Advances in Bioresearch
Adv. Biores., Vol 7 (3) May 2016: 56-60
©2015 Society of Education, India
Print ISSN 0976-4585; Online ISSN 2277-1573
Journal's URL:http://www.soeagra.com/abr.html
CODEN: ABRDC3
ICV Value 8.21 [2014]

Advances in Bioresearch

ORIGINAL ARTICLE

Effect of Sloped shoulder and Shoulder bevel Design using Selective laser sintering on Marginal Fit of Metal Ceramic Crowns

Ezzatollah Jalalian[1], Amin Eskandari-Damaneh [2*], Sanam Fanihanifeh [3]
1- Associate Professor, Department of Fixed Prosthodontics, Dental Branch, Islamic Azad University of Medical Sciences, Tehran, Iran
2- Dental Branch, Islamic Azad University of Medical Sciences, Tehran, Iran
3- Prosthodontics, Dental Branch, Islamic Azad University of Medical Sciences, Tehran, Iran
* Correspondence author: Email: ae.damaneh@gmail.com

ABSTRACT
Marginal fit of restorations are important factor for accuracy of them in clinical applications. Metal-ceramic crowns are one of the most usage crowns in Prosthodontics. Selective laser sintering (SLS) technique has several advantages such as low material usage, time and costs. The aim of the current study was to determine effect of sloped shoulder and shoulder bevel design using SLS on marginal fit of metal ceramic crowns. A total 10 metal ceramic crowns were used with SLS technique on shoulder bevel and sloped shoulder finish line. In one side of dye 1 mm shoulder bevel 45° used where finish line of dye was 1mm of 90° and in the other side 135° sloped shoulder finishing line. SLS Dies were scanned using 3 shapes scanner. Information inserted to the software and was structure made with 0.5 mm thickness. Superstructure scanned with SLS and melted chrome-cobalt was added. Frames were numbered and received pressure of 5 kg for 10 min. According to the results, SLS technique had beneficial results on the marginal fit of metal-ceramic crowns.
Keywords: *Sloped shoulder, Shoulder bevel, SLS, Marginal fit, Metal ceramic crowns*

Received 21/02/2016 Accepted 20/04/2016

How to cite this article:
E Jalalian, A Eskandari-Damaneh, S Fanihanifeh. Effect of Sloped shoulder and Shoulder bevel Design using Selective laser sintering on Marginal Fit of Metal Ceramic Crowns. Adv. Biores. Vol 7 [3] May 2016: 56-60.DOI: 10.15515/abr.0976-4585.7.3.5660

INTRODUCTION

Metal ceramic are the materials which applied frequently in fabricating complete coverage fixed partial dentures and crowns [1]. Lost-wax technique is one of the traditional fabricating methods which have been used in various metal alloys for casting [2]. Usually, this technique used via wax instruments such as PKT instruments. This technique is famous because of its ability for manipulated of shaped. So, it can completely eliminate from the mold by heating [3]. Wax pattern is labor-intensive step to make the porcelain fused-metal crown. Also, it is very time dependent and afterward the wax–up's quality is dependent to the skill of technician [4]. Additionally, further disadvantages are reported for wax pattern such as color and glossy surface, small defects [3, 5, 6].

Recently the manipulated technique, the CAD/CAM, is introduced in dentistry to fabricate the materials. Also, several disadvantage listed for max-pattern does not count for this technique. Recently, Fani-hanifeh et al. [7] reported the CAD/ CAM systems have many advantages e.g. producing higher and more uniform-quality restorations. They assumed that this method can use with high confidence in blocks of material, standardizing restoration shaping processes to reduce production costs, labor and time [8].

The CAD/CAM is most sensitive to margin detection and restoration design compared to manual waxing [8, 9]. Marginal and internal fit of restoration is determined by its discrepancy [6]. Success marginal fit is the most important factors for the long-term success of metal-ceramic crowns [10]. Discrepancies and high rate of gap in turn leads to cement dissolution and micro leakage. So, the cement seal becomes weak, permits the percolation of bacteria, and can cause inflammation of the vital pulp. For instance, a large marginal discrepancy in a fixed restoration correlates with a higher plaque index which leads to failure of treatment [11- 13]. The internal gap was defined as the perpendicular distance between the framework

and the abutment teeth and it is the misfit of the coping at the occlusal/incisal and axial surfaces [14-15]. Based on the literature, few reports exist on effect of SLS on marginal fit of metal ceramic crowns. So, the aim of current study was to investigate effect of sloped shoulder and shoulder bevel design using selective laser sintering on marginal fit of metal ceramic crowns.

