

A Double Blind Split Mouth Randomized Clinical Trail Comparing Marginal Fit Of Porcelain Laminate Veneers After Finishing Prepared Surfaces With Ultrasonic Tips

Research Article

Anas Abdo^{1*}, Hassan Achour², Mirza Allaf³¹Teacher Assistant -Damascus University – School of Dental Medicine, Damascus, Syria.²Head and Professor of Cosmetic and Surgery –Damascus University.³Head and Professor of Fixed Prosthodontics -Damascus University – School of Dental Medicine, Damascus, Syria.

Abstract

Background: Smoothing prepared surfaces improve the marginal fit of all prepared surfaces while several methods have been introduced in dental daily practice and in the literature so far. In the last few years ultrasonic tips entered the prosthetic aspect and several manufactured tips has been suggested to have a role in the accuracy of restored teeth process and could give an improvement to the daily dental practice.

Objectives: The aim of the study was to assess the marginal fit following preparation finishing with ultrasonic tips of porcelain veneers compared with prepared only by bur.

Material and Methods: 27 patient including 240 veneers prepared for porcelain veneers in overlap scheme with split mouth technique one side finished with ultrasonic tips (Perfect Margine Kit - Satelic R).Marginal fit is measured by cement replica technique. The extra light silicon all veneers under microscope all measures is documented and the comparison is achieved statistically .After measurement all veneers are cemented with rely x veneers resin cement.

Results: The fit was significantly different between both finishing systems across preparation ($P < 0.001$).The average fit was $42 \mu\text{m}$ for preparation with ultrasonic finishing veneers , $82 \mu\text{m}$ for preparation with conventional Conclusion: In conclusion, finishing the surface preparation with ultrasonic tips reduce the marginal gape and improve the marginal seal.

Keywords: Veneer; Marginal Fit; Ultrasonic; Ceramic.

Introduction

All-ceramic restoration are increasing in daily routine treatments although remain less popular than metal-ceramic crowns especially as the rises cost of metal rises and aesthetic requested people increases The increased demand for aesthetic treatments has led to the widespread use of metal-free ceramics for conservative restorations[1]. Whilst studies for clinical porcelain restorations clarifies satisfactory success rates describes the reasons for failure is due to advance the techniques and materials used in dental restorations. All-ceramic restorations failures are due to several reasons, such as restoration fractures, [2] discoloration in marginal area, marginal misfits [3] and secondary decays [1]. However, secondary caries is the main failure mentioned by the studies, responsible for 21% of the suddenly crown replacements. [1] The etiology of secondary caries is as classified to primary caries, with the

involvement of the same cariogenic microorganisms. The place and spread where to invade of primary and secondary lesions are also similar, with secondary caries developing mainly in the gingival tooth interface of restored teeth [4]. Different authors have mentioned different instrumentation to prepare teeth appropriately [5-7]. Preparation may be applied using diamond burs attached to sonic devices or high-speed rotating instruments with diamond or tungsten carbide burs.[8, 10]. The action of conventional high-speed instruments applied for tooth preparation has been widely researched [11-13] as well as the adhesion strengths and marginal micro leakage it produces [1]. Some authors insisted that dental surface morphology of prepared teeth is influenced by the type of bur used for preparation[14, 15]. When diamond rotating instruments used in preparing teeth, abrasive particles pass across the tooth surface and change in the substrate surface. Tooth surface is ejected ahead of abrading particles and the sur-

*Corresponding Author:

Anas Abdo,
Teacher Assistant -Damascus University – School of Dental Medicine, Damascus, Syria.
Tel: 00963955543861
E-mail: Dr.anasabdo@gmail.com

