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Evaluation of marginal adaptation of a class V composite resin restorations with different surface treatments after thermal and mechanical load cycling (An *In vitro* study)

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Abstract

This study compared *In vitro* the marginal adaptation of five different surface treatments total-etch technique only, self-etch technique only, laser only, laser with total-etch technique, laser with self –etch technique at four different composite/tooth interface regions (gingival, mesial, distal, occlusal regions) of standardized class V cavity restoration after thermal changes and mechanical load cycling. The gaps were detected by scanning electron microscopy. Twenty five sound human third molar of approximately comparable sizes were divided into five main groups of (five teeth) in each group according to the type of surface treatment that was used: Group A: The teeth were treated with Laser and then with tetric total-etch and tetric N-bond, restored with tetric N-ceram. Group B: The teeth were treated with laser and then with Tetric self-etch and restored with tetric N-ceram. Group C: The teeth were treated with tetric total-etch and tetric N-bond, restored with tetric N-ceram Group D: The teeth were treated with tetric self-etch and restored with tetric N-ceram. Group E: The teeth were treated with laser only, tetric N-bond and restored with tetric N-ceram. After specimens were stored in distilled water at 37°C, all specimens were subjected to thermocycling at (5° to 55°C) for 500 cycles, then submitted to mechanical load cycling (intermittent axial force of 50 N and a total of 50.000 cycles). The specimens were examined under scanning electron microscope to measure marginal gap width (the distance between the dental wall and the restoration) at gingival, mesial, distal, occlusal regions in micrometer using Tescan software, version 3.5. Data were analyzed statistically by one way ANOVA test and least significant difference tests.The results of this study showed that the group A in which teeth treated by laser with total etch technique showed highly significant more marginal adaption at gingival, mesial, distal, occlusal regions after the application of thermocycling and mechanical loading in comparison with groups treated by laser with self-etch technique, laser only, total etch only, self- etch only. Group E in which teeth treated with laser only showed highly significant lesser marginal adaption at gingival, mesial, distal, occlusal composite/tooth interface regions in comparison to other groups. All the five groups showed significantly higher marginal adaption at the occlusal region in comparison with gingival regions of class V composite restorations. In conclusions, none of the five surface treatments tested in this study totally prevented micro-gap formation at composite/enamel interfaces of class V cavity.

Keywords: Microleakage, Self-etch, Total-etch, Laser.

Introduction

The use of direct resin-based composite has increased primarily due to patient esthetic desires and product improvements. Other factors (substantiated or not) contributing to increased use of resin-based composite are environmental and health concerns with dental amalgam (Nadig *et al.*, 2011).

Despite the improvement of many composite resin restorative materials the marginal adaption of the restoration remains a challenge for dentistry. The marginal adaption of composite restoration refers to its marginal fit there by increasing the longitivity of the restorative material. Poor marginal adaptation may produce marginal discoloration, post-operative sensitivity and secondary caries. The marginal failure of composite resin restoration is related mainly to the quality of bonding to the dental structures, the stress generated on the restoration (Rodrigues *et al.*, 2010), the occlusal loads and alterations of the temperature of the oral behavior produce stress on the restoration and can also compromise the marginal sealing. Composite materials undergo volumetric polymerization contraction of at least 2% which may result in gap formation as the composite pulls away from cavity margins during polymerization (Nadig *et al.*, 2011), Therefore a tight marginal seal still has to be the primary goal for the clinician, because once happened; gap formation cannot be counteracted with restorative materials that prevent demineralization along with cavity margins .The adhesive systems are responsible for an efficient union between teeth and resin, resulting in a longevity restoration (Tay *et al*., 2002).

Although long term clinical success has been achieved with total–etch systems, the demand for simplified application led to the development of self –etching adhesive systems that do not require a separate acid etch step and are based on the use of nonrinse acidic monomers that simultaneously condition and prime dentin and enamel. This approach reduced technique-sensitivity of the material and post-operative sensitivity of patients. These factors contribute to the increasing popularity of these materials (Kermanshah *et al*., 2013).

