Original Article

Evaluation Of Marginal Accuracy Of Implant Supported Crown Obtained By Laser Metal Sintering Technique Fabricated On Gypsum Abutment And Epoxy Resin Abutment

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Abstract

Background- the marginal fit of the prosthesis is important for the health of the soft tissues and remaining abutment structures. Discrepancy in the margins can lead to plaque accumulation, leaching out of luting agent and dislodgement of the cemented prosthesis is along with gingival inflammation. To replicate marginal accuracy in cement retained implant prosthesis, the die fabrication from the abutment level implant impression should be dimensionally stable and accurate.

Aim- aim of this study was to evaluate the marginal accuracy of implant supported crown obtained by laser metal sintering technique fabricated on gypsum abutment and epoxy resin abutment

Material and methodology- Abutment level impressions were made and dies were prepared (n=40). 20 dies were fabricated from epoxy resin die (Group 1) and 20 dies from Gypsum material (Group 2). The dies were digitally scanned and prosthesis was fabricated using DMLS technique. The prosthesis was cemented on the abutment using zinc phosphate cement and were evaluated for marginal inaccuracy on four surfaces (Buccal, lingual,mesial, distal) under 40x magnification of stereomicroscope. The results were analyzed statistically by t test.

Observation and result- The copings fabricated from Epoxy die resin have the higher marginal accuracy on all four surfaces with the mean of 0.19996 mm as compared to marginal accuracy of Die stone with mean of 0.2432mm. ($p<0.05$)

Conclusion- Marginal Accuracy of prosthesis fabricated on epoxy resin dies was significantly better than prosthesis fabricated on gypsum dies

Key words- Marginal accuracy, Epoxy resin die, Gypsum die, cement retained implant prosthesis, Stereomicroscope.

Introduction-

Rehabilitation of the missing oral structures and teeth is of utmost importance as it restores the function, esthetics, phonetics & speech, facial contour for the patient.

The replacement of missing teeth can be fulfilled by various prosthetic treatment plans like, removable prosthesis, fixed dental prosthesis or combination of both. Dental implant has emerged to be the treatment of choice as it saves the abutment tooth preparation. Dental implants have long term success and longevity and fulfill the requirements for rehabilitation.

The success of implant therapy is dependent on the osseointegration of the implant fixture and the continuity of the prosthetic superstructure's connection to the fixture. Fracture of Prosthetic frame work or veneering material, loosening of abutment screws can be see if there is misfit of the superstructre.[1] Thus for the success of implant prosthesis fabrication, the impression technique, impression material, die material, method of fabrication of prosthesis & Luting cement becomes utmost important. Amongst all the impression materials available for making monophase phase consistency polyether material is widely used as it provides lowest dimensional changes and better surface detailed reproduction ascomparedtoothermaterials.[2]

There are different kind of Die materials available for implant impression like gypsum products, die resins, electroplated die amalgam die , metal sprayed die, ceramic die, flexible die material and etc. Most commonly used die material is gypsum product type IV die stone which has greatest disadvantage of its high setting expansion and relatively poor abrasion resistance, which can be partially overcome by using gypsum hardener. Epoxy resin have higher abrasion resistance and high strength & good surface detail reproduction.[3]

The marginal accuracy of prepared prosthesis is of great importance for success of implant restoration. Marginal inaccuracy leads to plaque accumulation, periimplantitis and complications. With advancement of CAD-CAM and additive technology, DMLS produces the accurate prosthesis fit with lesser marginal gaps.[4]There is lack of studies in literature to analyze the better die material for implant cement retained prosthesis, thus this study was designed with the aim of evaluating the marginal accuracy of implant supported crown obtained by DMLS method from Epoxy die resin.