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face is changed into a series of ridges and troughs running parallel to the direction of the moving particles [16]. Resultant axial wall roughness may affect the wettability and the interface where bonding quality of adhesive luting agents could be changed [5, 14, 16]. Oscillating instruments make a three-dimensional elliptical movement with longitudinal and transversal parts. There are certain positive actions to the use of sonic and ultrasonic oscillating burs over conventional high-speed burs: reduction of gum damage, less noise, and longer term durability of the bur itself [17, 18]. Dental preparation procedures by both oscillating and rotary burs produce similar intrapulpal temperature changes [19]. Despite the described advantages of oscillating instruments, the present study addresses the lack of research carried out to date into its effect of the marginal adaptation and the reduction of the marginal gap of restorations on teeth finished with these instruments following preparation. Reviewing the literature, it was noted that the roughened tooth surface texture produced by sonic oscillating instruments increases the total bonding surface area; this condition favors wettability and affect restoration retention. Some articles described the microleakage for this reason; reduced microleakage might be expected when teeth are finished with sonic oscillating instruments, due to the increased surface roughness produced [18]. But with no mention about the marginal gap so the aim of this study was to compare marginal fit in porcelain laminate veneer restorations following dental preparation using these two types of instrumentation. The test hypothesis was that marginal gap will be less when teeth are prepared with oscillating burs than the high-speed rotating burs.

Materials and Methods

Ethical Aspects

The study protocol was approved by the Medical Ethics Committee of the Academic Medical Centre in Damascus University. And the study was registered in clinicaltrials.gov under (NCT02683499). All voluntary participants were informed of the research, purpose and duration of the study and signed an

informed consent form which is documented in the research centre in the college of dental medicine Damascus University before enrolment.

Study Population

The participants were non-dental students from University colleges in and around Damascus between March 2015 till august 2015. They were recruited by reviewing the case documents which is filled in the diagnosis clinic and indicated for porcelain laminated veneers treatment. The inclusion criteria was 1- aesthetic request with no cracks and congenital loss of any incisors 2-discoloring teeth not responding to bleaching 4- age above 23 to have static occlusion with stable gingival position. Exclusion criteria was 1-evidence proximal caries, 2- edge to edge occlusion 3-parafunctional habits 4-root canal treated teeth. One hundred and twelve adult participants in good general health due to the evaluation criteria in the diagnostic clinic were screened out of which 85 were rejected because they did not meet the inclusion criteria (see Fig. 1). Participants had to demonstrate at least two symmetrical teeth at least 27 participants were enrolled into this study. The sample size of 240 veneers including two groups by split mouth technique so per group we had 120 veneer which were calculated a priori in such a way that index can be identified with $\alpha = .05$ in a two-tailed test, a sample size of 2 X 240 would result in a power of 94% (g power 3.1.3) based on a pilot study.

Study Design

This study is a split-mouth randomized controlled trials (RCTs) which can in the intervention of tooth preparation allows the patients are randomly allocated to different areas in the oral cavity [20]. Variability of outcome among patients is removed from the intervention effect estimate for a potential increase in statistical power, each subject being its own control than goes with the aim of veneer restorations. This study follows the guidelines of the consort statement.

Figure 1. Microscopic view of thr replica technique.

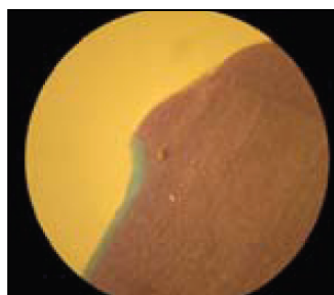


Figure 2. Marginal gap.

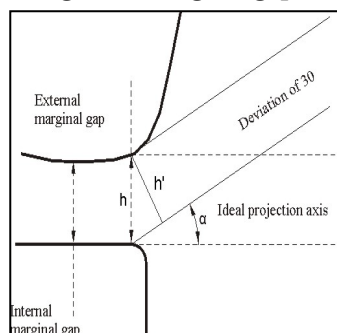


Figure 3. Section directions and measuring points of the replica.

