

Comparative evaluation of positional accuracy in multiple implant using open tray impression technique with different impression material: an in-vitro study

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Abstract

Background: To evaluate positional accuracy in multiple implant using open tray impression technique with different impression material.

Materials & Methods: Polyether and vinylsiloxan ether materials were employed to create impressions using customized trays. 15 open tray impressions were performed using polyether, with splinted impression transfer copings held in place by auto-polymerizing acrylic resin and 15 with vinyl siloxane ether. The result was analysed using SPSS software.

Results: The non-splinted method showcased a higher mean deviation from the master cast dimension in comparison to the splinted method.

Conclusion: When utilizing the open tray technique, polyether material demonstrated superior outcomes.

Keywords: impressions, open tray, polyether.

Introduction

Dental implants have provided alternative treatments to conventional removable prosthesis for partially and completely edentulous patients. In implant prosthodontics an important factor for success with implant supported restoration is the passive fit between the superstructure and the abutments.¹ The transfer technique uses tapered copings and a closed tray to make an impression. The copings are connected to the implants, and an impression is made and removed from the mouth, thereby leaving coping intraorally. Subsequently the copings are removed and connected to the implant analogs and then the coping-analog assemblies are inserted in the impression before pouring the definitive cast. The clinical situations which indicate the use of the closed tray technique are when the patient has limited interarch space, tendency to gag if it is too difficult to access an implant in the posterior region of the mouth. Besides the impression techniques, many dental materials have been developed to improve their dimensional stability, reproducibility and handling. The impression methods are also evolved to complement the recent material advancement to improve the impression accuracy. The selection of the impression methods and materials is entirely at the discretion of the dentist. It is mainly influenced by the clinical conditions and variation. A number of impression materials are commercially available for implants out of which the two widely used are vinyl

polysiloxane and polyether. The accuracy and dimensional stability of vinyl polysiloxane and polyether is well documented. Recently, a new impression material, classified as vinyl siloxanether by the manufacturer, has been made commercially available.² This material has been purposed by the manufacturer to possess a good mechanical and flow properties, along with excellent wetting characteristics in the unset condition as well as in the set condition. Enhancement of hydrophilicity may influence the accuracy of impressions and can result in improved flow and finer detail of impressions.^{3,4} However very less data has been published till date regarding this new material vinyl siloxanether. Two commonly used implant impression techniques are the closed tray and the open tray techniques. In this study open tray (Direct or Pick-up) technique, with splinting and without splinting copings and close tray (Indirect) technique has been used to obtain a master cast. Square impression copings were used for an open tray (a tray with an opening) and close tray copings (tapered) for close tray. The open tray impression allows the square copings to be removed, along with the impression by unscrewing and the implant analogs are directly connected to these copings to fabricate the definitive cast. There is avoidance of movement of the impression copings inside the impression material throughout the procedure. Also, unscrewing the guide pins from the impression copings when the tray is removed or screwing the matching implant analogs in the

impression do not cause any movement and results in an accurate cast.⁵ Hence, this study was conducted to evaluate positional accuracy in multiple implant using open tray impression technique with different impression material.

Materials & Methods:

Polyether and vinylsiloxanether materials were employed to create impressions using customized trays. The study encompassed a total of 30 impressions. Open tray impressions were conducted using vinyl siloxanether, with splinted impression transfer copings secured using auto-polymerizing acrylic resin. 15 open tray impressions were performed using polyether, with splinted impression

transfer copings held in place by auto-polymerizing acrylic resin and 15 with vinylsiloxane ether. The result was analysed using SPSS software.

Results:

The discrepancy of the open tray impression technique was statistically insignificant across the X, Y, and Z axes, as determined through the Mann-Whitney U test. Furthermore, the non-splinted method showcased a higher mean deviation from the master cast dimension in comparison to the splinted method. The difference between the groups was statistically non-significant at X axis, Y axis and Z axis analyzed using Mann whitney U test.

Table 1: open impression group

	GROUP	Mean Deviation	Std. Deviation	Pvalue
DEVX	Open	0.0150	0.02562	0.7(NS)
DEVY	Open	0.0130	0.02487	0.76(NS)
DEVZ_	Open	-0.0105	0.14872	0.59(NS)

Mann Whitney U test $p \leq 0.05$ is significant

Table 2: splinting and non-splinting

		SG	Mean	Std. Deviation	
Open	DEVX	Splinted	0.0038	.00146	0.8(NS)
		Non-Splinted	0.0202	.01820	
	DEVY	Splinted	0.0055	.00400	0.35(NS)
		Non-Splinted	0.0210	.01843	
	DEVZ_	Splinted	-0.0105	.00642	0.6(NS)
		Non-Splinted	0.0244	.19155	

Mann Whitney U test $p \leq 0.05$ is significant

Discussion:

An impression made with an elastic impression material must be securely attached to the tray to assure accuracy. In this study polyether and vinylsiloxanether tray adhesives have been used with corresponding impression materials. There is a Chemical adhesion by the use of tray adhesive i.e the carrier solvent swells the outermost surface of the tray, allowing adhesive to penetrate and interact intimately with the tray material. Thus the use of

impression tray adhesive in retaining the elastomeric impression material has definite benefits. Various authors such as, Vigolo et al 2000, 2003 and 2004 in their clinical studies found that custom tray should be coated with a uniform layer of tray adhesive for 15 minutes to prevent distortion of impression.⁶ Hence, this study was conducted to evaluate positional accuracy in multiple implant using open tray impression technique with different impression material. In the present study, the discrepancy of the open tray impression technique was statistically

insignificant across the X, Y, and Z axes, as determined through the Mann-Whitney U test. A study by Assif, Marshak and Schmidt (1996) assessed three implant impression techniques for accuracy in a laboratory cast that simulated clinical practise. The first technique used was autopolymerizing acrylic resin to splint the transfer copings. The second technique involved splinting of transfer copings directly to an acrylic resin custom tray. The third technique involved only impression material which was used to orient the transfer copings. The results revealed that the technique using the acrylic resin to splint transfer copings in the impression material was significantly more accurate than the two other techniques.⁷ In the present study, furthermore, the non-splinted method showcased a higher mean deviation from the master cast dimension in comparison to the splinted method. The difference between the groups was statistically non-significant at X axis, Y axis and Z axis analyzed using Mann Whitney U test. Another study by Burawiet al (1997) conducted a study where they made a master model of stone incorporating five implants (Bone Lock) was used to compare the dimensional accuracy of a splinted impression technique with a unsplinted technique. Thirty identical custom trays with spacers were fabricated. Addition silicone was used as impression material and single step putty wash impression technique was used. Fifteen impressions each were made for both the techniques. In the unsplinted technique, plastic transfer caps with anti rotation locater devices were fitted on metal transfer copings. The splinted technique used metal transfer copings splinted with autopolymerizing acrylic resin. Impressions were poured in type 4 stone. The master framework was a cast in gold fitting onto the five implants and was sectioned to get five pieces. Analysis of accuracy was made by fitting this framework onto the casts and recording corresponding measurements with microscope. The results showed that splinted technique showed more deviation from the master model than the unsplinted technique. This was associated with the rotational discrepancies along the long axis of implants for splinted technique.⁸ Kwon J.H et al (2011) evaluated and compared the dimensional accuracy of implant definitive casts that were fabricated by implant impressions with and without impression copings. For the coping group (Group C), open tray impression copings were used for the final impressions. For the no-coping group (Group NC), cementable abutments were connected to the implant replicas, and final impressions were made assuming the abutments were prepared teeth. At the first molar site, Group NC showed significantly greater linear distortion along the Y-axis, with a small difference

between the groups. At the second molar site, increased distortion was noted in Group NC for every linear and rotational variable, except for linear distortion along the Z-axis. They came to the conclusion that implant impression with open tray impression copings produced more accurate definitive casts than those fabricated without impression copings, especially those with greater inter-abutment distance.⁹ Papispyridakos et al (2011) investigated the effect of splinted and non splinted pickup impression techniques on the accuracy of fit for fixed implant prostheses in edentulous patients. This study included 12 completely edentulous patients with 13 edentulous arches treated. For the splinted (test group 1) implant impressions, a pickup technique was used. Impression copings were connected to the implants, and the seating of the copings on the implant platforms was confirmed radiographically. For the non splinted (test group 2) implant impressions, a second pickup impression was taken for each patient; this followed the same technique as the splinted group, but the impression copings were left free standing. Polyether material was used for all impressions. For the fabrication of the master implant cast (control group), temporary non engaging abutments were directly connected to the implants intraorally and splinted with light-polymerized acrylic resin. After the complex was removed from the mouth, implant analogs were attached to the acrylic resin jig. Three casts were generated for every patient as follows: group 1 (splinted) group 2 (non splinted) and group 3 (control). The accuracy of fit of each prosthesis was evaluated indirectly by examining them clinically and radiographically while they were fit on the generated casts. It was concluded that the splinted impression technique generates more accurate implant impressions and master casts than the non splinted technique for complete-arch, one-piece fixed prostheses.¹⁰ Enkling N et al (2012) tested the performance of three elastomeric materials for the open monophasic implant impressions technique: Polyether and Vinylsiloxanether and with additional simultaneous splinting of the implant impression copings with a higher shore hardness addition silicone. The overall results of the vinylsiloxanether impression material revealed that it was a good alternative for a polyether materials and it allows users to achieve excellent fits for dental prostheses and simultaneously achieves very positive ratings in terms of its clinical handling.¹¹

Conclusion:

When utilizing the open tray technique, polyether material demonstrated superior outcomes.

Furthermore, within the open tray impression technique, it was observed that splinting the copings led to more favorable outcomes than when the copings were not splinted.

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