods involves making the first impression using putty, this is to create space inside impression. Further, the impression is filled with light-body impression material, and the second impression is made. 1-step impression method uses both putty and light-body simultaneously. It was found that the 2-step method was less accurate than the 1-step method, the medium-body polyether monophase impression, and the medium-body VPS monophase impression.

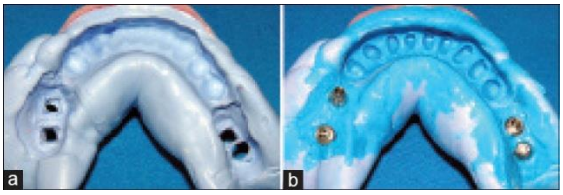

Figure showing 2-step impression (A) Impression using putty (B) Impression with light-body. [7]

Although polyether has been suggested as the choice of material in impression taking use of more elastic material such as vinyl polysiloxane may reduce the permanent deformation of impression material when impression with the copings is removed. [6]

A study on torque resistance of impression was done by Wee et al. [8], reported that polyether material showed more torque values, which may be favorable for manipulation of pick-up impression. Polyether and VPS showed improved accuracy in comparison with other materials such as polysulfide, reversible hydrocolloid, condensation silicone, irreversible hydrocolloid. [8]

A new impression material Vinyl polyether silicone (VPS), combination os vinylpolysiloxanes (VPS) and polyether (PE) has been introduced which combines characteristics of both the impression material such as intrinsic hydrophilicity and high dimensional stability. However, data regarding accuracy and reproducibility of this three material is inadequate, and 3D analysis showed no major difference in spatial deviation. [2,9].

Figure showing Impression with Vinyl polyether silicone. [10]

METHODOLOGY:

- **Data Sources and Search terms**

The review is a comprehensive search of PUBMED from the year 1992 to 2016. The following search terms were used: Implants impression techniques, Direct impression technique, indirect impression technique, Impression material.

- **Data Extraction**

Two reviewers have independently reviewed the studies, abstracted data, and disagreements were resolved by consensus. Studies were evaluated for quality and a review protocol was followed throughout.

The study was approved by the ethical board of King Abdulaziz University Hospital

Impression Techniques

Impression technique can be classified as:

- Direct Impression technique (Open tray, Pick up)
  - Splinted Technique
  - Non-splinted Technique
- Indirect Impression technique (Close tray transfer)
- Snap-fit Impression technique

DIRECT VS INDIRECT IMPRESSION TECHNIQUE:

Though different impression making techniques can influence the precision of implant placement two most commonly used techniques are direct and indirect impression technique to transfer intraoral position of implants to working casts.

Tapered copings are used in indirect technique with a closed tray to make an impression. Copings are connected to the implant; the impression is made and removed from mouth leaving copings intraorally. Further, the copings are removed and connected to implant analogs. Coping-analog assemblies are inserted in the impression before pouring cast. [13] On the other hand in direct impression technique square copings are used with and open tray impression (an opening is made in the tray), this allows the coronal ends of the impression coping screw to be exposed. The coping screws are unscrewed to be removed along impression, before separating implants. Copings are connected to implant analogs in the impression to pour cast. Rotational movement of impression coping and blind attachment of implant analog to impression coping is a major disadvantage in this technique which leads to misfit of the component. [14]

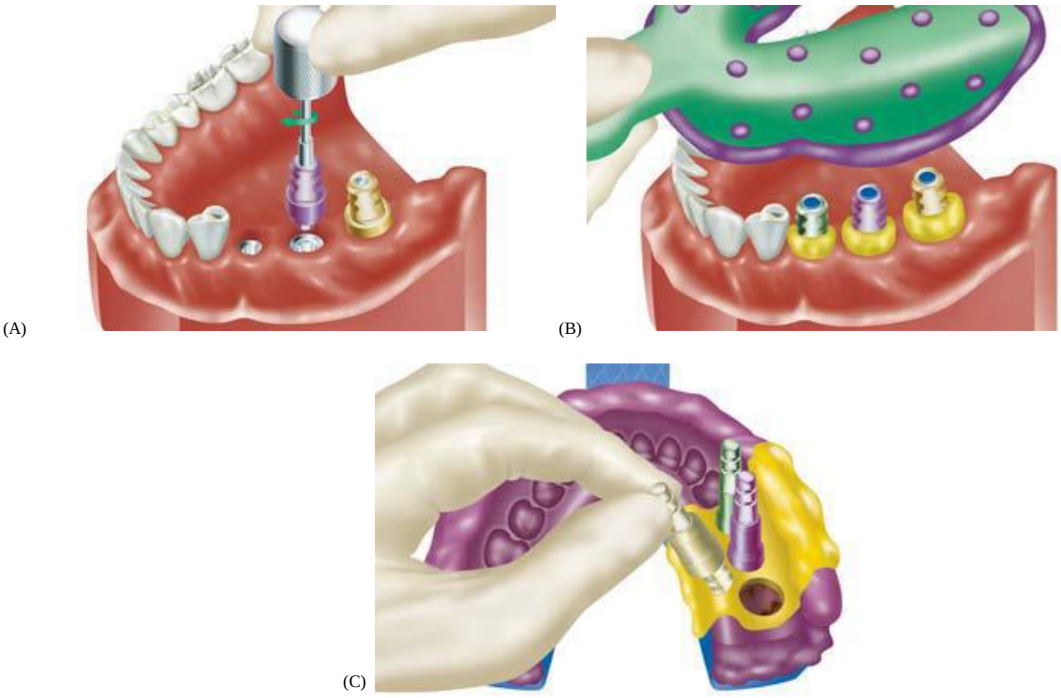

Figure showing Indirect or closed tray impression technique (A) Placement of impression coping (B) Impression with closed tray (C) Impression coping with lab analog into place. [15]

