

Comparison of three dimensional accuracy of two implant level impression techniques; using three different elastomeric impression materials-an in vitro study

Jagadeesh Naik¹, Sidhartha S. P. Behera^{2*}, Girish Galagali³, Prakash Nidawani⁴

¹Private Practitioner, ²Associate Professor, ³Professor and HOD, ⁴Professor, Dept. of Prosthodontics, ²Kims Dental College, Amalapuram, Andhra Pradesh, ^{3,4}Navodaya Dental College and Hospital, Raichur, Karnataka, India

Abstract

Aim: To compare 3-Dimensional accuracy of open and closed impression technique using three elastomeric impression materials to transfer the intraoral position of implant fixture to the working cast.

Objective: To compare 3-Dimensional accuracy of open and closed tray impression technique by using addition silicone, condensation silicone and polyether impression materials for making implant level impressions.

Materials and Methods: Experiments was conducted to find the three dimensional accuracy of casts made with three impression materials for implant impressions by open and closed tray impression techniques. Five implant analogs were placed on a maxillary acrylic model; impression posts were screwed to implant analogs. 30 stock trays and 30 open window custom trays were prepared. These 30 stock trays and 30 open window custom trays were again divided into three subgroups by using three impression materials. Then the impressions were poured using die stone according to manufacturer's instructions. Specific dimensions of resultant cast was measured. The dimensional changes were measured using White light laser scanner and data analysis was done by XOV Rapidform Software.

Comparison between materials was done by ANOVA test followed by Tukey's multiple comparison test. Comparison between two techniques was done by unpaired 't' test.

Results: The data was subjected to statistical analysis which was done by ANOVA test followed by Tukey's multiple comparison test and Comparison between two techniques was done by unpaired 't' test. Statistical analysis shows significantly less difference in open tray technique when compared to closed tray impression technique.

Conclusion: Within the limitation of this study; 1. Open tray impression technique is more accurate than the closed tray impression technique for making implant impression; 2. Polyether and Addition silicone elastomeric impression materials were there commended materials for implant impressions.

Keywords: Implants, Impression Techniques

Introduction

Reproducing the intraoral relationship of implants on working cast through impression procedures is the first step in achieving an accurate, passively fitting prosthesis.¹ Consequently, recording the intraoral three-dimensional position of implants is a more critical task in the realization of implant supported than in tooth supported prostheses to ensure an accurate relationship transferred on the master cast. However, the results are not always consistent, and various studies reported greater accuracy with different impression techniques as well as impression materials.² In dental implant prosthesis, fabrication of passively fitting prosthesis will lead to the long term success of the restorations. The critical aspect is to record the 3-dimensional orientation of the implant as it is present intra orally, other than reproducing fine surface detail for successful implant prosthodontics treatment.³ Implant-level impression making permits selection of the most appropriate abutments in the laboratory with abutment selection kits, which is helpful for situations where vertical space and/or angulation of the abutment are

difficult to determine intra orally. In addition, it facilitates replacement of the healing caps by eliminating the need to cover the abutments with temporary restorations or protective caps. In particular, when the restoration connects directly to the implants, as in cases of insufficient vertical space, the definitive cast is obtained by an implant-level impression.⁴

Materials and Methods

Materials

A edentulous maxillary acrylic model had been fabricated and five implant analogs of ADIN implants with impression posts were placed on the acrylic model, Maxillary perforated metal stock tray is used for making closed tray impression technique and Custom made maxillary acrylic tray for open tray impression technique. Three elastomeric impression materials such as Addition silicone impression material-Coltene, Condensation silicone impression material-Stomaflex and Polyether impression material-3M ESPE had been used.

