International Journal of Current Advanced Research
ISSN: O: 2319-6475, ISSN: P: 2319-6505, Impact Factor: 6.614
Available Online at www.journalijcar.org
Volume 8; Issue 06 (D); June 2019; Page No.19197-19199
DOI: http://dx.doi.org/10.24327/ijcar.2019.19199.3692

Research Article

A COMPARITIVE EVALUATION OF MARGINAL FIT OF IMPLANT ABUTMENT COPINGS MADE BY DIRECT AND INDIRECT IMPRESSION TECHNIQUES AND FABRICATED BY CONVENTIONAL CASTING AND LASER SINTERING

Prashasthi Shetty, Roseline Meshramkar, Lekha KP and Ramesh K Nadiger

Department of Prosthodontics, A J Institute of Dental Sciences

ARTICLE INFO

Article History:
Received 06th March, 2019
Received in revised form 14th April, 2019
Accepted 23rd May, 2019
Published online 28th June, 2019

Key words:
implant abutment interface, direct impression, indirect impression,conventional casting, laser sintering

ABSTRACT

Statement of problem: Failures in implant therapy have been associated with lack of stability or misfit at the implant-abutment interface.Two-piece implants have a microgap depending on the interface type or system, but presence of fluid flow at this interface and its relationships are very variable. This has been correlated to the presence of bacterial infiltration and inflammatory cells that may lead to bone loss around this area.
Purpose of the study: The purpose of this study is to evaluate and compare the marginal fit of implant abutment copings made by direct and indirect impression techniques and fabricated by conventional casting and laser sintering.
Materials and methods: Implant abutment copings were evaluated for marginal discrepancies at four random points after which interface was evaluated using scanning electron microscope.
Result: On evaluation, the implant abutment copings fabricated by direct impression technique and laser sintering showed minimal marginal discrepancies compared to the other groups.
Conclusion: Within the limitations of the study, in relation to the marginal fit, the implant abutment copings fabricated by direct impression technique and laser sintering had the most significant result with the least marginal discrepancies

INTRODUCTION

Despite the excellent success rates in osseointegrated implant rehabilitation, many flaws have been described related to surgical tecniques and mechanical microbiological factors. Bacteria and their products may cause inflammatory reactions in the peri-implant soft tissue, which is why the important role of microorganisms in implant survival should be considered.

Excessive premature loading, occlusal trauma and poor bone support are considered the main factors associated with early implant loss. Recent reports demonstrated that microorganisms in the oral cavity, especially the ones involved in periodontal diseases, together with unfavorable occlusal factors are considered as the main causes of unsuccessful treatment with implants. A direct correlation between presence of microorganisms and disease of the peri-implant tissues has been demonstrated. Periodontitis in proximity to implants and presence of periodontal pathogenic bacteria in the peri-implant sulci are considered risk factors to the success of dental implants. Surface characteristics, physical properties, as well as biological factors involved in this type of treatment may facilitate bacterial colonization and growth of potentially pathogenic microorganisms at the implant sites. Because of fundamental deficiencies in the dental casting technique, a gap of varying width is likely to occur between a casting and the abutment, both internally and at the margin.The potential distortions inherent in casting of dental alloys such as Co–Cr may be overcome through the use ofdirect metal laser sintering (DMLS) technologies. Lasersintered structures are built up in layers by means of a highenergy- focused laser beam that fuses metal–alloy powder
following a sliced 3D computer-aided design (CAD) file obtained from the abutments' digitisation.

Thus, the purpose of this study is to evaluate and compare the marginal fit of implant abutment copings made by direct and indirect impression technique and fabricated by conventional casting and laser sintering.

MATERIALS AND METHODS

This study involved making of two different implant level impressions: Direct impression (DI) technique and Indirect impression (II) technique and fabrication of metal copings by two different techniques: Conventional Casting (CC) and Laser Sintering (LS). The marginal fit of these copings were evaluated using stereomicroscope.

Corresponding author:* **Prashasthi Shetty
Department of Prosthodontics, A J Institute of Dental Sciences

Preparation of the Working Model

Self-cure acrylic resin was poured into a wax mould made. The implant along with its abutment was embedded into the acrylic leaving the cervical area exposed, before the polymerization of the acrylic resin. (Fig 1)

Making of Impressions

Direct Impression Technique

In direct impression technique, light body impression material was injected to surround the abutment. The tray was then filled with the impression material and seated over the abutment. (Fig 2)

Indirect Impression Technique

In indirect impression technique, light body impression material was injected to surround the transfer copings. The impression tray was then filled with the impression material and delivered over the transfer copings. After the material sets, the tray was removed and abutment analogs was placed into the transfer coping, embedded within the impression. (Fig 3) The impressions were poured with high strength type IV dental stone to obtain 24 dies in each group. (Fig 4 & 5)