MATERIAL AND METHODS

This study was designed based on single blind experimental using ceramic crowns in department of prosthodontics, School of Dentistry in Islamic Azad University, Tehran, Iran. At first an standard die of stainless steel with 7 mm height and 5 mm in diameter. Half of the marginal area of the dies was prepared with a 45º shoulder bevel preparation and the other half was prepared with a 135º sloping shoulder. The dye stainless steel was fixed on metal plate. All samples were prepared using one technician to minimize the experimental errors. Then die spacer (pico-fit red, renfert gmbh, hilzingen, Germany) filled the die and the cut was done from the margin.

The samples which done using SLS technique, the dyes were scanned using 3shape D810,3 shape, (Copenhagen, denmark) in Dentware laboratory in Sweden. The marginal gap of frames was done before cementation. The cementation was done with 5 Kg for 10 min using gc gold labled,tokyo,japan. The marginal gap was monitored using STERIO microscope (Ernst leitz Wetzlai-germamy).

The blocks were cut using a watter jet cutter (watter jet cutting system,jet edge world headquarters, stmichael, USA) and left side of samples were polished using silicon carbide paper (MATADOR waterproof, Germany). The microscopic pictures used for further analysis.

Statistical analysis

The data was processed using SPSS software (SPSS, Inc., Chicago, IL, USA), and the difference between the two preparation designs was analyzed using the Student t-Test.

RESULTS

The Z comologroph and Sminoroph results for test normality of data is presented in table 1. According to the data, there was no significant difference for Pre-experiment of Sloped shoulder and Shoulder bevel, Absolute marginal discrepancy, Marginal gap shoulder bevel and the other factors which are listed (P>0.05).

Table 1. The Z comologroph and Sminoroph results for normality of data.

	Z comologroph, Sminoroph	*P value*
Pre-experiment of Sloped shoulder	0.707	0.699
Pre-experiment of Shoulder bevel	0.477	0.977
Absolute marginal discrepancy	0.844	0.474
Marginal gap shoulder bevel	0.891	0.405
Walls of shoulder bevel 1	0.538	0.934
Walls of shoulder bevel 2	0.409	0.996
Internal fit at occlusal wall	1.09	0.184
Absolute marginal discrepancy	0.714	0.688
Marginal gap sloped shoulder	0.736	0.651
Walls sloped shoulder 1	0.904	0.387
Walls sloped shoulder 2	0.982	0.290

The effect of sloped shoulder and shoulder bevel design using SLS on internal fit of metal ceramic crowns is presented in table 2. According to the results, the gap of sloped shoulder and shoulder bevel before cementation were 49.7±12.83 and 42.6±9.66 µm. Also, the gap of internal fit at axial walls sloped shoulder for 1 and 2 were 23.40±7.33 and 26.90±10.01 µm. Furthermore the internal fit at occlusal wall was 51±31.69 µm (P>0.05). Additionally, the internal fit at axial walls shoulder bevel 1 and 2 were 25±12.89 and 25.40±13.36 µm, respectively (P>0.05) (table 2).

Table 2. Effect of sloped shoulder and shoulder bevel design using selective laser sintering on internal fit of metal ceramic crowns

	Sloped shoulder before cementation (µm)	Shoulder bevel before cementation (µm)	Internal fit at axial walls sloped shoulder2 (µm)	Internal fit at axial walls sloped shoulder1 (µm)	Internal fit at occlusal wall (µm)	Internal fit at axial walls shoulder bevel 2 (µm)	Internal fit at axial walls shoulder bevel 1 (µm)
SLS	49.7±12.83	42.6±9.66	26.90±10.01	23.40±7.33	51±31.69	25.40±13.36	25±12.89
P value	0.0148	0.034	0.739	0.467	0.253	0.572	0.984