*Corresponding Author: Sidhartha S. P. Behera, Dept. of Prosthodontics, Kims Dental College, Amalapuram, Andhra Pradesh, India
Email: drsidprosthokims@gmail.com
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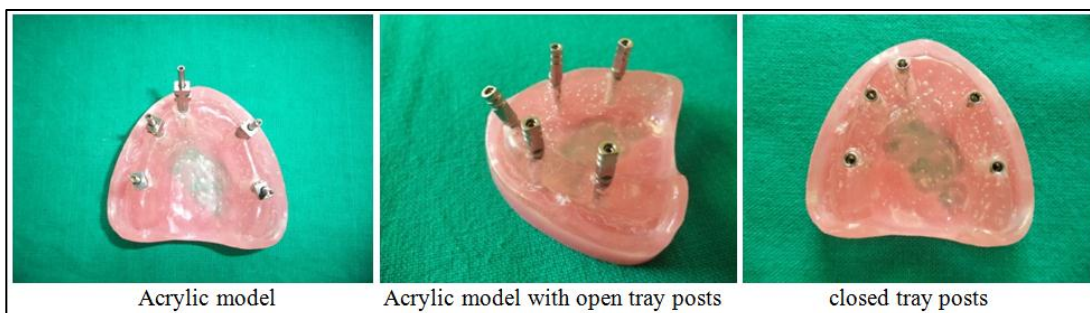


Fig. 1:

Method of collection of the data

Five implant analogs were placed on a maxillary acrylic model, impression posts were screwed to implant analogs. 30 stock trays and 30 open window custom trays were prepared. These 30 stock trays and 30 open window custom trays were again divided in to three subgroups by using three impression materials.

Group A (Open tray technique)

A) Polyether 10 impressions B) Condensation silicone 10 impressions C) Addition silicone 10 impressions.

Group A (Closed tray technique)

A) Polyether 10 impressions B) Condensation silicone 10 impressions C) Addition silicone 10 impressions.

Impression making

For the open tray technique, warmed boxing wax were adapted over the openings before loading the tray with impression material. After the tray was seated, the base plate wax was used to prevent flowing of the impression material through the openings and also to help identify the location of the impression copings. The copings were loosened with a driver and removed; the tray was separated from the master cast while the impression copings remained locked in the impression. The guide pins were placed back into the open tray impression copings from the top, while an implant analog was connected to the hex and the guide pins were hand tightened.

For the open tray technique copings remained on the master cast after the impression material had polymerized when the tray was removed. These impression copings were removed one at a time from the resin model and attached to an implant analog. The combined impression coping and analog unit was inserted into the impression by firmly pushing it into place to full depth. Type IV gypsum product (Die stone) – Kalabhai was mixed with water according to manufacturer recommendation (16 ml water will be used with each 70 gm powder). The stone was mixed and was poured on a vibrator (Whip Mix Corporation, Louisville, KY). Casts were separated from the impressions after allowing the stone to set for 1 hour, followed by trimming and labeling to prepare for measurements.

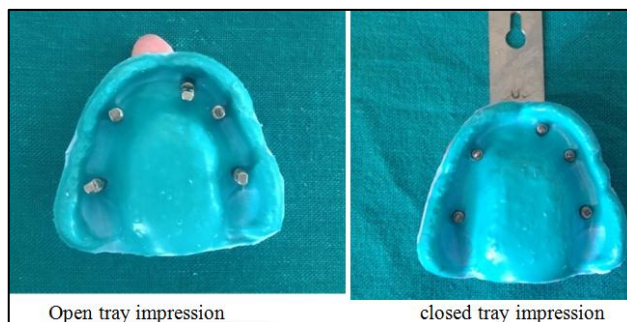


Fig. 2:

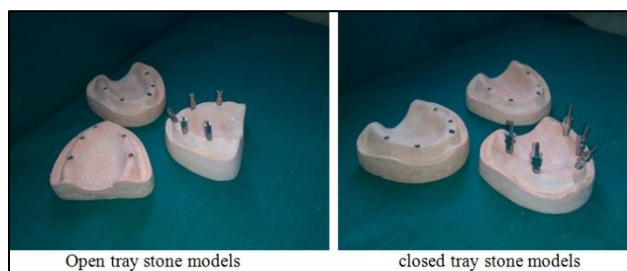


Fig. 3:

Measurement protocol

Dimensional measurements

The dimensional changes were measured using White light laser scanner and data analysis was done by XOV Rapidform Software.

Statistical analysis

Descriptive statistics such as mean and SD was used. Comparison between materials was done by ANOVA test followed by Tukey’s multiple comparison test. Comparison between two techniques was done by unpaired ‘t’ test. A p-value less than 0.05 were considered as significant.

