(e) ISSN Online: 2321-9599
(p) ISSN Print: 2348-6805

SJIF (Impact factor) 2017= 6.261
Index Copernicus value = 80.90

ORIGINAL ARTICLE

Assessment of effect of Different Impression Techniques on Dimensional Accuracy of Implant Definitive Casts: A Comparative Study

Nausheen Jajira[1], Rajat Khajuria[2], Sidhant Sudan[3], Tanvi Sudan[4], Priyanka Choudhary[5], Gurjot Sodhi[6]

[1]Private practitioner, Alarjis Alwardi Clinic, Kingdom of Saudi Arabia, [2]Ex- Registrar, Department of Prosthodontics, Indira Gandhi Gove Dental College, Jammu, [3]Registrar, Department of Prosthodontics, Indira Gandhi Gove Dental College, Jammu, [4]PG student, Department of Paediatric and Preventive dentistry, Himachal Dental college, Sundernagar, HP, [5]PG student, Department of Periodontology, Himachal Dental college, Sundernagar, HP, [6]Senior Lecturer, Guru Nanak Dev Dental College & Research Institute, Sunam (PB).

***ABSTRACT*:**
Background: A passively fitting prosthesis is considered an essential prerequisite for maintaining osseointegration. This is related to the fact that dental implants, unlike natural teeth, lack the cushioning effect of periodontal fibers and cannot completely accommodate the demands of the superstructure.**Aim:** To comparatively evaluate the effect of different impression techniques on dimensional accuracy of implant definitive casts.**Materials and method:** The present study was conducted in the Department of Prosthodontics of the dental institution. For the study, a stainless steel model of maxillary arch with 4 internal connection implants with 4 mm diameter and 10.5 mm length in maxillary right canine (implant no: 1) lateral incisors (implants no: 2 and 3) and left first premolar (implant no: 4) areas were used. In this study, impressions were made via two techniques: Open tray with long impression copings and closed tray with short impression copings. To evaluate the accuracy of each impression technique, centers of implants on the master model were located in three dimensions and compared with the centers in the experimental casts. **Results:** We observed mean displacement of Implant no. 2 with technique 1 was 0.06 and technique 2 was 0.07. Mean displacement of Implant no. 3 with technique 1 was -0.04 and technique 2 was 0.16. Mean displacement of Implant no. 3 with technique 1 was 0.03 and technique 2 was 0.29.**Conclusion:** Within the limitations we conclude that there is no significant difference between open and closed tray impression technique on dimensional accuracy of implant definitive casts.
Keywords: Dental implants, dental impression techniques, dental models.

Corresponding Author: Dr. Nausheen Jajira, Private practitioner, Alarjis Alwardi Clinic, Kingdom of Saudi Arabia.

This article may be cited as: Jajira N, Khajuria R, Sudan S, Sudan T, Choudhary P, Sodhi G. Assessment of effect of Different Impression Techniques on Dimensional Accuracy of Implant Definitive Casts: A Comparative Study. J Adv Med Dent Scie Res 2017;5(12):115-118.

Access this article online	
Quick Response Code	Website: www.jamdsr.com
	DOI: 10.21276/jamdsr.2017.5.12.32

INTRODUCTION:

A passively fitting prosthesis is considered an essential prerequisite for maintaining osseointegration.[1, 2]This is related to the fact that dental implants, unlike natural teeth, lack the cushioning effect of periodontal fibers and cannot completely accommodate the demands of the superstructure. Misfit of the implant prostheses might induce strains on the components, consequently resulting in mechanical and biological complications.[3, 4] Therefore, fastidious and accurate implant prosthodontic procedures are a necessity to achieve a passive fit, and undoubtedly accurate impression making is a crucial step in this process. Two basic techniques for dental impression include direct and indirect techniques. Many researchers have evaluated the effects of direct and indirect techniques, splinted and non-splinted techniques, and different impression materials on the accuracy of dental implant impressions.[5] Some researchers believe that direct technique is more accurate than indirect technique.[6]Ebadian et al, mentioned that using ball-top technique can increase the accuracy of impressions.[7] Another study showed that snap-on technique is as accurate as direct technique.[8] Hence the present study is planned to comparatively evaluate the effect of different impression techniques on dimensional accuracy of implant definitive casts.