The application of laser in dentistry began over 35 years ago, and since then many types of lasers have been used in soft tissues and hard structures with different objectives. Since FDA (Federal Drug Administration) approval of the ER YAG laser in 1997 ER YAG laser has been used for caries removal, cavity preparation and conditioning of tooth substance Thermal damage is reduced, especially with the water spray, etching by laser become alternative method to acid etching .by the formation of rough dentin surface with micro-retentive pattern that reveals tubule opening without smear layer. This characteristic is supposed to favor the bond strength of resin-based materials with tooth structure (Souza *et al*., 2008).The high quality of modern composite materials has made it more difficult to see changes in the quality of restoration margins, which in turn, has increased the need for more sensitive methods to assess the early changes of the marginal adaptation. Scanning electron microscopy (SEM) is a method that can be used for closer examination of the restoration margins because of its ability to magnify and reveal details (Schmidt *et al*., 2012).This study was conducted with aim of comparing *In vitro* the marginal adaptation performance after different surface treatment.

Materials and Methods

Teeth selection: Twenty five sound, human third molar without any restorations, endodontic treatment, caries or erosion extracted for the periodontal disease or impaction reasons were selected for this study. To determine that the enamel was free of cracks, abrasion or structural deformities all teeth were visually examined by using a 10X magnifying lens and blue light transillumination and all defective teeth were discarded (Majeed *et al*., 2012). All The teeth of this study were cleaned with pumice and rubber cup to remove any debris and teeth were stored for two months maximum (Borges *et al*., 2012). During all stages of the study, dehydration of the specimens was avoided. For this study teeth of similar dimensions were selected. Teeth dimensions were determined by measuring the buccolingual and mesiodistal widths by digital caliper. Teeth with similar dimensions (a maximum deviation of 10% from a mean determined from data obtained in a pilot study) were chosen for both the treatment in such a way that mean dimensions were not statistically different for all groups (ANOVA, P>0.05) (Paulu *et al*., 2008).

Teeth Mounting: All teeth were embedded in a custom made mold of a length 20mm, width16mm and a height18 mm dimensions filled with a mixed cold cure- acrylic powder and liquid according to manufacture Instruction. Each tooth was suspended in the middle of the mold using dental Surveyor to ensure vertical positioning of the tooth inside the mold, as follows; the center of the occlusal surface of each tooth was attached to the vertically moving arm of the surveyor along its long axis with sticky wax. When the axis of the tooth was positioned correctly, acrylic resin was poured into the mold and before it reached the dough stage the tooth was inserted. All specimens were embedded up to 2mm below the CEJ to simulate the natural biologic width (Khatib *et al*., 2009). After initial polymerization, the samples were placed in water to avoid overheating due to resin polymerization (Sorrentino *et al*., 2006). To differentiate each group a five colors had been add to acrylic.

Samples grouping: The teeth randomly were divided into five main groups (five teeth in each group) as follow

Group A: The teeth were treated with laser and then treated with total etch and tetric N-bond, restored with tetric N-ceram

Group B: The teeth were treated with laser and then treated with tetric self-etch and restored with tetric N-ceram

Group C: The teeth were treated with total-etch and tetric N-bond, restored with tetric N-ceram

Group D: The teeth were treated with Tetric self-etch and restored with tetric N-ceram

Group E: The teeth were treated with laser and restored with tetric N-ceram

Cavity preparation: Class V cavities were prepared on buccal and lingual surfaces of each tooth in which cavity margins located about 2mm occlusal to the cement-enamel junction. Dimensions of the cavities were 3mm mesio-distally, 3mm occluso-gingivally directions, and 1.5mm depth. To standardize the cavity preparation adhesive paper was placed over buccal and lingual surface of each tooth within cemento-enamel junction and making a window in the paper with an outline of 3 mm of mesio-distal width and 3 mm of occluso-gingival height. The depth of the cavity was calibrated by measuring it with a marked periodontal probe (measured in millimeters). The tooth was placed in the modified dental surveyor and the cavity preparation was made by using the parallel sided; flat- ended carbide fissure bur of 1 mm diameter with a high speed water-cooled hand piece that was fixed to the vertical arm of modified dental surveyor. To maintain cutting efficiency, a new bur was used for each four preparations (Borges *et al*., 2012).