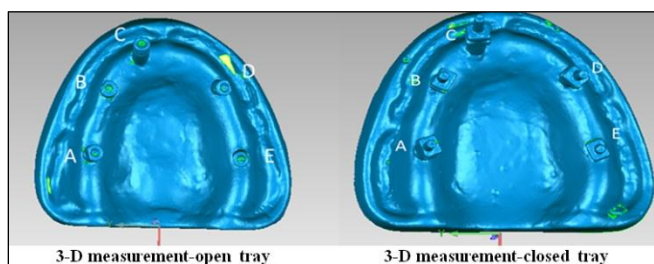


Fig. 4:

Results

Table1:Distance comparison open tray vs close tray; Addition silicone

Closed trayimpression technique				Open tray impression technique		
Reference point	Standard model	Addition silicone	Mean diff.	Standard model	Addition silicone	Mean diff.
A-B	18.394 ± 0.0	18.377 ± 0.04	0.017	18.005 ± 0.0	18.005 ± 0.004	0.00
B-C	15.533 ± 0.0	15.531 ± 0.006	0.002	17.247 ± 0.0	17.247 ± 0.006	0.00
C-D	25.62 ± 0.0	25.620 ± 0.003	0.00	27.728 ± 0.0	27.728 ± 0.02	0.00
D-E	20.299 ± 0.0	20.299 ± 0.005	0.00	20.145 ± 0.0	20.145 ± 0.01	0.00

Table2:Distance comparison open tray vs close tray; Condensation silicone

Closed trayimpression technique				Open trayimpression technique		
Reference point	Standard model	Condensation silicone	Mean diff.	Standard model	Condensation silicone	Mean diff.
A-B	18.394 ± 0.0	18.419 ± 0.02	0.025	18.005 ± 0.0	18.022 ± 0.03	0.017
B-C	15.533 ± 0.0	15.543 ± 0.01	0.01	17.247 ± 0.0	17.252 ± 0.04	0.005
C-D	25.62 ± 0.0	25.625 ± 0.006	0.005	27.728 ± 0.0	27.743 ± 0.01	0.015
D-E	20.299 ± 0.0	20.310 ± 0.02	0.011	20.145 ± 0.0	20.155 ± 0.009	0.01

Table5: Distance comparison open tray vs close tray; Polyether

Closed trayimpression technique				Open trayimpression technique		
Reference point	Standard model	Polyether	Mean diff.	Standard model	Polyether	Mean diff.
A-B	18.394 ± 0.0	18.392 ± 0.01	0.002	18.005 ± 0.0	18.005 ± 0.01	0.00
B-C	15.533 ± 0.0	15.532 ± 0.01	0.001	17.247 ± 0.0	17.247 ± 0.003	0.00
C-D	25.62 ± 0.0	25.619 ± 0.006	0.001	27.728 ± 0.0	27.728 ± 0.009	0.00
D-E	20.299 ± 0.0	20.299 ± 0.006	0.00	20.145 ± 0.0	20.145 ± 0.009	0.00

Statistical analysis shows significantly less difference in open tray technique when compared to closed tray impression technique. Based on the data open tray technique is more accurate than closed tray technique for making implant impression.

Discussion

In dental implant prosthesis, fabrication of passively fitting prosthesis will lead to the long term success of the restorations. Reproducing the intraoral relationship of implants through impression procedures is the first step in achieving an accurate, passively fitting prosthesis. The critical aspect is to record the 3-dimensional orientation of the implant as it is present intra orally, other than reproducing fine surface detail for successful implant prosthodontics treatment.

Previous studies compared the accuracy of pick-up on transfer impression techniques,⁵⁻¹² and few studies showed more accurate impressions with the transfer technique.¹³ Daoudi et al investigated repositioning of the copings after making the transfer impression by 3 different groups of people: senior dentists, post graduate dental students, and dental technicians. The copings never returned to the original position and this was believed to be the primary source of error in the transfer impression technique. This error could be multiplied when the impression is made in situations of multiple implant placement. It was found that for situations in which there

