IJBPAS, April, 2015, 4(4): 2035-2041

ISSN: 2277–4998

International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

A COMPARISON REVIEW OF ACCURACY AND RELIABILITY OF TECHNIQUES TO MEASURE MARGINAL ADAPTATION RESTORATIONS IN DENTISTRY

SANAM FANIHANIFEH[1], ZEINAB BAHRANI[2], ROJMAN NOSRATPOUR[2]* AND EZZEDIN SADEGHKHANI[1]

1: Postgraduate student of Prosthodontics- School of Dentistry- Islamic Azad University- Tehran- Iran

2: Postgraduate student of Prosthodontics-school of Dentistry- Tehran University of medical Sciences

***Correspondence Author E Mail:** rojman_nosratporr@yahoo.com

ABSTRACT

The most important factor for long-term success of full-coverage restorations is marginal adaptation. The terminology describing "fit" and the techniques used for measuring fit vary considerably in the literature. Although fit can be most easily defined in terms of "misfit," there are many different locations between a tooth and a restoration where the measurements can be made. The measurements of misfit at different locations are geometrically related to each other and defined as internal and marginal gaps, vertical marginal and horizontal marginal discrepancies, overextended and under extended margins, absolute marginal and seating discrepancy. Preparation design is one of the important factors influencing the marginal integrity. In this paper we compared the accuracy and reliability of techniques to measure marginal adaptation restorations.

Key Words: Marginal adaptation; Restoration, Teeth

INTRODUCTION

New technologies introduced in the fixed prosthodontics in dentistry during past decades but controversial reports exist for success and/or usefulness of these technics **[1]**. Achieving esthetically and functionally ideal restorations has been the goal of dental clinicians, prosthodontists and manufacturers throughout the history of

dentistry **[2]**. Three main factors esthetic value, resistance to fracture, and marginal adaptation are responsible for success of a dental restoration **[3]**. Inadequate fit leads to plaque accumulation which increases the risk of carious lesions and can cause micro leakage and endodontic inflammation **[4]** and finally terminates to periodontal diseases such with sub gingival margins **[5]**. Misfit could contribute to cement dissolution, so, obtain the best technique minimize subsequent abnormalities. In this paper we compared accuracy and reliability of available techniques to measure marginal adaptation restorations in dentistry.

Lost-wax

Lost-wax is the traditional technique for fabricating the metal substructure is the lost-wax technique and using various metal alloys for casting **[6]**. Conventionally, wax patterns were fabricated with wax and waxing instruments for example the popular PKT instruments. Wax is used to make the patterns because it can be conveniently manipulated, precisely shaped and can also be completely eliminated from the mold by heating. The fabrication of the wax pattern is the most critical and labor-intensive step in making the porcelain fused-metal crown **[7]**. To fabricate a restoration prepared using the lost-wax technique, the dentist must first make an impression and the impression appointment may be uncomfortable for the patient because of the retraction procedure and need for anesthesia. Subsequently, time is required by the dental laboratory technician for careful pouring of the stone die or cast from the impression, preparation of the cast, then fabrication of the wax pattern, investing, and casting. Considering the lower unit cost of base metal alloys, a more economical dental laboratory technique would be helpful to replace the previously described technique for preparing cast restorations **[6]**.

Laser sintering

The dental computer aided design-computer aided manufacturing (system was developed as an alternative to the traditional lost wax technique and casting method to produce more effective and standardized fixed dental prostheses (FDPs) **[1]**. Laser sintering is a novel technology which may replace casting of the base metal alloys. Briefly in this system, a high-power laser can quickly fuse small particles on the surface of a powder bed of the base metal alloy into a mass representing the desired three-dimensional object by scanning cross-sections generated from a 3 dimensional digital description of the part. This can be done from a CAD file or another file created from scanned data. After each cross-section is scanned, the thickness of the powder bed of the base metal alloy is lowered by one layer, and a new layer of base metal alloy is applied on

top. This process is repeated until the part is completed. The physical process involved with the laser sintering can be full melting, partial melting or liquid-phase sintering and up to a hundred percent density can be achieved **[8]**.

Selective laser sintering

Selective laser sintering (SLS) is a manufacturing technology recently introduced in dentistry. SLS, is one of the fast prototyping production techniques, uses a high-temperature laser to beam selectively substructure metal powder based on the CAD data with the FDP design. A thin layer of the beamed area becomes burnt and the FDP is completed by laminating these thin layers. The metal-ceramic crown is formerly one of the most commonly used FDPs and the lower core is mostly produced by the lost wax technique and casting method. However, SLS system has several benefits such as material, time and expenses saving was well as the production is simpler compared to the existing methods **[9]**.