Restorative procedure:

A-Conditioning of teeth

1. Conditioning of teeth by laser: For group A, B, E KAVO KEY 3 Laser device with a laser hand-piece number 2060 were used for teeth conditioning procedure. The laser parameters were (energy 300 mj and frequency 6 Hz) selected according to manufacture instruction. The surfaces of cavities were treated with Er: YAG laser device (2.94-µm wavelength). The laser beam was delivered with noncontact, defocused mode and with a fine water mist at 5ml/min. The distance between exit window of laser hand-piece and teeth cavity was standardized by using a modified dental surveyor in which the hand-piece (No. 2060) was positioned so the laser beam could be delivered perpendicularly to the surfaces of the cavity, at 17mm distance according to manufacture instruction, this distance was fixed by using an indicating orthodontic wire fixed previously to vertical arm of the dental surveyor (Marcella *et al*., 2008). The adjustable base of the surveyor, on which the teeth were individually and firmly fixed by manufactured holding arm that could be moved in all directions, this allowed the laser beam to provide a complete and more accurate treating of each surface of the cavity .The laser treatment was performed in scanning manner. After Er: YAG laser treatment, the samples were rinsed thoroughly with deionized water spray and dried with compressed air.

2- Conditioning of teeth by acid:

A-Total-etch: For group A and for group C after laser conditioning teeth were etched using the total- etch technique by 37% phosphoric acid gel for 15sec. the surface was rinsed with water for 10sec. excess water was removed by application of a gentle stream of air for 5sec.

B-Self-etch and Tetric N-bond: For group B and for group D after laser conditioning the self - etch Tetric N-bond was applied to the entire cavity for 15 seconds then dispersed with a stream of air and light-cured for 10 seconds by light curing device

B-Application of Tetric N-bond of total-etch: For group A, C and E, the tetric N-bond was applied on the tooth surface with a disposable brush, wait for 15 seconds, the solvent removed by blowing gently with air from an air syringe for 5sec, light cure for 10 seconds using a visible light curing unit.

C- Placing the restoration: For all groups of this study the Tetric N-ceram composite were placed by the aid of plastic instrument for composite placement. After selection the suitable size of Hawe-trasparent-cervical-anatomically shaped transparent cervical matrices ideal for class V restorations for molars, placing it on the restoration. Then by using dental probe the excess of composite was removed then the composite was cured by light curing device for 10sec. according to the manufacturer's instructions. After placement of the restorations, the teeth were stored in distilled water at 37ºC for 24hrs. finishing was done by the use of oprtapol finishing burs. Restorations were checked with a stereomicroscope (Altay, Italy) at 20X magnification to ensure that no flashes remain along the margins of the restorations. All the restored teeth were stored in distilled water at 37°C in a dark container (Bin-Hasan *et al*., 2012).

Thermocycling procedure: In an attempt to simulate the temperature changes that take place in the oral cavity that might result in changes in the microspace between the tooth and the restoration. All specimens were subjected to thermal changes cycles. The procedure done by cycling the teeth between two custom made water baths; one of the water baths maintained at 5°± 0.5°C and the other at 55°± 0.5°C, with a dwell time of 15sec. The number of cycles was 500 cycles according to the International Organization for Standardization (ISO TR 11405) (Loguercio *et al.,* 2004).

Mechanical load cycling procedure: All the specimens were submitted to mechanical load cycling in an attempt to simulate the clinical situation. A custom made apparatus was used for the cycling load. The design was consisted of metalic piston with cylindrical arm and spherical end. A compressor of a dental chair delivered compressed air with pressure that was fixed at 2bar. The pressure was regulated using a diaphragm valve and the pressure was monitored by a dial pressure gauge. The gauge had a range of 0 – 10bar. measurement to ensure accurate setting of the air pressure.

5kg was required to obtain an intermitant axial force of 50N, this force delivered in intermittent way to the specimen (Borges *et al*., 2012), this five kg was checked by using digital weight indicator.The tip of the device (spherical end) was placed in contact with the center of the occlusal surface of the tooth after the tooth had been firmly attached to the base of the apparatus by using an adhesive. The samples were subjected to 50,000 cycles (corresponding to 5.5hrs. in the machine). The number of the cycles was displayed on a digital counter (china) attached to the apparatus. The number of working hours of apparatus were displayed on a flash timer (china) attached to the apparatus.