MATERIALS AND METHOD:

The present study was conducted in the Department of Prosthodontics of the dental institution. The ethical clearance for the study protocol was obtained from the ethical committee of the institute. For the study, a stainless steel model of maxillary arch with 4 internal connection implants with 4 mm diameter and 10.5 mm length in maxillary right canine (implant no: 1) lateral incisors (implants no: 2 and 3) and left first premolar (implant no: 4) areas were used. In this study, impressions were made via two techniques: Open tray with long impression copings and closed tray with short impression copings. The custom impression trays with 2 layers of Base Plate Wax were fabricated using light-polymerizing acrylic resin tray material. Polyether impression material was used to make the impression. To evaluate the accuracy of each impression technique, centers of implants on the master model were located in three dimensions and compared with the centers in the experimental casts. The statistical analysis of the data was done using SPSS version 20.0 for windows. Student's t-test and Chi- square test were used to check the significance of the data. The $p \leq 0.05$ was pre determined to be statistically significant.

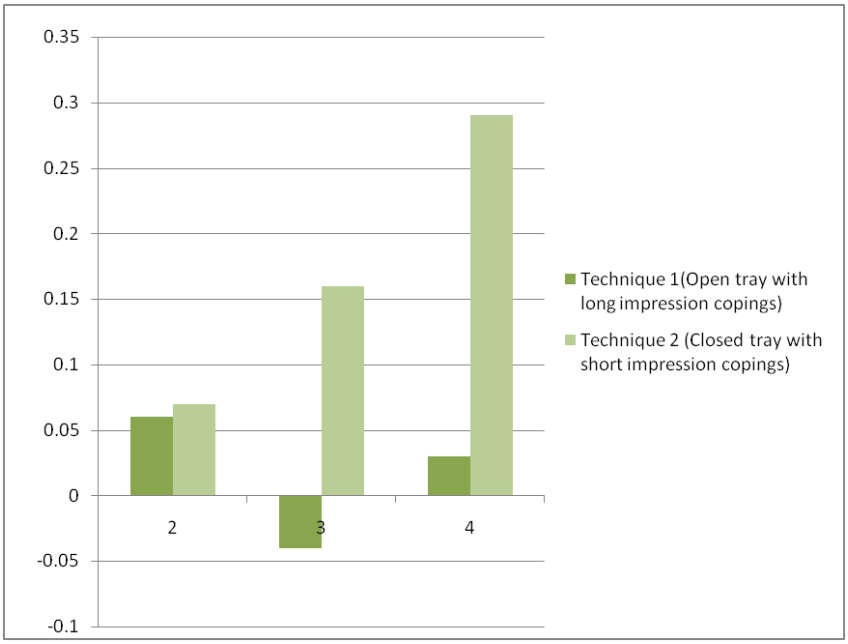
RESULTS:

Table 1 shows mean changes in distances of implants 2, 3 and 4 in mediolateral and anteroposterior directions with respect to implant no. 1. We observed mean displacement of Implant no. 2 with technique 1 was 0.06 and technique 2 was 0.07. Mean displacement of Implant no. 3 with technique 1 was -0.04 and technique 2 was 0.16. Mean displacement of Implant no. 3 with technique 1 was 0.03 and technique 2 was 0.29. On comparing the results, we observed statistically non-significant results ($p>0.05$) **[Fig 1]**.

Table 1: Mean difference (SD) of distances for implant no. 2, 3 and 4 with respect to implant no. 1

Implant no.	Impression technique		p-value
	Technique 1(Open tray with long impression copings) (mm)	**Technique 2** (Closed tray with short impression copings) (mm)	
2	0.06	0.07	0.001
3	-0.04	0.16	
4	0.03	0.29	

Fig 1: Mean difference (SD) of distances for implant no. 2, 3 and 4 with respect to implant no. 1



DISCUSSION:

Misfit can result in mechanical problems such as abutment screw loosening and breakage of the screw or prosthesis.[9] There are several factors and errors during prosthesis construction which can affect the precision of the cast and prosthesis fit such as precise connection of the impression post to the implant or abutment, distortions of the impression materials, connection of implant analogue or abutment and impression coping and movement of the analogue in impression materials and within the cast due to the dimensional changes of the dental stone.[10]

In this study, the accuracy of two impression techniques including, open tray and closed tray with short coping was evaluated. The statistical analysis showed no differences between groups. The results were compared with similar studies conducted by other authors from the literature. Rashidan N et al compared the accuracy of two different impression techniques with two different impression coping shapes using polyether impression material to obtain precise definitive casts. Two reference acrylic resin models with five internal connection implants having different shapes of impression copings were fabricated. Twenty medium-consistency polyether impressions of these models were made with square and conical impression copings of each system using open-tray and close-tray techniques. Matching implant replicas were screwed into the impression copings in the impressions. Impressions were poured with type IV stone, and the positional accuracy of the implant replica heads in x-, y-, and z-axes and also rotational displacement were evaluated using a coordinate measuring machine. Less inaccuracy occurred in less retentive shape impression copings (Replace Select) compared with the more retentive one but there was no significant difference between direct and indirect impression techniques. It was concluded that the impression coping shape had more impact on impression inaccuracy than impression technique did. Understanding of the magnitude and variability of distortion when employing certain impression-making methods and impression coping shapes helps the clinician to select a better implant component and impression technique.[11]