Table 1

Groups	Impression technique	Number of samples
Group I	Direct Impression Technique	24
Group II	Indirect Impression Technique	24

Fabrication of Metal Copings

Conventional Casting

In conventional casting, the wax patterns of the copings weremade (S-U-MODELLING WAX; SCHULER-DENTAL, Ulm/Germany) and invested with phosphate-bonded investment material (BELLAVEST SH; BEGO, Wilhelm-Herbst-Str. 1, Germany) using ringless cylinders. Casting was done with an induction centrifugal casting machine (FORNAX T; BEGO, Wilhelm-Herbst-Str. 1, Germany) under vacuum pressure (580 mmHg) at a temperature of 1450°C. The aluminium oxide particles of 50µmwere sandblasted in the metal structures that were retrieved and cleansed for 10 s at a working distance of 5 mm and a pressure of 50±3.5 N/cm^2 to remove the investment residues.(Fig 6 & 8)

Laser Sintering

Laser Sintering (LS) machines fuses small particles of alloy into a massemploying a high power laser source . Laser sintering uses Nickel-Chromium powdered base metal alloy. An optical laser (CERCON EYE; DENTSPLY)scanned the abutments automatically when placed on the Cercon Eye's rotating platform to digitize them. The optical laser, Cercon Eye's scanner works based on the theory of laser light-sectioning. The surface of the rotating object is projected with a laser beam utilizing two cameras.The preview image is captured by a third camera in place. Once the abutments are digitized, the framework is designed by the computer by employing the system's application software (CERCON ART; DENTSPLY). The information is generated in a file comprising the computer-aided design (CAD file) and are transferred to the laser sintering machine (PM 100 DENTAL; PHENIX SYSTEMS™). The temperature of the LS machine was cautiously increased to 1650°C. Starting with the margins, the Ni-Cr powders began to sinter layer by layer of about 20µm on the dies in an argon atmosphere until the copings were completely fabricated. Enabling for exceptional tolerances to be held (±0.0254), a 500W Yb-fiber laser was precisely controlled in the X and Y coordinates. After the sintering was completed, structures were let to cool down to the ambient temperature (descending at the rate of 9°C per min) inside the furnace. (Fig 7 & 9)

Table 2

Subgroups	Fabrication technique	Number of samples
Subgroup a	Conventional Casting	24
Subgroup b	Laser Sintering	24

Table 3

Groups	Impression technique	Fabrication technique	Number of samples
Group Ia	Direct Impression Technique	Conventional Casting	12
Group Ib	Direct Impression Technique	Laser Sintering	12
Group IIa	Indirect Impression Technique	Conventional Casting	12
Group IIb	Indirect Impression Technique	Laser Sintering	12

Evaluation of Marginal fit

Marginal fit of the metal copings were measured using stereo microscope. Marginal gaps were measured randomly by fixing three points on each side of the model with a personal computer attached to the stereomicroscope (×50) and camera using software. All the measurements were performed by a single investigator, and average values were calculated. (Fig 10)

Data Analysis

Each coping groupwere determined for their mean marginal gap values. SPSS software (version 21, IBM, Armonk, NY, USA) was utilized for the data analysis. Descriptive statistics (minimum, maximum,mean, and standard deviation) were calculated. p value was calculated using ANOVA test and all the groups in the study were compared using Post-hoc-Bonferroni test. Statistical significance was set to $\alpha=0.05$.

RESULTS

The present study was designed to evaluate and compare the marginal fit of implant abutment copings fabricated using 2 different impression techniques and 2 different fabrication techniques. The data obtained during the study was subjected to statistical analysis using SPSS software (version 19, IBM, Armonk, NY, USA). An overview of the results is shown in table 4, table 5 and table 6. The mean values and standard deviation were calculated for each group as tabulated in table 4. The result was analyzed using one way ANOVA test in which the significance level was set as $p< 0.005$ as shown on table 5.

Marginal Discrepancy

The mean and standard deviation (SD) for marginal discrepancy are displayed in Table 4. The impression techniques and fabrication techniques affected the marginal fit of the copings with $p < 0.005$. Interaction between the two factors were significant ($p = 0.000$) as tabulated in table 5. For each impression technique, LS samples exhibited better marginal fit.