Specimen preparation for SEM investigation: For SEM investigation, all the specimens were sectioned horizontally 2mm below the cemento-enamel junction with a water cooled diamond disc to separate the crowns from the roots and the crowns were kept for SEM examination. Two specimens from each group were mounted on a metal SEM stub. The surfaces were then sputter-coated with gold (EMS-76M; Earnest F) and evaluated buccally and lingually under SEM. Photographs were taken and stored digitally.

Evaluation of marginal adaptation: All the samples were examined by Tescan SEM to detect marginal gaps. The measurement of marginal gap width (the distance between the dental wall and the restoration) in each sample were taken at: three points in the gingival margin, three points at the occlusal margin, three points at the mesial side and three points at the distal margin. The positioning of each three points in each side of the region were assigned by putting the first point at the middle of the region (A), the second point was placed at the midway between the corner of the cavity and the first point (B) and the third point was placed at the midway between the middle point and the other corner of the cavity(C) (Bin-Hasan *et al*., 2012).

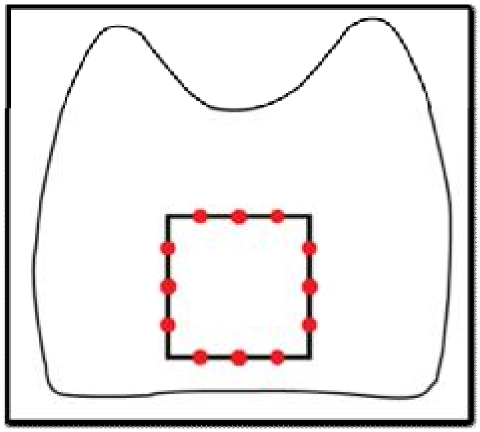

Figure (1): The location of the points (●) in each margin, G: Gingival margin's points, M: Mesial margin points, D: distal margin points, O: Ocllusal margin points.

Results and Discussion

The data were collected and analyzed using SPSS (Version 20) for statistical analysis. For the gingival, mesial, distal and occlusal region, the mean of largest marginal gap of each region was taken for each sample. (Figure 2).

The means, standard deviations, minimum and maximum values at the gingival, mesial, distal, occlusal regions for the five groups (descriptive statistics) are summarized in (Figure 3).

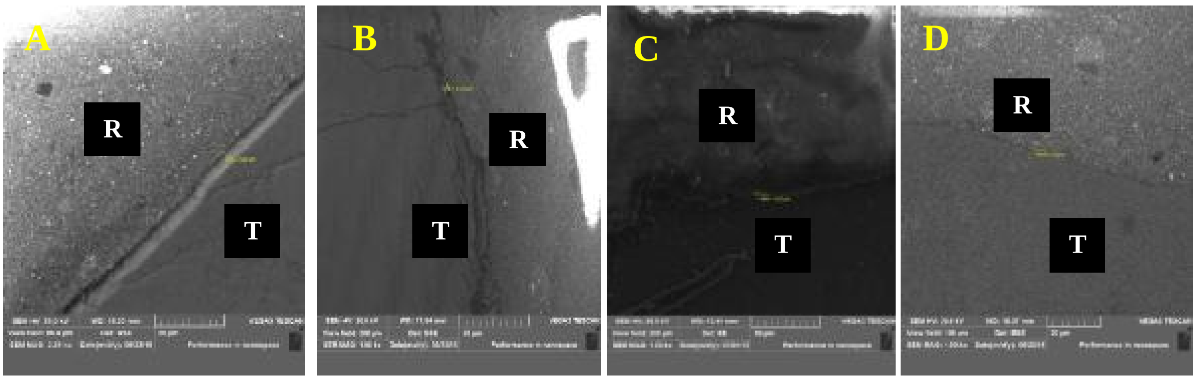

Figure (2): The tooth (T)/restoration (R) marginal gaps width of sample conditioning by laser, A- Gingival region's point, B- Mesial region's point, C- Distal region's point, D-occlusal region's point.