Vigolo P et al evaluated the accuracy of 3 different impression techniques using polyether impression material to obtain a precise definitive cast for a multi-unit implant restoration with multiple internal connection implants. A reference acrylic resin model with 4 internal connection implants (3i Implant Innovations) was fabricated. Forty-five medium-consistency polyether impressions (ImpregumPenta) of this model were made with square impression copings using an open-tray technique. Three groups of 15 specimens each were made with different impression techniques: in the first group, nonmodified square impression copings were used (NM group); in the second group, square impression copings were used and joined together with autopolymerizing acrylic resin before the impression procedure (R [resin] group); and in the third group, square impression copings previously airborne-particle abraded and coated with the manufacturer-recommended impression adhesive were used (M [modified] group). Matching implant replicas were screwed into the square impression copings in the impressions. Impressions were poured with ADA type IV stone. A single calibrated examiner blinded to the nature of the impression technique used examined all definitive casts to evaluate the positional accuracy (mum) of the implant replica heads using a profile projector. These measurements were compared to the measurements calculated on the reference resin model which served as control. The data obtained with the profile projector revealed significant differences within the 3 impression techniques. The Student Newman-Keuls procedure disclosed significant differences between the groups, with group R casts being significantly more accurate than group NM and group M casts. The mean distance between the posterior implants compared to the reference acrylic resin model was 18.17 mum greater for group R casts, 41.27 mum greater for group M casts, and 46.21 mum greater for group NM casts. Distances between the anterior implants were also greater than those recorded on the reference model. The distance was 15.23 mum greater on group R casts, 38.17 mum greater on group M casts, and 43.23 mum greater on group NM casts. Within the limitations of this study,the authors concluded that improved accuracy of the definitive cast was achieved when the square impression copings joined together with autopolymerizing acrylic resin were used to make an impression of multiple internal connection implants.Pujari M et al evaluated the accuracy of 3 different impression techniques using polyether and vinyl polysiloxane (VPS) impression material to obtain a precise cast for multiple internal connection implants. A reference acrylic resin model with 4 internal connection implants was fabricated. Impressions of the reference model were made using 3 different techniques and 2 different impression materials. The study consisted of 24 specimens divided into 6 groups of 4 each. Impressions were poured with ADA type IV stone. All casts were evaluated for the positional accuracy (mm) of the implant replica heads using a profile projector. These measurements were compared to the measurements calculated on the reference resin model, which served as a control. The results revealed significant difference for anterior implant distance between the 2 impression materials and also among the 3 different techniques. The lowest mean variation was found with the polyether impression material and the splinted technique. For posterior implants, the results suggested no significant difference between the 2 impression materials. Although results were not statistically significant, the polyether impression material showed the lowest mean variation as compared to the VPS impression material. However, there was a significant difference among the 3 different