Table 4 Mean and standard deviation of each group

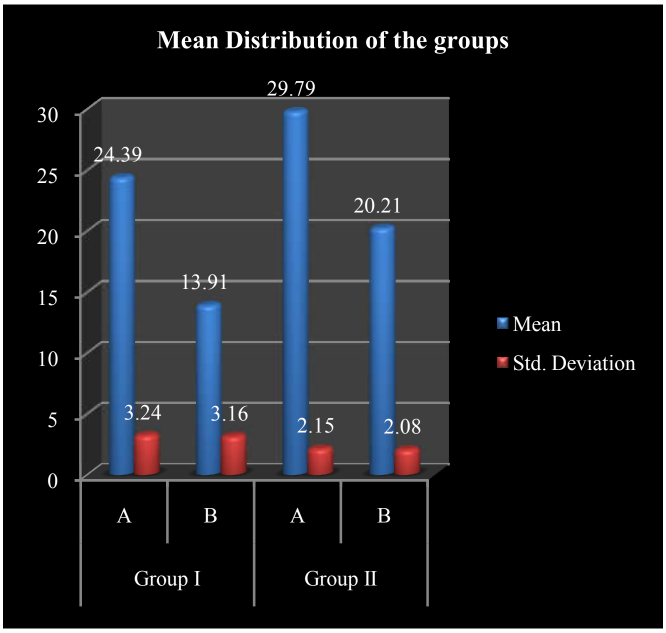
Descriptive		Minimum	Maximum	Mean	Standard Deviation
Group I	A	19.630	31.115	24.39	3.24
	B	9.780	19.110	13.91	3.16
Group II	A	27.164	34.164	29.79	2.15
	B	16.970	23.890	20.21	2.08

Table 5 One way ANOVA test

Anova	F	p value
Group1A,1B,2A,2B	73.239	0.000*

*significant

According to results of ANOVA, there were significant differences amongst the 4 groups ($p < 0.0005$). The processed data are shown in graph 1 with a color scale,making it possible to compare the all the groups.



Graph 1 Mean and Standard Deviations of all groups

Post-hoc-Bonferroni test was applied for comparative evaluation of marginal fit in different groups as shown in table 6. The marginal fit of Group Ia compared to Group Ib, Group IIa and Group IIb was found to be statistically significant ($p < 0.005$). The marginal fit of Group I compared to Group Ia, Group IIa and Group IIb was found to be statistically significant ($p < 0.005$). The marginal fit of Group IIa compared to Group Ia, Group Ib and Group IIb was found to be statistically significant ($p < 0.005$). The marginal fit of Group IIb compared to Group Ia, Group Ib and Group IIa was found to be statistically significant ($p < 0.0001$).

Table 6 Post-hoc-Bonferroni

Group	Groups	Mean Difference	Std. Error	p value	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
IA	IB	10.48*	1.10	0.000*	7.41	13.54
	IIA	-5.39*	1.10	0.000*	-8.45	-2.33
	IIB	4.18*	1.10	0.003*	1.12	7.24
IB	IIA	-15.87*	1.10	0.000*	-18.93	-12.81
	IIB	-6.29*	1.10	0.000*	-9.35	-3.23
IIA	IIB	9.580*	1.10	0.000*	6.51	12.64

*The mean difference is significant at the 0.05 level.

References

1. Vigolo P, Majzoub Z, Cordioli G. Evaluation of the accuracy of three techniques used for multiple implant abutment impressions. J Prosthet Dent 2003 Feb;89(2):186-92
2. Balouch F, Jalalian E, Nikkheslat M, Ghavamian R, ToopchiSh, Jallalian F, Jalalian S. Comparison of dimensional accuracy between open tray and closed tray implant impression technique in 15° angled implants. J Dent (Shiraz). 2013 Sept;14:96-102
3. Castillo-de-Oyagüe R, Sánchez-Turrión A, López-Lozano JF, Albaladejo A, Torres-Lagares D, Montero J, Suárez-García MJ. Vertical misfit of laser-sintered and vacuum-cast implant supported crown copings luted with definitive and temporary luting agents. Med Oral Patol Oral Cir Bucal. 2012 Jul 1;17(4):e610-7
4. Vigolo P, Fonzi F, Majzoub Z, Cordioli G. An evaluation of impression techniques for multiple internal connection implant prostheses. J Prosthet Dent 2004 Nov;92(5):470-6.
5. BalaMurugan T, Manimaran P. Evaluation of accuracy of direct transfer snapon impression coping closed tray impression technique and direct transfer open tray impression technique: an in vitro study. J Indian Prosthodont Soc. 2013 Sept;13(3):226-32.
6. Ebadian B, Rismanchian M, Dastgheib B, Bajoghli F. Effect of different impression materials and techniques on the dimensional accuracy of implant definitive casts. Dent Res J (Isfahan). 2015 Mar-Apr;12(2):136-43.
7. Martínez-Rus F, García C, Santamaría A, Özcan M, Pradíes G. Accuracy of definitive casts using 4 implant-level impression techniques in a scenario of multi-implant system with different implant angulations and subgingival alignment levels. Implant Dent. 2013 Jun;22(3):268-76.

How to cite this article:

Prashasthi Shetty *et al* (2019) 'A Comparitive Evaluation of Marginal Fit of Implant Abutment Copings Made by Direct and Indirect Impression Techniques and Fabricated by Conventional Casting and Laser Sintering', *International Journal of Current Advanced Research,* 08(06), pp. 19197-19199. DOI: http://dx.doi.org/10.24327/ijcar.2019.19199.3692

****