

Comparison of Direct and Indirect Transfer Impression Technique Made with Polyether and Polyvinyl Siloxane Impression Material: An In Vitro Study

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ABSTRACT

Background: Implant impression technique selection is always very crucial for success of implant treatment as any minor deviation from accurate transfer will result in ill fitting of framework. The present study has evaluated two most widely used techniques and comparison between their accuracy is done to get the most accurate technique.

Materials and Method: Total 60 impressions were recorded with 15 each subdivided in 4 groups. Impressions were recorded and cast prepared from each impression. 4 Reference points were marked and distance from each reference points were measured in the prepared cast and comparison was done with the master model. Measured values were tabulated and Statistical analysis was done using Statistical Package of Social Science (SPSS Version 20; Chicago Inc., USA). One Sample t-test for comparison with master model and Student's t-test was used to analyze the variation in mean between two groups of a variable with a normal distribution were employed. Significance level was fixed at $P < 0.05$.

Result: Measurements of distances among each points A,B,C,D was recorded and comparative analysis of mean deviation of interabutment distance from master model at various distance was found statistically non-significant. ($P > 0.05$). Least mean deviation was found in group of open tray technique with Polyether impression material for all distance. Closed tray with Polyvinyl Siloxane showed highest deviation of mean values. However, when intergroup comparison among groups was done through Student 't' test, deviations did not show any significant statistical difference ($P > 0.05$). Mean deviation between open tray with polyether and polyvinyl siloxane as well as between closed tray with polyether and polyvinyl through student 't' test showed comparable accuracy with no significant statistical difference ($P > 0.05$).

Conclusion: Within limitation of the study conducted, the following conclusions were drawn from the study that both Open tray and closed tray techniques can be used with either Polyether or polyvinyl siloxane impression material to get accurate transfer of intraoral implant positions to the working cast.

Keywords: Implant, Impression, Polyether, Polyvinyl Siloxane.

INTRODUCTION

Dental impression is defined as a negative imprint of an oral structure used to produce a positive replica of the structure to be used as a permanent

record or in the production of a dental restoration or prosthesis.¹ The object of making an impression in implant dentistry is to accurately relate an

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Table 1: The impressions were categorized in to two groups A & B groups and further subdivided in A1,B1, A2 and B2

	(A)Open Tray Technique With Custom Tray (N=30)	(B)Closed Tray Technique With Stainless Steel Stock Tray (n=30)
(1)Polyether (n=30)	(A1)Polyether Impression Made With Open Tray Technique (n=15)	(B1) Polyether Impression Made With Closed Tray Technique (n=15)
(2)Polyvinyl Siloxane (n=30)	(A2)Polyvinyl Siloxane Impression Made With Open Tray Technique (n=15)	(B2)Polyvinyl Impressions Made With Closed Tray Technique (n=15)

Table 2: Comparison of Mean deviation from master model between group A-1 & A-2 at various distance.

Distance	MASTER MODEL	GROUP A-1 DEVIATION		GROUP A-2 DEVIATION		Unpaired Student 't' Test Value	P Value
		MEAN	SD	MEAN	SD		
AB	15.566	0.00580	0.002111	0.00620	0.002484	0.475	0.638(NS)
BC	39.982	0.00353	0.001407	0.00380	0.001656	0.475	0.638(NS)
CD	16.656	0.00580	0.002111	0.00620	0.002484	0.475	0.638(NS)
AD	41.766	0.00567	0.001759	0.00600	0.002070	0.475	0.638(NS)
AC	31.564	0.00687	0.004926	0.00873	0.006408	0.894	0.379(NS)
BD	43.563	0.01073	0.004574	0.01247	0.005951	0.894	0.379(NS)

P > 0.05 Not significant

Table 3: Comparison of Mean deviation from master model between group A-1 & B-1 at various distance.