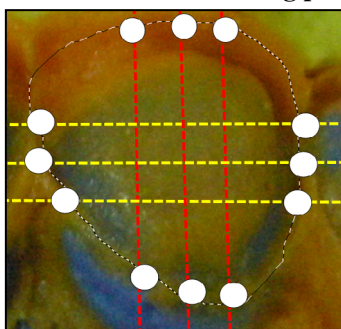
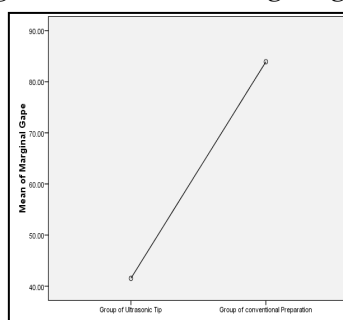


Figure 4. Mean of the marginal gape.



Restoration Placement

In the study placed 240 restorations. The 240 teeth to be treated with porcelain laminate veneers in advance according to the type (overlap) so the further steps could be easily achieved. periapical x-ray with a diagnostic cast for each case criteria and documentation. The preparation were placed under local anesthesia and cheek retractor is used to get the symmetric preparation as possible in a high-speed handpiece with water spray were used in all preparation carefully achieved with all surface in enamel 0.5 mm in depth by using KOMET USA's Cosmetic Prep/Seat Kit (FOL617).Preparation kept in enamel for maximum adhesive retention. The preparation finish line is applied in just the gingival sulcus and for tissue management the retraction cord is applied (Ultrapak® E- ultradent USA) before impression taking. Impression with additional silicon material 3M ESPE, including automatic mixable putties, offer additional advantages because they are suitable for convenient automatic mixing in the Pentamix™ automatic mixing unit, which stands for a homogeneous and void-free mix of base and catalyst material. Appropriate tooth shades were selected using the Vita shade guide supplied by the study co-other under ambient lighting condition. All restorations sent for marginal gape measurements in the department of lab research measurement and analysis branch in coordinating with the committee of measures in school of engineering Damascus University and a stereo microscope. Half mouth was mentioned randomly by the patient number with the help of research randomizer [21] to use right or left side to finish the surfaces of the teeth related to by Perfect Margin kit under water spray [22] for 1 minute which is part of the acceptance included in the committee of dental research protocols in Damascus university. All restorations after cleaning and dried where all cemented with resin cement (RelyX™ Veneer Cement-3m-USA) after applying a total etch bonding agent 3M™ ESPE™ Single Bond Adhesive-USA) and excess cement was removed my a brush like applicator then 30 second light curing with SmartLite Max LED Curing Light (densply – USA • High output up to 2850 mw/cm2) [23] and the

solid excess cement was removed and complete cure is achieved then rubber cone was used to polish the margin.

A. Measurement results for marginal gaps – replica technique:

Replica technique required the application of impression material build up of addition-silicone. Addition-silicone of low viscosity type (Express™2 Ultra-Light Body Quick) was applied to all restorations interior, after which the crowns were set onto basic samples. Impression material was set within the time which is recommended by the manufacturer, while the pressure force of 50 N was applied toward facio occlusal direction after the removal of all restorations from the basic samples, the layer of impression material remained on the restoration's inner surface due to its higher roughness compared to the abutment surface.

The thin film layer of impression material gives the meaning of a replica of space between the abutment and restoration. In order to control this layer, low-viscosity addition-silicone of different color (Express™2 Light Body Flow Quick) was applied inside the restoration. After the silicone impressions was set, they were cut by a manual scalpel along buccogingivo and mesiodistal directions (in across direction) in three parallel sections. Each section is numbered and the measure was randomly achieved to keep masking. The prepared impressions were measured by stereo microscope (Stemi SVII, Karl Zeiss, USA) (Fig. 1) in 12 pre-determined points 3 on the mesial, 3 distal, 3 gingival and 3 incisal (Fig. 3). The measurements were performed by the author just according to the number of sections masking the type of finishing margin related to, the marginal gape is measured as recommended by Holmes *et al.*, [24] as clarified in Fig. 2. Surface of a cross section examined on stereo microscope. Mean values of porcelain laminate veneer marginal gaps for each measuring point are shown in Table 1, while the marginal gape is statistically carried out by IBM SPSS (Data Collection USA).