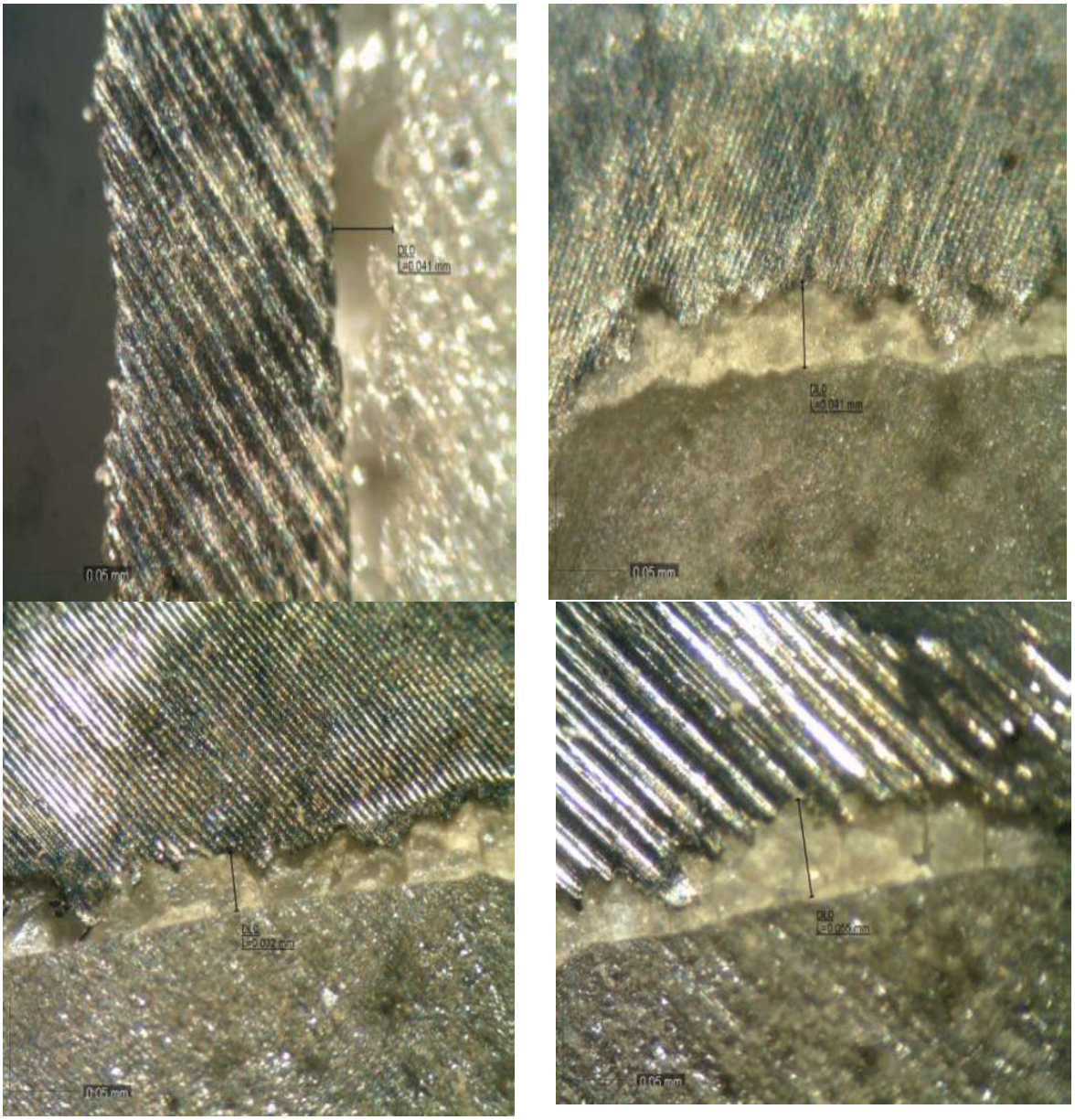

Figure 1. Microscopic picture of samples.

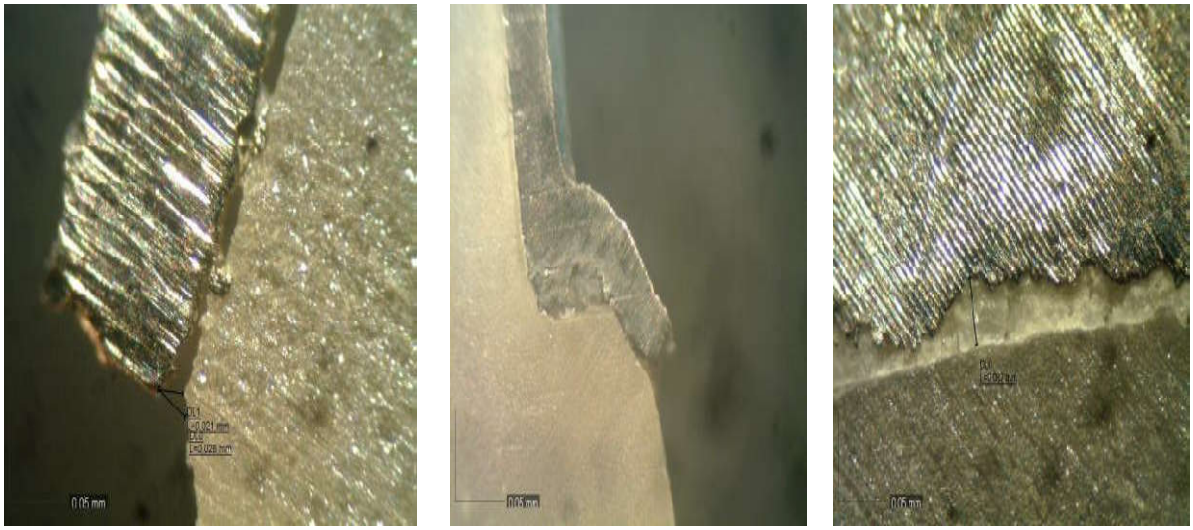

Figure 2. Microscopic picture of samples.