Methodology:

The typhodont from Mandibular API Jaw set were replaced with 10 standard size implant lab analogues (IA-CS3459Alphabiopvtltd.) And were secured with Modeling wax (Y dent pvt. ltd) in the empty socket space. Straight implant abutments (7 mm height, 1 mm gingival cuff height and 4.8 mm diameter, TLASP-1,Alphabiopvtltd.)) were placed and tightened with hex screw on all lab analogues.(Figure1). Custom tray with 3 mm Spacer wax was fabricated from Light cure acrylic resin. (Individolux, Voco dental ltd.). 4 Abutment level impressions were made using Polyether Monophase impression material (3Mimpregumpentated on the tray after spacer removal (figure 2). For fabrication of samples for Group 1(n=20); releasing agent was sprayed over the impression and dried for 10 minutes.2 impressions were poured with epoxy resin (Fast set Whipmix formula, American dental supply inc.) Impression was kept in dry place for 4 hours as per manufacture instruction. For fabrication of samples for Group 2(n=20); Gypsum die stone (Kalrock, Kalabhai dental corp.) was manipulated with water (W:P=24%) and impression was poured using vibrator. Impressions were kept for 45 minutes for as per manufacture instructions. (Figure3) thus a total of 40 die specimens were fabricated. All the die specimens were scanned with digital scanner (NEWAY SCANNERS) and copings were designed digitally with CAD design (Exo-CAD software). The copings were fabricated by laser sintering and sand blasted (Refinite metals pvt.) with 50 µm alumina. Acrylic block were fabricated and the analog, abutment assembly was mounted on it. The copings were cemented on the abutment using zinc phosphate luting cement (Harvard cement) and analyzed under stereomicroscope with 40 X magnification for marginal gap on four surfaces (Mesial, Distal, Buccal and Palatal). [Figure 4] The data was evaluated and statistical analysis was done using SPSS software (SPSS1.0.0.1406; IBM)

Figure no 1: Dental implant model for impression

Figure no 2 : Abutment level impression taken by polyether

Figure no 2 : Abutment level impression taken by polyether

Figure no 3b : Die fabricated from die stone

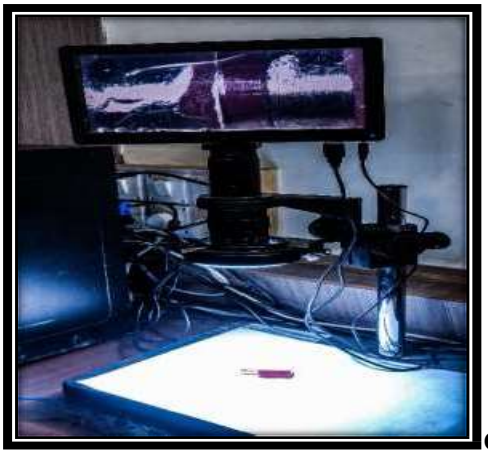
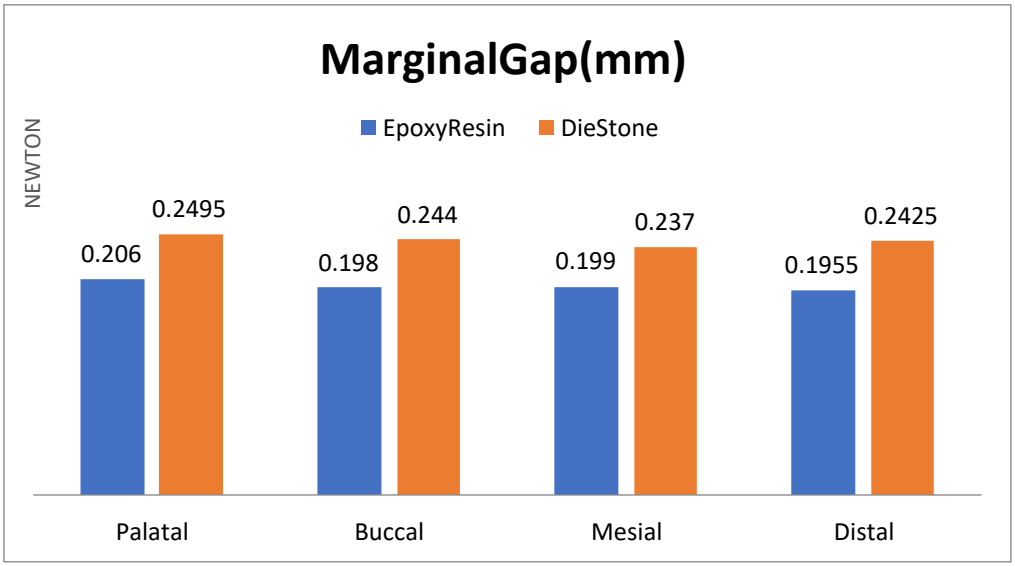


Figure 4 : Evaluation of marginal accuracy by stereomicroscopeat 40**X** magnification



GRAPH 1: Shows comparison of mean value of marginal gap of both groups on four sides.