Statistical Analysis

The data allocated then were analysed with respect to the area. The average marginal and standard deviation [25] were calculated. The statistical package spss IBM was used and independent t test was performed to look for significant difference between both the conventional preparation technique and ultrasonic finishing kit.

Results

All data sets were subjected to normality tests using the Kolmogorov Smirnov method; data are presented as medians. One-way ANOVA and Tukey HSD tests were used to perform multiple comparisons with a level of $P > .05$ significance level. All analyses were performed with the statistical package for scientists (Spss IBM, WA, and USA).

The mean of marginal gape was 81µm in the conventional preparation and 41 µm in the group finished with ultrasonic tips (Fig. 5). statistical analysis revealed a significant difference between two groups $P > .05$. The mean of marginal gape was (57.3, 57.01, 50.5) µm in the incisal, gingival, proximal respectively for the conventional preparation group and (42.18, 37.7, 40.70) for the ultrasonic finishing tips group with a significant difference in the sub groups related to the area $P > .05$.

Discussion

As stated in a study carried out by [18, 26] marginal adaptation of the laminate veneers affected by the following factors: tooth preparation, whether the area of preparation areas are over enamel or dentin, surface manipulated technique used, adhesive, insertion procedures, and the restorative material itself. The present study was designed to reproduce standard clinical protocols used for veneer restorations, while also the finishing margin techniques that appear to present more smooth surfaces that enhance the adaptation between the restoration material and the tooth surface. The inclusion criteria included the aesthetic request to avoid any complex geometry in the preparation surface that affect the line of insertion so the study could be multifactor study which could reduce the power of the study due to the participants needs to be more in number. Following the recommendations of several authors, a standard bonding procedure was used in the study; the internal surfaces of the porcelain veneers were etched with

hydrofluoric acid, silanized, and bonded to the teeth which had been prepared using an etch-and-rinse adhesive luting composite. finishing technique with ultrasonic tips revealed better marginal fit and reduced the gape which suggests a reduction of bacteria and enzymes which affect the interface between the restoration material and the surface of the tooth which resulted in the study of lauffer [27]. The reduction of marginal gape due to the smoothing surfaces [28]. This study revealed that the marginal fit is better in both the gingival and incisal areas which the author suggest that the difference because of the 3 dimensional movement in the ultrasonic tips which gives more polishing active in the both ends (the tip and the base) but not in the middle further more the tip itself is moving in liner tip direction so the control of the position when smoothing the proximal walls (elbow) areas [29, 30]. The perfect margin kit gives smoothing surface and avoid scratching that happens with the scaling tips in periodontal treatments [31] because of the surface area touching the tooth and the deference between the surfaced the enamel in this study and the cementum in perio research field [32-39]. The kit giver more over advantages which is the gradual smoothing with controllable situation avoiding damaging soft tissues. The study avoided the effect of deviation of cement replica technique but considering the case is the measuring point away of counting the mean of each veneer to stay away of bias caused by more statistically steps so each area of measure is a case itself.

Conclusion

Under the limitation of this study:

1. Ultrasonic tips gives more smoothing surface so decrease the marginal gape $p > 0.05$.
2. With ultrasonic tips more gingival and incisal adaptation is gained $p > 0.05$.

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Table 1. Descriptive values

		Descriptives							
		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Ultrasonic Group	Incisal	720	42.1861	22.18380	0.82674	40.5630	43.8092	3.00	80.00
	gingival	720	37.7403	20.54435	0.76564	36.2371	39.2434	3.00	72.00
	Proximal	1440	41.4542	22.36178	0.58928	40.2982	42.6101	3.00	80.00
	Total	2880	40.7087	21.93798	0.40879	39.9071	41.5102	3.00	80.00
Conventional Group	Incisal	720	57.3847	19.19139	0.71522	55.9806	58.7889	25.00	90.00
	gingival	720	57.0125	18.99992	0.70809	55.6223	58.4027	25.00	90.00
	Proximal	1440	50.5507	23.50060	0.61930	49.3359	51.7655	3.00	95.00
	Total	2880	53.8747	21.66217	0.40365	53.0832	54.6661	3.00	95.00

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