The effect of sloped shoulder and shoulder bevel design using SLS on marginal fit of metal ceramic crowns is shown in table 3. According to the results, marginal gap for sloped shoulder was 33±18.12 µm. Also, the SLS-induced marginal gap sloped shoulder was 33±18.12 µm (P>0.05). As observed, absolute marginal discrepancy of sloped shoulder and shoulder bevel were 51.70±23.46 and 43.40±22.37 µm, respectively. Moreover, marginal gap for shoulder bevel was 42.50±21.19 µm (P>0.05).

Table 3. effect of sloped shoulder and shoulder bevel design using selective laser sintering on marginal fit of metal ceramic crowns

	Sloped shoulder before cementation (µm)	Shoulder bevel before cementation (µm)	Marginal gap sloped shoulder (µm)	Absolute marginal discrepancy sloped shoulder (µm)	Marginal gap shoulder bevel (µm)	Absolute marginal discrepancy shoulder bevel (µm)
SLS	49.7±12.83	42.6±9.66	33±18.12	51.70±23.46	42.50±21.19	43.40±22.37
P value	0.0148	0.034	0.526	0.179	0.069	0.341

DISCUCCION

Marginal integrity is a critical factor in the success or failure of a cast porcelain-fused-to-metal veneer crown restoration. If margins are not managed appropriately, they may contribute to the cause of many clinical problems. If the gap between the prepared tooth and the crown margins is more than the acceptable standard, the exposed soluble dental cement will dissolve rapidly. Cariogenic microorganisms accumulate in the void and cause caries development under the crown [16]. Fixed dental restorations mainly aim to restore function and esthetics of lost intraoral structures without jeopardizing the oral or general health of patients. For clinical success the full ceramic restorations should have ensure requirements for strength and precision [17]. High marginal discrepancies lead to penetrate of the material to the oral environment, then cement dissolution and micro leakage happens. Subsequently bacteria permit into the restorations and can cause inflammation of the vital pulp [18]. As observed in this study, the marginal discrepancy for restorations was in acceptable clinical level. The fit of crowns is influenced by the quality of the investment material and the metal, the casting conditions, the firing of porcelain, and the polishing. Fabrication procedures are also directly related to the skill of the technician. Studies have reported measurement of fit relative to marginal adaptation, internal adaptation, vertical seating, radiographic appearance and clinical adaptability as judged by experienced practitioners [19]. A relationship exists between marginal adaptation and periodontal tissue health. McLean and von Fraunhofer revealed [20] the clinically acceptable maximum marginal gap and marginal discrepancies within the clinic is 120 µm . However, Moldovan et al. [21] rated the values of 100 µm for marginal misfit as good and values of 200-300 µm as acceptable. Therefore, the marginal accuracies, represented by the absolute marginal discrepancy and measured in the present study, could be rated as good for conventional group and as acceptable for CAD/CAM group. The result of this study was within the range of the values reported by previous studies [22].

Although clinical evaluations of marginal discrepancies have their limitations and inherent errors, it seemed to be important to investigate newly developed fabrication technologies. Previous studies concerning different materials and techniques resulted in a wide range of reported values of marginal and

internal fit. Replicas of the gap between the inner surface of the crown and outer tooth surface can be made with a silicone indicator paste to evaluate discrepancies [23]. Achieving esthetically and functionally ideal restorations has been the goal of dental clinicians, prosthodontists and manufacturers throughout the history of dentistry. This paper revealed effects of SLS using sloping shoulder and a shoulder bevel on marginal integrity of metal-ceramic crowns. So, results of current paper, might be provide information for further research. We think merit researches needed to investigate effects of SLS using sloping shoulder and a shoulder bevel on marginal integrity of metal-ceramic crowns in practical dentistry.