Distance	MASTER MODEL	GROUP A-1 DEVIATION		GROUP B-1 DEVIATION		Unpaired Student 't' Test Value	P Value
		MEAN	SD	MEAN	SD		
AB	15.566	0.00580	0.002111	0.00660	0.002746	0.894	0.379(NS)
BC	39.982	0.00353	0.001407	0.00407	0.001831	0.894	0.379(NS)
CD	16.656	0.00580	0.002111	0.00660	0.002746	0.894	0.379(NS)
AD	41.766	0.00567	0.001759	0.00633	0.002289	0.894	0.379(NS)
AC	31.564	0.00687	0.004926	0.00873	0.006408	0.894	0.379(NS)
BD	43.563	0.01073	0.004574	0.01247	0.005951	0.894	0.379(NS)

P > 0.05 Not significant

Table 4: Comparison of Mean deviation from master model between group A-1 & B-2 at various distance.

Distance	MASTER MODEL	GROUP A-1 DEVIATION		GROUP B-2 DEVIATION		Unpaired Student 't' Test Value	P Value
		MEAN	SD	MEAN	SD		
AB	15.566	0.00580	0.002111	0.00700	0.002928	1.288	0.208(NS)
BC	39.982	0.00353	0.001407	0.00433	0.001952	1.288	0.208(NS)
CD	16.656	0.00580	0.002111	0.00700	0.002928	1.288	0.208(NS)
AD	41.766	0.00567	0.001759	0.00667	0.002440	1.288	0.208(NS)
AC	31.564	0.00687	0.004926	0.00967	0.006831	1.288	0.208(NS)
BD	43.563	0.01073	0.004574	0.01333	0.006343	1.288	0.208(NS)

P > 0.05 Not significant

analogue of implant or implant abutment to the other structures in the dental arch. Commonly used Implant impression techniques include open tray and closed tray techniques with impression material of choice being Polyether and Polyvinyl Siloxane.

Closed tray impression techniques have impression copings retained in the mouth when the set impression is removed. The implant analogue is attached to the impression coping after removal from the mouth and this assembly is replaced in the indentation left on the set impression. No custom tray is required for this type of impression. In Open Tray impression technique, impression copings are incorporated in the impression and are removed from the mouth together with the set impression. They require access to the retaining screw to allow release of the screw prior to removal of the impression coping - impression assembly; the implant analogues are then attached to the impression copings while they remain embedded in the impression tray. A custom tray with access to the impression coping screws is required for open tray technique.

MATERIAL AND METHODS

A maxillary typhodont Jaw set from API was taken and all typhodont teeth were removed except two central incisors and right and left second molar as well as third molars. These typhodont teeth were covered with self cure Polymethyl Methacrylate in such a way that they formed a block of 13 mm height each. These blocks could be removed during the procedure if required. These blocks gave a uniform clearance and fixed stop for the stock tray during all impressions. Four implant fixtures were placed in places of right and left canines and second premolars and sealed with autopolymerising polymethyl methacrylate to make it properly fixed and immobile. After placing all implant fixtures, respective implant abutments were fastened to the fixtures and radiographs were taken to check proper fit at implant abutments interface. Total 60 impressions were recorded with 15 each subdivided in Group A1,A2, B1 and B2 as mentioned in Table- 1. In closed tray impression technique, 30 stainless steel stock tray were used with uniform size for 15 impression with polyether as well as Polyvinyl Siloxane. In Open tray technique, 30 custom trays were prepared with holes for implant

abutments for 15 impressions each with both materials. All the impressions were recorded without splinting of transfer copings.³ Vertical stops were made in master model to ensure same thickness of impression material in every impression.

Working cast were prepared then with Type IV dental stone and the linear distance between margins of implant abutments in the master model was recorded using Nikon Profile Projector and compared with working cast. Four reference points at the distal margin were fixed as A, B, C, D on all four Implant abutments and the distance from one reference point to another were measured in the master model as well as the working cast to check for any deviation. The distances were measured using a profile projector with an electronic digital micrometer mechanism having a measurement capability of 1 µm.