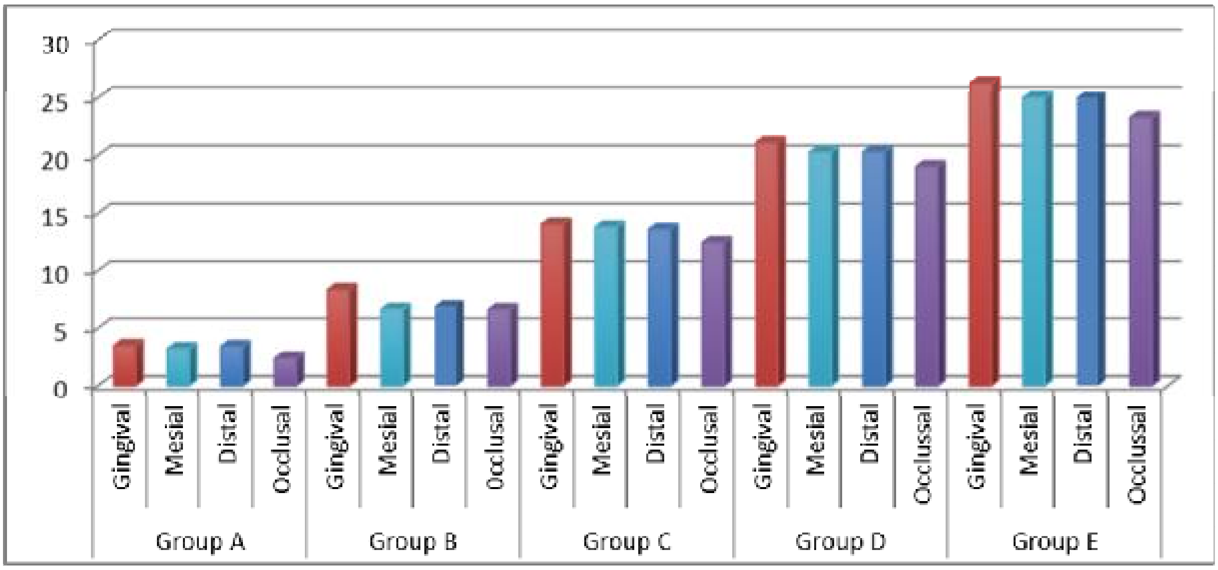

Figure (3): Bar chart showing the differences between the means and ±SD for the marginal gaps width (µm) at gingival, mesial, distal and occlusal regions for all groups of this study.

A. The comparison between the five groups in marginal gaps width (µm) at each region

To compare among the five groups at each region, ANOVA test was performed to analyze the presence of statistically significant difference for the marginal gaps width (µm) at the gingival, mesial, distal and occlusal regions and the result showed that there were statistically highly significant differences among all groups of this study (P≤0.01) (Table 1).

LSD test was performed for gingival regions. The results showed that, the group A was highly statistical significant more marginal adaption than the other groups (Table 2).

On the other hand LSD test was performed for mesial regions, the results showed that, the group A was highly statistical significant more marginal adaption than the other groups (Table 3).

LSD test was performed for distal regions, the results showed that, the group A was highly statistical significant more marginal adaption than the other groups(Table 4).

LSD test was performed for occlusal regions, the results showed that, the group A was highly statistical significant more marginal adaption than the other groups (Table 5).

B. The comparison of marginal gaps width (µm) between gingival and occlusal regions of each group: T test was performed to identify the presence of statistically significant differences for the marginal gaps width (µm) among gingival and occlusal regions within each group. The result showed that, for all groups there was a highly significant difference more marginal gaps width (µm) in the gingival as compared to occlusal regions (Table 6).