were 4 or more implants, more studies showed more accurate impressions with the pick-up technique than the transfer technique. Various impression materials were tested, such as condensation silicone, polysulfide, reversible hydrocolloid, irreversible hydrocolloid, and plaster, but polyether and addition silicone were used most frequently. The studies comparing the accuracy of polyether and addition silicone,⁹⁻¹⁴ and few studies reported that the accuracy did not differ.^{15,16} Lee et al reported that putty and light-body combination addition silicone impression material was more accurate than medium-body polyether impression material when the implant was placed deep subgingivally. The findings of this in vitro study do not support rejection of the null hypothesis, as Statistical analysis shows significantly less difference in open tray technique when compared to closed tray impression technique.¹⁷ Based on the data open tray technique is more accurate than closed tray technique for making implant impression with polyether and addition silicon elastomeric material showing the higher accuracy of Implant level Impressions.

Conclusion

Within the limitation of this study

1. Open tray impression technique is more accurate than the closed tray impression technique for making implant impression

2. Polyether and Addition silicone elastomeric impression materials were the recommended materials for implant impressions.

It is important to understand all of the prosthetic steps necessary for the treatment success. With proper selection of impression material and technique to make implant level impression are more predictable when compared with conventional techniques. Future studies can be taken up with various other material and techniques subjected to the more scientific evaluation under simulated clinical conditions.

Source of Funding

None.

Conflict of Interest

None.

Reference

1. Steigenga JT, Al-Shammari KF, Nociti FH, Misch CE, Wang H. Dental implant design and its relationship to long-term implant success. *Implant Dent* 2003;12(4):306-17.
2. The glossary of prosthodontic terms July. *J Prosthet Dent* 2005;94(1):10-92.
3. S.Reddy, KPrasad, HVakil, A Jain, RChowdary. Accuracy of impressions with different impression materials in angulated implants. *Nigerian J Clin Pract* 2013;16(3).
4. Choi JH, Lim YJ, Yim SH, Kim CW. Evaluation of the accuracy of implant-level impression techniques for internal-connection implant prostheses in parallel and divergent models. *Int J Oral Maxillofac Implants* 2007;22:761-68.
5. Barrett MG, de Rijk WG, Burgess JO. The accuracy of six impression techniques for osseointegrated implants. *J Prosthodont* 1993;2:75-82.
6. Del'Acqua MA, Arioli-Filho JN, Compagnoni MA, Mollo Fd A Jr. Accuracy of impression and pouring techniques for an implant-supported prosthesis. *Int J Oral Maxillofac Implants* 2008;23:226-36.
7. Daoudi MF, Setchell DJ, Searson LJ. An evaluation of three implant level impression techniques for single tooth implant. *Eur J Prosthodont Restor Dent* 2004;12:9-14.
8. De La Cruz JE, Funkenbusch PD, Ercoli C, Moss ME, Graser GN, Tallents RH et al. Verification jig for implant-supported prostheses: A comparison of standard impressions with verification jigs made of different materials. *J Prosthet Dent* 2002;88:329-36.
9. Carr AB. Comparison of impression techniques for a five-implant mandibular model. *Int J Oral Maxillofac Implants* 1991;6:448-55.
10. Carr AB. Comparison of impression techniques for a two-implant 15-degree divergent model. *Int J Oral Maxillofac Implants* 1992;7:468-75.
11. Conrad HJ, Pesun IJ, DeLong R, Hodges JS. Accuracy of two impression techniques with angulated implants. *J Prosthet Dent* 2007;97:349-56.
12. Wenz HJ, Hertrampf K. Accuracy of impressions and casts using different implant impression techniques in a multi-implant system with an internal hex connection. *Int J Oral Maxillofac Implants* 2008;23:39-47.
13. Humphries RM, Yaman P, Bloem TJ. The accuracy of implant master casts constructed from transfer impressions. *Int J Oral Maxillofac Implants* 1990;5:331-6.
14. 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.
15. Wenz HJ, Hertrampf K. Accuracy of impressions and casts using different implant impression techniques in a multi-implant system with an internal hex connection. *Int J Oral Maxillofac Implants* 2008;23:39-47.
16. Daoudi MF, Setchell DJ, Searson LJ. A laboratory investigation of the accuracy of two impression techniques for single-tooth implants. *Int J Prosthodont* 2001;14:152-8.
17. 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;99:107-13.

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