All the measurements were recorded three times by the same operators and the mean value was selected as final measurement. The measurements of the master model and the working stone casts obtained were statistically analyzed to see the deviations. Statistical analysis was done using Statistical Package of Social Science (SPSS Version 20; Chicago Inc., USA). One Sample t-test for comparison with master model and Student's t-test was used to analyze the variation in mean between two groups of a variable with a normal distribution were employed. Significance level was fixed at $P \leq 0.05$.

RESULTS

Measurements of distances among each points A,,B,C,D was recorded and comparative analysis of mean deviation of interabutment distance from master model between A1&A2, A1&B1, A1&B2, A2&B1, A2&B2 and B1&B2 at various distance was found statistically non-significant. ($P>0.05$) as illustrated in Table 2-4 respectively.

DISCUSSION

Accuracy of impressions and casts is a pre requisite for the fabrication of precisely fitting implant-retained prostheses and consequently for the long-term clinical success of these restorations. Two basic impression techniques routinely used for the transfer of the implant positions from the intraoral

situation to a working cast are open tray technique and closed tray technique. It is always a matter of dilemma for clinicians to select best technique in terms of accuracy to get exact transfer of implant positions to their working casts. Selection of right implant impression material has also been a very subjective and confusing for many clinicians. Both the techniques and materials have their own pros and cons. Closed tray technique is less complicated as they do not require custom tray and is just like traditional conventional impression making whereas in Open tray technique, need custom tray with holes. In the present study, least percentage mean deviation for interabutment distances in working cast was found in group A1(Open tray technique with Polyether impression material) for distances AB,BC,CD,DA,AC and BD than group A2,B1and B2 whereas B2(Closed tray technique with Polyvinyl Siloxane) showed highest deviation of mean values from master model. However, when intergroup comparison among groups was done through Student 't' test, deviations did not show any significant statistical difference ($P>0.05$). That shows that both the techniques can be used with comparable results and clinician may choose any of the techniques of their choice and ease of use. **Nakhaei et al.** ² also found similar result where closed tray implant impression technique was found similar to the open-tray technique. However, study by **Balouch et al.** ³ found less dimensional changes in closed impression technique compared to open tray method whereas **Carr AB.** ⁴ founded that open tray transfer method provided the most accurate working cast and the inaccuracy seen with the closed tray transfer method seemed to correlate with the nonparallel abutment relationship and the apparent deformation of the impression material.

Another parameter which was analyzed in the present study was the accuracy of impression material. Polyether was used in group A1 and B1 and Vinyl Polysiloxane material was used in group A2 and B2. Comparison of mean deviation from master model between A1 and A2 as well as between B1 and B2 through student 't' test showed comparable accuracy with no significant statistical difference ($P>0.05$) between Polyether and Vinyl Polysiloxane impression material. This again makes it very easy for clinician to decide and choose among these two materials as both give equally accurate result. These results are in consonance

with study result by **Liou et al.** ⁵Whereas, past study by **Wee et al.** ⁶ illustrated the torque resistance of impression materials and reported that polyether material showed the greatest torque values and is suitable for pick-up impression whereas **Lee et al.** ⁷ found Vinyl Polysiloxane impression materials more precise than polyether impression materials when implants are placed deep into the gingival.

Even though efforts have been done to simulate the clinical situations closely, further *in vivo* studies would be essential to yield more clinically applicable findings. The present study had some limitations which include chances of human error in recording the values of measurements, impression record environmental variation during setting of working die stone cast. Also, further clinical investigations would be necessary to confirm the results of the present *in vitro* study.

CONCLUSION

Within limitation of the study conducted, the following conclusions were drawn from the study that both Open tray and closed tray techniques can be used with either Polyether or polyvinyl siloxane impression material to get accurate transfer of intraoral implant positions to the working cast. Clinicians may choose among these techniques and materials whichever they find suitable and easy to use at their clinical set up to get accurate result.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interest regarding this article

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