Research Article

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Comparison of Two Different Implant Impression Techniques: An In Vitro Study

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ABSTRACT

Aim: The purpose of this study is to investigate the most accurate impression technique and to know the influence of the tray type and impression material in transferring the intraoral position of implant fixture to working cast.

Materials and methods: An acrylic resin model of edentulous model, 12 implant analogs of standard imension , 3.3mm in diameter of Hitech brand are used. Two types of clear acrylic custom trays that are open window and closed window custom trays were fabricated. Two types of impression posts were used, namely closed window impression post and open window impression posts. Two types of impression materials are used those are polyether medium body (impregum) and polyvinyl siloxane heavy and light body used. Type IV die stone is used. 30 impressions by using open window and 30 by closed window techniques were made. Casts were made. CMM machine is used to record the measurements in 3D.

Results: Statistical analysis shows that there is significant difference between open window technique and closed window technique. But there is no significant difference found between two impression materials that are polyether and polyvinyl siloxane .

Conclusion: Open window tray technique is much better than closed window tray technique for making implant impressions. Both impressions materials, polyether and polyvinyl siloxane are ideal impression materials for implants.

Keywords: Open window tray, Closed window tray, Coordinated measuring machine.

INTRODUCTION

Osseointegration as first defined by Brånemark is a scientific milestone that delineates a certain sense of separation of the old from the new concepts in implant dentistry. Osseointegrated implants intends to prove successful beyond doubts. Even though predictable long term results can now be achieved , certain failures do occur. Failures may be attributed to the inaccurate fit of prosthesis , to the faulty implant components or to the faulty surgical techniques. Inaccurate fit produces abnormal stress which can result in fracture of prosthesis , the fixture, the screws, or the bone[1].

An acceptable prosthesis require optimal accuracy in all steps of fabrication. To achieve a precise, passive fitting prosthesis; different tray types , impression materials and impression techniques have been suggested by different literature. Investigation has proved that rigid

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custom trays produced significantly more accurate implant fixture level impression[2]. One of the crucial steps for producing a well-fitting prosthesis is an accurate impression. The literature suggests that direct impression copings produce more accurate impressions than reseatable impression coping techniques. It also seems prudent to use a rigid elastomeric impression material, such as polyether, because it is rigid and maintains impression copings accurately, is dimensionally stable, has a good resistance to permanent deformation, has a low strain in compression (flexibility), and has a high initial shear strength[3]. Studies with prepared teeth show that custom trays produce more consistently accurate impressions , compared with stock trays. This may be because, the tray rigidity does not allow distortion of the impression[4].

The object of making an impression in implant dentistry is to accurately relate an analog of the implant or implant abutment to the other structures in the dental arch. This is affected by use of an impression coping which is attached to the implant or implant abutment. This impression coping is incorporated in an impression – much as a metal framework is 'picked up' in a remount impression for fixed prosthodontics. With implant copings the coping is usually attached to the implant or abutment with screws. The impression material used is usually an elastomeric impression material; the two types most widely used and shown to be the most appropriate are polyether and polyvinyl siloxane impression materials[5].

During impression making, proper orientation of position of implant is important. any discrepancies in orientation will affect the final prosthesis part. Thus this study will concentrate on orientation of implant position during impression making , by using two techniques , open window custom tray and closed window custom tray technique ,with the use of two impression materials that are polyether and polyvinyl siloxane.

AIMS & OBJECTIVES

1. To assess accuracy of casts obtained from closed window implant impression technique by using putty and light body polyvinyl and medium body polyether impression material.

2. To asses accuracy of casts obtained from open window implant impression technique by using putty and light body polyvinyl siloxane and medium body polyether impression material.

MATERIALS & METHOD

MATERIALS.

1. An acrylic resin model of edentulous mandible.
2. 12 implant analogues of standard dimension , 3.3 mm in diameter of Hitech brand.
3. 6 impression posts for closed window technique, Hitech brand.
4. 6 impression posts for open window technique, Hitech brand.
5. Polyvinyl siloxane heavy and light body impression material, 3M ESPE.
6. Polyether medium body impression material, 3M ESPE IMPREGUM.
7. Clear acrylic resin, DPI company.
8. Type IV die stone.
9. Coordinated measuring machine of ZEISS company.

METHODS

Fabrication of an acrylic resin model. Type III dental stone model was poured. By using straight handpiece and straight fissure carbide bur, 6 holes were drilled , 3.5mm in diameter , for placement of implant analogue on dental stone model .Out of which 4 holes were drilled in anterior region from canine to canine and 2 holes were drilled in posterior region at premolar region of both sides [Fig.1]. The whole dental stone model with drilled holes was then duplicated in agar- agar[BEGO][Fig.2]. And a clear acrylic resin model was obtained[Fig.3].