Table (1): ANOVA test for the marginal gaps width (µm) among the five groups at each region

Regions	ANOVA	Sum of Squares	df	Mean Square	F	Sig.
Gingival	Between Groups	3393.441	4	848.360	3549.228	.000
	Within Groups	10.756	45	.239		
	Total	3404.197	49			
Mesial	Between Groups	3305.068	4	826.267	2328.868	.000
	Within Groups	15.966	45	.355		
	Total	3321.034	49			
Distal	Between Groups	3231.732	4	807.933	2002.170	.000
	Within Groups	18.159	45	.404		
	Total	3249.891	49			
Occlusal	Between Groups	2963.219	4	740.805	3225.453	.000
	Within Groups	10.335	45	.230		
	Total	2973.555	49			

Table (2): LSD test for gingival regions

Regions	Groups		Mean Difference (I-J)	Std. Error	P-value
	(I) Code	(J) Code			
Gingival	A	B	-4.86400-*	.21864	.000
		C	-10.56600-*	.21864	.000
		D	-17.60000-*	.21864	.000
		E	-22.70700-*	.21864	.000
	B	C	-5.70200-*	.21864	.000
		D	-12.73600-*	.21864	.000
		E	-17.84300-*	.21864	.000
	C	D	-7.03400-*	.21864	.000
		E	-12.14100-*	.21864	.000
	D	E	-5.10700-*	.21864	.000

Table (3): LSD test for mesial regions.

Regions	Groups		Mean Difference (I-J)	Std. Error	P-value
	(I) Code	(J) Code			
Mesial	A	B	-3.43100-*	.26638	.000
		C	-10.56500-*	.26638	.000
		D	-17.04000-*	.26638	.000
		E	-21.79300-*	.26638	.000
	B	C	-7.13400-*	.26638	.000
		D	-13.60900-*	.26638	.000
		E	-18.36200-*	.26638	.000
	C	D	-6.47500-*	.26638	.000
		E	-11.22800-*	.26638	.000
	D	E	-4.75300-*	.26638	.000

Table 4: LSD test for distal regions.

Regions	Groups		Mean Difference (I-J)	Std. Error	P-value
	(I) Code	(J) Code			
Distal	A	B	-3.53100-*	.28409	.000
		C	-10.16400-*	.28409	.000
		D	-16.86900-*	.28409	.000
		E	-21.62200-*	.28409	.000
	B	C	-6.63300-*	.28409	.000
		D	-13.33800-*	.28409	.000
		E	-18.09100-*	.28409	.000
	C	D	-6.70500-*	.28409	.000
		E	-11.45800-*	.28409	.000
	D	E	-4.75300-*	.28409	.000

Table (5): LSD test for occlusal regions.

Regions	Groups		Mean Difference (I-J)	Std. Error	P-value
	(I) Code	(J) Code			
Occlusl	A	B	-4.26600-*	.21432	.000
		C	-10.08400-*	.21432	.000
		D	-16.69600-*	.21432	.000
		E	-20.92600-*	.21432	.000
	B	C	-5.81800-*	.21432	.000
		D	-12.43000-*	.21432	.000
		E	-16.66000-*	.21432	.000
	C	D	-6.61200-*	.21432	.000
		E	-10.84200-*	.21432	.000
	D	E	-4.23000-*	.21432	.000

Table (6): T-test for comparison of marginal gaps width (μm) between gingival and occlusal regions of each group

Groups	Region	Mean	S.d	T-test	P-value	Sig.
A	Gingival	3.49	0.24	7.71	0.000	H.S
	Occlusal	2.37	0.39			
B	Gingival	8.36	0.53	6.99	0.000	H.S
	Occlusal	6.64	0.57			
C	Gingival	14.06	0.57	6.44	0.000	H.S
	Occlusal	12.45	0.54			
D	Gingival	21.09	0.51	9.09	0.000	H.S
	Occlusal	19.07	0.49			
E	Gingival	26.20	0.52	14.32	0.000	H.S
	Occlusal	23.30	0.37			