Marginal gap is the critical point for accuracy of techniques

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 **[10, 11]**. Fixed dental restorations mainly aim to restore function and esthetics of lost intraoral structures without jeopardizing the oral or general health of patients **[12]**.

Accuracy of techniques

Several systems have been introduced for the fabrication of nonmetallic ceramic crowns. All ceramic materials are widely used in dentistry for restoring anterior and posterior teeth to provide a metal-free structure and esthetic appearance **[13, 14]**. Ceramic crowns/copings can be made from different high-strength ceramic materials, and various manufacturing processes can be used. Today stronger and tougher ceramic materials are available, such as a lithium disilicate-reinforced glass ceramic **[13]**.

All ceramic restorations must ensure requirements for strength and precision of marginal fit for clinical success **[15]**. Marginal fit is one of the most important criteria for the long-term success of all ceramic crowns. Increased marginal discrepancies expose the luting material to the oral environment, thus leading to cement dissolution and micro leakage **[10]**. The cement seal becomes weak, permits the percolation of bacteria, and can cause

inflammation of the vital pulp **[13, 16]**. In-vivo studies have provided evidence that a large marginal discrepancy in a fixed restoration correlates with a higher plaque index and reduced periodontal conditions. Types of finish lines and ceramic manufacturing technique are the factors that have been investigated for all-ceramic crowns. Heavy chamfers and rounded shoulder finish lines have been advocated for all-ceramic crowns, as well **[13]**. 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 **[7]**. Studies have reported measurement of fit relative to marginal adaptation, internal adaptation, vertical seating, radiographic appearance and clinical adaptability as judged by experienced practitioners. Two common techniques are measurement of embedded and sectioned specimens and measurement of specimens (or their replicas) by direct visualization. Mechanical devices, such as the tracing jig to measure relative distortion at the margin during porcelain firing cycles, have also been used frequently. Studies concerning preparation design, marginal configuration, marginal finishing, and cement thickness must ultimately address the question of fit to reach conclusions. What constitutes an adequate fit has not been satisfactorily resolved in the literature, and each study attempting to evaluate fit must establish its own definitions then attempt to draw conclusions based on those definitions. The choice of terminology and definitions is often subjective and unavoidably introduces the bias of the investigator. The wide variety of terminology and definitions of fit in the literature demonstrates the inherent difficulty in dealing with this subject **[17]**.

Lost-wax Vs. SLS

Metal ceramic is the common material for fabricating complete coverage crowns and fixed partial dentures where is considered as the standard treatment in dentistry. Lost-wax technique is the old-fashioned technique for fabricating the metal substructure and using various metal alloys for casting. Lost-wax used to make the patterns for many reason such as conveniently manipulated, precisely shaped and completely eliminated from the mold by heating **[18]**. The fabrication of the wax pattern is the most critical and labor-intensive step in making the porcelain fused-metal crown. Disadvantages of this system includes: time consumption, quality of wax–up's is dependent on the skilled labor of the individual. Also, because of the wax pattern's color and glossy surface, small defects cannot easily identify **[7]**.

Owing to the increased demand for safe and esthetically pleasing dental materials, new high strength ceramic materials have been recently introduced as materials for dental devices. When we started research and development in the1980s, the design and processing of dental devices using CAD/CAM technology was generally believed to be simpler and easier than for industrial products **[19]**. The SLS has several advantages which are impressed in section 3. So to avoid repetition we avoided list of benefits for this system here. This paper is part of our incoming research which based on that we want to compare effects of lost-wax and SLS using sloping shoulder and a shoulder bevel on marginal integrity of metal-ceramic crowns. So, using the literature review of current paper, we started or incoming research project which the results will publish in recent future.

CONCLUSION

Food, debris, and by-products of microorganism activity in various regions have the ability to provoke the vital pulp. Poor marginal integrity can cause an increase in microbial plaque, changes in the sub gingival flora, gingival inflammation and color changes in the marginal gingival. In severe cases an increase in pocket depth and loss of attached gingiva may occur several clinical reports support this theory. Researches confirm the relation between inappropriate marginal integrity and gingival inflammation and reports the most important factor in periodontal disease prevalence is an unsuitable marginal fit **[11]**. Marginal fit is one of the most important criteria for the long-term success of all ceramic crowns. This paper is heading of our recent research which based on that we want to compare effects of lost-wax and SLS using sloping shoulder and a shoulder bevel on marginal integrity of metal-ceramic crowns. So, we are trying to introduce new methods instead of old time consuming and costly methods which have been used in marginal adaptation restorations in dentistry.