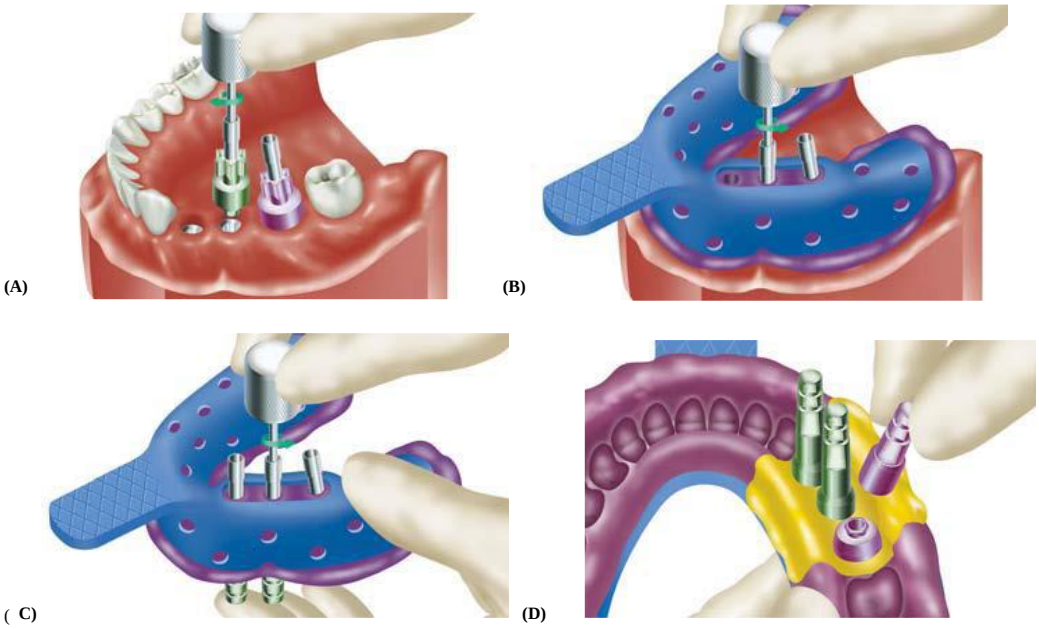

Figure showing Direct or Open Tray Technique (A, B) Placement of impression coping and unscrewing of the impression coping from open tray (C, D) Placement of implant analog. [15]

According to some studies, direct impression technique leads to more precision [6,11] while some other favors indirect technique.[4,11] The use of the direct technique has been proposed with multiple angulated implants while indirect is employed in parallel or divergent, 2- implant situation.[9] The indirect technique was found to be less challenging by many practitioners in case of implants to be positioned in the posterior region, patients with gag-reflex and when the intermaxillary distance in not adequate in the opening.[12]

A study conducted by Daoudi et al. compared the Indirect technique at implant level with Direct technique at abutment level for a single tooth implant, and studies revealed direct technique to be more superior and predictable whereas indirect technique had discrepancies regarding axial rotation and inclination of the analogs. [16]

Another study by him investigated the repositioning of the copings after making the indirect impression by three different group of people (dental technicians, dental students, postgraduates and senior dentists) revealed the copings never returned to its original position, and it was believed to be primary source error in impression technique. This error can be enhanced in case of multiple implant placement. Thus, in case of multiple implants, direct impression technique was found to be more accurate than indirect technique. [16]

SNAP-FIT IMPRESSION TECHNIQUE:

A new impression technique has been developed by some manufacturers, i.e. Snap-fit (press fit) plastic impression coping. It is neither a pick-up impression nor transfer impression but has advantages of both the techniques. This does not require an open tray but uses a closed tray, and the plastic impression copings are picked up in the impression. The technique is comparatively easier to manipulate since the coping is connected to the implant by pressing instead of screwing. It allows removal of coping with the impression. [17]

(A)  (B) 

Figure showing snap-fit press impression technique (A) Snap-fit impression copings placed on implants (B) Implants analog attached to the picked snap fir impression coping. [15]

SPLINTED VS NON-SPLINTED TECHNIQUE:

Among various impression making methods, the splinted technique has gained popularity regarding being most accurate. [18,19] Though there was no consistent accuracy reported among splinted and non-splinted technique. According to some authors, the splint impression technique was frequently associated with distortion of materials [20] and fracture od connection between splint material and impression copings. [21] According to a study conducted by Kim et al. [22] on the accuracy of implant impression over multiple laboratory procedures, Non- splint impression technique was more accurate during impression making procedure whereas splint impression technique was more accurate during cast fabrication procedure.

Metal splint impression coping technique model [23]

CONCLUSION:

An accurate impression can be obtained with proper material selection and manipulation for fabrication of tooth implant-supported restorations. Most of the studies proved Vinyl polysiloxane as better impression material because of its excellent dimensional stability, superior deformation recovery and accurate reproduction of details, ability to withstand various stress upon removal of an impression. Similarly, greater accuracy is seen with splint technique when compared to Non- splint technique. Incase of multiple implants direct impression technique was found to be better than indirect impression technique.

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