TABLE1: Shows independent sample T test which shows descriptive statistical comparison of 2 groups.

Independent Samples Test					
	t-test for Equality of Means				
	T	df	Sig. (2-tailed)	Mean Difference	Std.Error Difference
Palatal	-2.090	38	.043	-.04350	.02081
Buccal	-2.200	38	.034	-.04600	.02091
Mesial	-1.907	38	.061	-.03800	.02324
Distal	-2.001	38	.053	-.04700	.02349

Observation and Results:

Independent student T test was performed for the obtained data. The mean values of marginal inaccuracy were noted (graph 1) and student t test was performed. On detailed statistical analysis for comparing marginal accuracy; group 1 had lower marginal gap as compared to group 2 for all surfaces. The marginal gap on palatal side between two groups showed higher marginal gap 0.2060 mm in group 2 and lower marginal gap value 0.2495mm ($p<0.05$).Comparison of marginal gap on buccal side between two group showed, statistical significant difference ($p<0.05$)in mean values of group 1 (0.1980mm) and Group 2(0.2440mm) with higher mean value for group 2.The

values were not statistically significant for marginal gap on the mesial and distal side. (Table1)

Discussion-

The accuracy and longevity of the implant prosthesis depends on the clinical as well as laboratory procedures. The more accurate the laboratory procedures, more precise the prosthesis and better function is achieved. The abutment level implant impressions are preferred when the soft tissue thickness is more.5 For accurate fabrication of prosthesis, the die fabrication form the impression should be a saccurate as possible. Various Die materials are available like gypsum products, die resins, electroplated die, amalgam die, metal sprayed die, ceramic die, flexible die material and etc. amongst these; Gypsum type IV are most widely used. But the main disadvantage is poor abrasion resistance. This can be partially overcome by using gypsum hardener. Epoxy resins are also used as die materials. They have higher abrasion resistance and high strength & good detail reproduction in comparison to gypsum products.6,7,8 However, fabrication of epoxy resin dies is more technique sensitive, time consuming and undergoes polymerization shrinkage on setting. Therefore, their dimensional accuracy has been questioned.9

The cement retained implant prosthesis serve few advantages like simplification of the treatment planning and restoration of implants, axial loading of implant body, decrease in crestal bone loading but the main drawback is retention of the prosthesis on abutment and retrieval of thesuperstructureforroutinecareandmaintenance9 In order to overcome this drawback of retention; the prosthesis should be precisely fitting on the abutment. This is possible when there is accurate die fabrication for prosthesis. The CAD-CAM and DMLS designed and manufactured copings have proven to improve prosthodontic precision of fit. 8,10

To avoid complications such as plaque accumulation , peri-implant soft tissue inflammation and marginal bone loss surrounding implant, the prosthesis marginal gap should be as minimum as possible and the retention of the prosthesis should be optimum.11Retention can be enhanced by proper use of impression material, accuracy of the die material and dental cement used for luting.

Result of this present study shows that the copings fabricated from Epoxy die resin have the higher marginal accuracy on all four surfaces with the mean of 0.19996 mm as compared to marginal accuracy of Die stone with mean of 0.2432mm. The marginal accuracy was almost similar on the proximal surfaces but there was significant difference in the marginal accuracy on the buccal and lingual sides for both the groups.

Conclusion-

In the present study, copings fabricated using CAD-CAM DMLS technique on 2 different kinds of die were analyzed for marginal accuracy(n=40) Marginal accuracy was measured on four surfaces (Palatal, Buccal, Mesial &Distal) of coping. On studying the marginal gap under stereomicroscope, the marginal accuracy was derived and statistically evaluated. It can be concluded that, when fabricating prosthesis from the Abutment level implant impression, made using polyether impression material, the die fabricated using epoxy resin die material should be preferred over gypsum die material for better accuracy and Marginal fit of the prosthesis. However further studies need to be done for analyzing the possible changes in accuracy using different impression materials and different die materials.

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