REFERENCES

[1] Kim, K, Kim, J, Kim, W, Kim, H, Kim, J, Evaluation of the marginal and internal gap of metal-ceramic crown fabricated with a selective laser sintering technology: two- and three dimensional replica techniques. J Adv Prosthodont., 5, 2013, 179-86.

[2] Contrepois, M, Soenen, A, Bartala, M, Laviole, O, Marginal adaptation of ceramic crowns: A systematic review. J Prosthet Dent., 110, 2013, 447-45.

[3] Hunter, AJ, Hunter, AR, Gingival margins for crowns: a review and discussion. Part II: discrepancies and

configurations. J Prosthet Dent., 64, 1990, 636-42.

[4] Behrend, DA, Crown margins and gingival health. Ann R Australas Coll Dent Surg., 8, 1984, 138-45.

[5] Karlsson, S, A clinical evaluation of fixed bridges, 10 years following insertion. J Oral Rehabil., 13, 1986, 423-32.

[6] Ucar, Y, Akova, T, Akyil, MS, Brantley, WA, Internal fit evaluation of crowns prepared using a new dental crown fabrication technique: Laser-sintered Co-Cr crowns. J Prosthet Dent., 102, 2009, 253-259.

[7] Vojdani, M, Torabi, K, Farjood, E, Khaledi, AAR, 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 Sept., 14(3), 2013, 118-129.

[8] Wang, XC, Laoui, T, Bonse, J, Kruth, JP, Lauwers, B, Froyen, B, Direct selective laser sintering of hard metal powders: experimental study and simulation. Int J Adv Manuf Technol., 5, 2002, 351-7.

[9] Akova, T, Ucar, Y, Tukay, A, Balkaya, MC, Brantley, WA, Comparison of the bond strength of laser-sintered and cast base metal dental alloys to porcelain. Dent Mater., 24, 2008, 1400-4.

[10] Jacobs, MS, Windeler, AS, An investigation of dental luting cement solubility as a function of the marginal gap. J Prosthet Dent., 65(3), 1991, 436-42.

[11] Jalalian, E, Jannati, H, Mirzaei, M, Evaluating the Effect of a Sloping Shoulder and a Shoulder Bevel on the Marginal Integrity of Porcelain-Fused-to-Metal (PFM) Veneer Crowns. J Contemp Dent Pract., (9)2, 2008, 17-24.

[12] Nawafleh, NA, Mack, F, Evans, J, Mackay, J, Hatamleh, MM, Accuracy and Reliability of Methods to Measure Marginal Adaptation of Crowns and FDPs: A Literature Review. J Prosthodont., 22, 2013, 419–428.

[13] Subasi, G, Ozturk, N, Inan, O, Bozogullari, N, Evaluation of marginal fit of two allceramic copings with two finish lines. Eur J Dent., 2012, 6, 163-168.

[14] Bindl, A, Mormann, WH, An up to 5-year clinical evaluation of posterior in-ceram CAD/CAM core crowns. Int J Prosthodont ., 15, 2002, 451-456.

[15] Schwartz, NL, Whitsett, LD, Berry, TG, Stewart, JL,

Unserviceable crowns and fixed partial dentures: life-span and causes for loss of serviceability. J Am Dent Assoc., 81, 1970, 1395-1401.

[16] Goldman, M, Laosonthorn, P, White, RR, Microleakage full crowns and the dental pulp. J Endod., 18, 1982, 473-475.

[17] Holmes, JR, Bayne, SC, Holland, GA, *et al*., Considerations in measurement of marginal fit. J Prosthet Dent., 62, 1989, 405-408.

[18] Abduo, J, Lyons, K, Swain, M, Fit of zirconia fixed partial denture: a systematic review. J Oral Rehabil., 37, 2010, 866-876.

[19] Miyazaki, T, Hotta, Y, Kunii, J, Kuriyama, S, Tamaki, Y, Review of dental CAD/CAM: current status and future perspectives from 20 years of experience. Dent Mat J., 28(1), 2009, 44-56.

[20]