Fabrication of clear acrylic resin custom trays for closed window and open window technique**:** Impression posts for closed window technique were tightly screwed to implant analogs[HITECH] which were placed in resin model. By using modelling wax the whole assembly was splinted and undercuts had been blocked. Then try was fabricated using clear acrylic. For open window technique Clear acrylic resin tray was fabricated , window was created in the custom tray.

Fig 1: Stone model with drilled holes.

Fig 2: Duplicate stone model in Agar Agar.

Fig 3: Coordinates measuring machine.

Fig 4: Acrylic resin model.

Fig 5: Acrylic resin model with closed tray implant analogue.

Fig 6: Closed tray PVS impression.

Fig 7: Closed tray polyether impression.

Fig 8: Master cast.

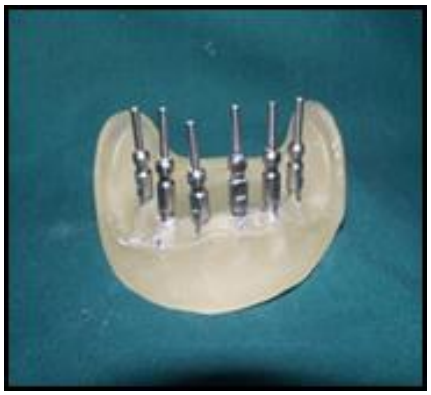

Fig 9: Acrylic resin model with open try implant analogue.

Fig 10: Open tray PVS impression.

Fig 11: Open tray polyether impression

Fig 12: Master cast.

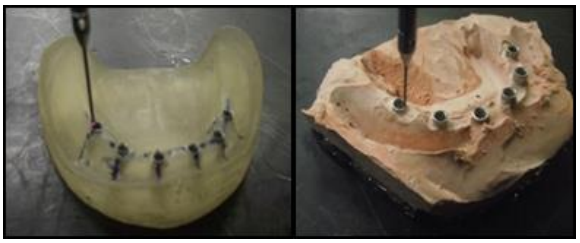

Fig 10: Measurement of acrylic resin model and master cast In X,Y,Z axes by CMM machine.

IMPRESSION PROCEDURE.

CLOSED WINDOW TECHNIQUE.

15 impressions each were made by polyvinyl siloxane[3M ESPE] and polyether[3M ESPE IMPREGUM] impression material, using closed tray impression technique[Fig 6][Fig.7]. Before making an impression the intalgo surface of tray should be coated with tray adhesive. Impression posts for closed window were tightly screwed to implant analogs[HITECH][Fig.5]. Impressions were made. Impression posts were unscrewed from implant analogues. Then impression posts were placed in impression along with new implant analogues. By using type IV die stone impressions are poured and casts were made[Fig.8].

OPEN WINDOW TECHNIQUE.

15 impressions each were made by polyvinyl siloxane[3M ESPE] and polyether[3M ESPE IMPREGUM] impression material using the open tray impression technique[Fig.10][Fig.11]. Before making an impression the intalgo surface of tray should be coated with tray adhesive. Impression posts were attached in such a way that they should come along with impressions[Fig.9]. Impressions were made. Implant analogs[HITECH] were connected to posts which was picked up in the impressions[Fig.9]. Type IV die stone was used to pour the impressions, and casts were obtained[Fig.12]. Evaluation of resultant cast for accuracy as compared to master cast by using coordinated measuring machine. Coordinated measuring machine[ZEISS] is capable of measuring in a three axes, that are X axis , Y axis and Z axis. Dimensions of master cast was measured by

Table 1: The difference in mean orientation between the groups is found to be statistically significant (P<0.001)

Module	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Min	Max
				Lower Bound	Upper Bound		
Open Tray - PVS	9.102	0.091	0.023	9.052	9.152	8.876	9.214
Open Tray - Polyether	9.136	0.170	0.044	9.042	9.230	8.756	9.501
Closed Tray - PVS	8.495	0.143	0.037	8.416	8.574	8.267	8.881
Closed Tray - Polyether	8.450	0.172	0.044	8.354	8.545	8.133	8.786

Table 2. The difference in mean orientation between the groups is found to be statistically significant (P<0.001)
ANOVA:

Source	df	Sum of Squares (SS)	Mean SS	F	P-Value
Between Groups	3	6.300	2.100	96.526	<0.001*
Within Groups	56	1.218	0.022	---	---
Total	59	7.518	---	---	---

*denotes significant difference

Table 3. (1 sample t-test) The difference in mean orientation between the master model and all the other modules were found to be statistically significant (P<0.001)

Module	Mean	Stddev	Mean difference	t	P-Value
Open Tray - PVS	9.102	0.091	-0.509	-21.730	<0.001*
Open Tray - Polyether	9.136	0.170	-0.475	-10.850	<0.001*
Closed Tray - PVS	8.495	0.143	-1.116	-30.300	<0.001*
Closed Tray - Polyether	8.450	0.172	-1.161	-26.100	<0.001*

*denotes significant difference

Table 4: Mean values of all 15 samples of each four groups.