techniques. Among the 3 different techniques, the lowest mean variation between 2 posterior implants was found in the splinted technique. Casts obtained from impression techniques using square impression copings splinted together with autopolymerizing acrylic resin prior to the impression procedure were more accurate than casts obtained from impressions with nonmodified implant impression copings and with airborne particle-abraded, adhesive-coated copings. Casts obtained from polyether impression material were more accurate than casts obtained from vinyl polysiloxane impression material.Lee H et al evaluated the effect of subgingival depth of implant placement on the accuracy of implant impressions. A stone master model was fabricated with 5 implant analogs, embedded parallel to each other, at the center (E) and the 4 corners (A, B, C, and D). The vertical position of the shoulders of the implants was intentionally different among the implants: A and E were flush with the top surface of the model; B was 2 mm below, and C and D were 4 mm below the surface. The horizontal distances of implants A, B, C, and D from E were measured with a measuring microscope. A cross-shaped metal measuring bar was then fabricated and connected to E, with the arms of the casting designed to be 2 mm above the top surface of the model and incorporating a reference mark. With the measuring bar connected to E, the vertical distances from the apical surface of A, B, C, and D to the measuring reference marks were measured with a digital micrometer. The body of the impression coping for implant D was modified by adding 4 mm of additional impression coping, while standard impression copings were used for all other implants. Open tray impressions were made using medium-body polyether material (ImpregumPenta) or a combination of putty and light-body vinyl polysiloxane (VPS) material. Then casts were poured with type IV dental stone. The vertical and horizontal distances of the casts were measured with the methods outlined above for the master model. The distortion values that were determined as differences between the measurements of the master model and those of the casts were collected for statistical analysis. Two-way and 1-way repeated measures ANOVA followed by Tukey's HSD test were performed to compare the distortion values. For vertical measurements, 2-way repeated measures ANOVA showed no significant depth, material, or interaction effects. However, it showed significant depth effect for horizontal measurements. Within the polyether group, 1-way repeated measures ANOVA showed significant differences in horizontal measurements among the implants with different depths. The post hoc Tukey's test showed that the impression of 4-mm-deep implants with normal impression copings (C) was significantly less accurate than impressions of 0-mm-deep implants (A). Within the VPS group, there was no significant difference among the implants with different depths. It was concluded that there was no effect of implant depth on the accuracy of the VPS group. However, for the polyether group, the impression of an implant placed 4 mm subgingivally showed a greater horizontal distortion compared to an implant placed more coronally. Adding a 4-mm extension to the retentive part of the impression coping eliminated this difference.[12-14]

CONCLUSION:

Within the limitations we conclude that there is no significant difference between open and closed tray impression technique on dimensional accuracy of implant definitive casts.

REFERENCES:

1. Guichet DL, Caputo AA, Choi H, Sorensen JA. Passivity of fit and marginal opening in screw- or cement-retained implant fixed partial denture designs. Int J Oral Maxillofac Implants. 2000;15:239–46.
2. Karl M, Taylor TD, Wichmann MG, Heckmann SM. In vivo stress behavior in cemented and screw-retained five-unit implant FPDs. J Prosthodont. 2006;15:20–4.
3. Jemt T. In vivo measurements of precision of fit involving implant-supported prostheses in the edentulous jaw. Int J Oral Maxillofac Implants. 1996;11:151–8.
4. Jemt T, Rubenstein JE, Carlsson L, Lang BR. Measuring fit at the implant prosthodontic interface. J Prosthet Dent. 1996;75:314–25.
5. Reddy S, Prasad K, Vakil H, Jain A, Chowdhary R. Accuracy of impressions with different impression materials in angulated implants. Niger J ClinPract. 2013. Jul-Sep;16(3):279–84.
6. Bambini F, Girreti L, Mane L, Pellecchia M, Selvaggio R. Comparative analysis of direct and indirect implant impression techniques an in vitro study. Minerva Stomatol. 2005. June;54(6):395–402.
7. Ebadian B, Rismanchian M, Dastgheib B, Bajoghli F. Effect of different impression materials and techniques on the dimensional accuracy of implant definitive casts. Dent Res J (Isfahan). 2015. Mar-Apr;12(2):136–43.
8. Nakhaei M, Madani AS, Moraditalab A, Haghi HR. Three-dimensional accuracy of different impression techniques for dental implants. Dent Res J (Isfahan). 2015;12(5):431–7
9. Kim S, Nicholls JI, Han CH, Lee KW. Displacement of implant components from impressions to definitive casts. Int J Oral Maxillofac Implants. 2006;21:747–55.
10. Lorenzoni M, Pertl C, Penkner K, Polansky R, Sedaj B, Wegscheider WA. Comparison of the transfer precision of three different impression materials in combination with transfer caps for the Frialit-2 system. J Oral Rehabil. 2000;27:629–38.
11. Rashidan N, Alikhasi M, Samadizadeh S, Beyabanaki E, Kharazifard MJ. Accuracy of implant impressions with different impression coping types and shapes. Clin Implant Dent Relat Res. 2012 Apr;14(2):218-25.
12. Vigolo P, Fonzi F, Majzoub Z, Cordioli G. An evaluation of impression techniques for multiple internal connection implant prostheses. J Prosthet Dent. 2004 Nov;92(5):470-6.
13. Pujari M, Garg P, Prithviraj DR. Evaluation of accuracy of casts of multiple internal connection implant prosthesis obtained from different impression materials and techniques: an in vitro study. J Oral Implantol. 2014 Apr;40(2):137-45.
14. Lee H, Ercoli C, Funkenbusch PD, Feng C. Effect of subgingival depth of implant placement on the dimensional accuracy of the implant impression: an in vitro study. J Prosthet Dent. 2008 Feb;99(2):107-13.