REFERENCES

1. Pettenò D, Schierano G, Bassi F, Bresciano ME, Carossa S. (2000). Comparison of marginal fit of 3 different metal-ceramic systems: an in vitro study. Int J Prosthodont ; 13:405-408.
2. Quante K, Ludwig K, Kern M. (2008). Marginal and internal fit of metal-ceramic crowns fabricated with a new laser melting technology. Dent Mater. 24:1311-1315.
3. Rosenstiel SF, Land MF, Fujimoto J. (2006). Contemporary fixed prosthodontics. 4th ed. St. Louis: Mosby; pp. 562–579.
4. Sun J, Zhang FQ. (2012). The application of rapid prototyping in prosthodontics. J Prosthodont. 21:641-644.
5. Zeltser C, Lewinstein I, Grajower R. (1985). Fit of crown wax patterns after removal from the die. J Prosthet Dent. ; 53:344–346.
6. Abduo J, Lyons K, Swain M. (2010). Fit of zirconia fixed partial denture: a systematic review. J Oral Rehabil. 37:866-876.
7. Fani-hanifeh S, Bahrani Z, Nosratpour R, Sadeghkhani E. (2015). A comparison review of accuracy and reliability of techniques to measure marginal adaptation restorations in dentistry. IJBPAS, 4(4): 2035-2041
8. Strub JR, Rekow ED, Witkowski S. (2006). Computer-aided design and fabrication of dental restorations: current systems and future possibilities. J Am Dent Assoc.; 137:1289-1296.
9. Tan PL, Gratton DG, Diaz-Arnold AM, Holmes DC. (2008). An in vitro comparison of vertical marginal gaps of CAD/CAM titanium and conventional cast restorations. J Prosthodont. 17:378-383.
10. Hunter AJ, Hunter AR. (1990). Gingival margins for crowns: a review and discussion Part II: Discrepancies and configurations. J Prosthet Dent. 64:636-642.
11. Gulce Subasi, Nilgun Ozturk, Ozgur Inan, Nalan Bozogullari. (2012). Evaluation of marginal fit of two all-ceramic copings with two finish lines. Eur J Dent. 6:163-168.
12. Felton DA, Kanoy BE, Bayne SC, Wirthman GP. (1991). Effect of in vivo crown margin discrepancies on periodontal health. J Prosthet Dent. 65:357-364.
13. Jacobs MS, Windeler AS. (1991). An investigation of dental luting cement solubility as a function of the marginal gap. J Prosthet Dent; 65:436-442.
14. Wettstein F, Sailer I, Roos M, Hämmerle CH. (2008). Clinical study of the internal gaps of zirconia and metal frameworks for fixed partial dentures. Eur J Oral Sci. 116:272–279.
15. Kokubo Y, Nagayama Y, Tsumita M, Ohkubo C, Fukushima S, Vult von Steyern P. (2005). Clinical marginal and internal gaps of In-Ceram crowns fabricated using the GN-I system. J Oral Rehabil. 32:753-758.
16. Jalalian E, Esmaeeli M, Elyasi M, Keshavarzi G, (2009). Comparison the effect of shoulder and classic chamfer finish lineon marginal integrity of IPS e.max Press full ceramic restoration. Journal of Dental School, Shahid Beheshti University of Medical Sciences ;28(4):207-213.
17. Shiratsuchi H, Komine F. (2006). Influence of finishing line designs of marginal adaptation of electroformed metal ceramic crowns. J Prosthet Dent ; 237-242.
18. Subasi G, Ozturk N, Inan O, Bozogullari N. (2012). Evaluation of marginal fit of two allceramic copings with two finish lines. Eur J Dent ; 6:163-168.
19. Vojdani M, Torabi K, Farjood E, Khaledi AAR. (2013).Comparison the marginal and internal fit of metal copings cast from wax patterns fabricated by CAD/CAM and conventional wax up techniques. J Dent Shiraz Univ Med Sci,; 14(3): 118-129.
20. McLean JW, von Fraunhofer JA. (1971). The estimation of cement film thickness by an in vivo technique. Br Dent J; 131: 107-111.
21. Moldovan O, Rudolph H, Quaas S, Bornemann G, Luthardt RG. (2006). Internal and external fit of CAM-made zirconia bridge frameworks-a pilot study. Dtsch Zahnärztl Z; 61: 38-42.
22. Martins LM, Lorenzoni FC, Melo AO, Silva LM, Oliveira JL, Oliveira PC, Bonfante G. (2012). Internal fit of two allceramic systems and metal-ceramic crowns. J Appl Oral Sci; 20: 235-240.
23. Quante K, Ludwig K, Kern M. (2008). Marginal and internal fit of metal-ceramic crowns fabricated with a new laser melting technology. Dental materials 24: 1311-1315.