SR NO.	OPEN TRAY POLYVINYL SILOXANE.	OPEN TRAY POLYETHER.	CLOSED TRAY POLYVINYL SILOXANE.	CLOSED TRAY POLYETHER.
1	9.120	9.501	8.398	8.623
2	9.135	9.139	8.567	8.786
3	9.094	9.112	8.481	8.268
4	9.013	8.959	8.267	8.498
5	9.159	8.756	8.397	8.133
6	9.074	9.053	8.881	8.254
7	9.214	9.213	8.357	8.363
8	8.984	9.204	8.544	8.663
9	9.173	8.976	8.523	8.457
10	9.053	9.095	8.637	8.510
11	9.159	9.287	8.388	8.591
12	9.165	9.256	8.517	8.473

13	9.198	9.153	8.431	8.412
14	8.876	9.101	8.501	8.397
15	9.117	9.234	8.531	8.319

Table 5: Mean value of each group was calculated. All values are in millimeters.

SAMPLES	MEAN VALUES.
MASTER MODEL	9.611
OPEN TRAY POLYVINYL SILOXANE GROUP.	9.102
OPEN TRAY POLYETHER GROUP.	9.136
CLOSED TRAY POLYVINYL SILOXANE GROUP.	8.495
CLOSED TRAY POLYETHER GROUP.	8.450

using coordinated measuring machine, in three axis. Dimensions of resultant 60 samples were measured by using coordinated measuring machine in three axis that are X axis , Y axis and Z axi[Fig.13]. The study was done at UNIQUE INSTRUMENTS AND MFRS PVT LIMITED, PEENYA INDUSTRIAL ESTATE, BANGALORE.

RESULTS

STATISTICAL ANALYSIS.

Mean orientation (mm) recorded in the four different modules. Higher mean orientation is recorded in Open Tray – Polyether followed by Open Tray – PVS and Closed Tray – PVS respectively. Lowest mean orientation is recorded in Closed Tray – Polyether. The difference in mean orientation between the groups is found to be statistically significant (P<0.001) [Table 1 & 2][Fig.15] The difference in mean orientation between the master model and all the other modules were found to be statistically significant (P<0.001) [Table.3] [Fig.16]

Mean values calculated from sum of all actual values divided by three dimensions of all analogues[Table.4]. All measurements were recorded in x, y and z axes respectively. Statistical analysis shows that there is significant difference between open tray window technique and closed window technique. But there is no significant difference found between two impression materials that are polyether and polyvinyl siloxane . Red arrow is indicating X axis, Green arrow is indicating Y axis, Blue arrow is indicating Z axis[Fig.14].

DISCUSSION

For successful prosthetic part proper orientation of implants is necessary during impression making. In the past recent years so many studies has been done on implant impression techniques. Investigation has suggested that custom tray proved to be better than stock trays for implant impressions, and ideal material is elastic impression material that is polyvinyl siloxane and polyether impression material. In 2008 Heeje lee and joseph suggested that polyether and polyvinyl siloxane are the best recommended impression materials for the implant impressions[6]. Stefen Holst and Markus Blatz in 2007 investigated that polyether and polyvinyl siloxane materials provide comparable accuracy, not the kind of elastomer but rather the specific composition and viscoelastic properties of the materials are most important[7]. W Chee and S Jeevraj in 2006 also suggested that polyvinyl siloxane and polyether impression materials are the recommended impression materials for implant impressions[8]. Jason Burns and Richard Palmer in 2003 suggested that rigid custom trays produced significantly more accurate implant impression than that of polycarbonate stock trays[7].

All research suggested that custom trays that are open tray and closed trays are much better in producing accurate implant impression than that of stock trays . But this study showed only orientation of implant analogs in three dimensions. This study does not explain marginal fit of implant analogue after making

impressions. Due to the limitations pertaining to the study, further research regarding implant impression techniques combined with marginal fit of implant analogues have been suggested.

CONCLUSION

Finally this study concludes that , Open window tray technique is much better than closed window technique for making implant impressions. Both impressions materials polyether and polyvinyl siloxane are ideal impression materials for implants.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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