Marginal integrity of restorations remains a challenge for dentistry. Marginal discoloration, postoperative sensibility, and secondary caries may result from poor marginal adaptation, these are the most frequent reasons to replace or repair an adhesive restoration (Bernardo *et al*., 2007). Marginal adaptation of composite resin restorations depending on the quality of bonding to the dental structures and on the stress generated on the restoration.The de-bonding followed by gap formation can be observed when the restoration is submitted to stresses. Polymerization of composite resin results in a reduction in the intermolecular distance between the monomers and consequential shrinkage, when bonding the composite resin to the cavity walls this shrinkage impairs the material deformation and generates shrinkage stress on the bonding interfaces .A contraction gap resulted, when the stress between the dental substrate and the adhesive system exceeds the bond strength, affecting the restoration's longevity. In addition to stress shrinkage, the occlusal loads and alterations of the temperature of the oral behavior produce stress on the restoration and can also compromise the marginal sealing (Verluis *et al*., 2011). The class V cavity was chosen in this study because it remain a challenge for restorative procedure. Thus, most of the clinical studies using a class V cavities to evaluate the performance of an adhesive system. The C-factor of the class V cavities affecting flowing of composite resin during the polymerization shrinkage, increasing the stress over the boding interface. Moreover, these cavities frequently present gingival margins in the dentin or a thin enamel thickness, consisting of an additional challenge to obtain a proper marginal sealing. The results of this study shows that group treated by laser only has the least marginal adaptation between the tooth structure and composite restoration (higher marginal gap) (Cozean *et al*., 1997). This results could be due to the fact that the Er:YAG laser, un like phosphoric acid treatment does not produce homogeneous and uniform microporosities, instead it allows a disorganized destruction of enamel prisms, because the laser process of tissue removal depends on nonselective thermally induced microexplosion ablation. Furthermore, the non- continuous Er: YAG laser beam emission will produce non conditioned areas, that possibly obtaining from difficulty for getting a uniform pulse administration (Apel *et al*., 2002), resulting in irregular microstructure than can be the reason for bond failure. Another factor that affecting bonding between laser-etched surface and a sealant is blocking the intra- and interprismatic spaces by substances resulting from destruction of the enamel substrate from laser irradiation. Adhesion to lased tooth surface appears to develop mainly from the mechanical retention provided by formation of resin tag into open dentinal tubules and by the infiltration of the bonding agent into the micro-irregularities and micro-craters created during irradiation. Er:YAG laser irradiation modifying the collagen fibers of the superficial layer that become partially denatured, fused or melted and poorly attaching to the underlying dentin substrate and also resulting in loosing part of its cross-banding . According to this, the layer of collagen will probably restricting the infiltration of resin into the subsurface intertubular dentin, because it's had none of interfibrillar spaces, thus affecting on the formation of an authentic, typical hybrid layer (Ceballos *et al*., 2002). Higher degree of micro-leakage will be result during conditioning surfaces of the enamel only by Er: YAG laser. This agrees with Sancakli *et al*. (2011) who stated that the Er: YAG laser does not improve the bond strength to the tooth and produce high degree of microleakage and disagrees with other study done by Basaran *et al*. (2011) who stated that treating tooth surface with acid-etch had the same bonding strength values when treating tooth surface with Er: YAG laser only. In this study, group conditioned by

37% phosphoric acid after Er:YAG, give the highest marginal adaptation values (less marginal gap), this is due to laser irradiation, there is morphological and possibly chemical changes in inorganic and/or organic content of hard tissue this may lead to better interaction and supposed chemical linking of acidic resin monomers with dental substrate residues/by products and as a result of the microexplosion that caused by thermo-mechanical ablation after Er-YAG laser irradiation producing typical flaky, scaly dentin structure that cause enlargement of adhesive area which enhance the bonding (Hossain *et al.*,2003). Adhesion in this group could be explain by the mechanical retention resulted from the adhesive resin infiltration into micro-pores and resin tags formalizing in lased and mineralized dentin. This result agrees with previous study done by Lupi-Pegurier *et al*. (2003) who stated that treatment the tooth surface by ER: YAG laser only does not exclude the need for adjunctive etching by acid. The result of group that conditioning with self-etching adhesive system after laser irradiation has lower marginal adaptation than the total etch following the Er: YAG-laser group. The limited effectiveness of self-etching on laser irradiated tooth surface might be resulted from the limiting capability of the acidic monomer for changing the morphological pattern resulting from effect of laser irradiation and demineralizing the laser-modified superficial layer. Breakdown of dentin organic substances and changing in structure and size of apatite crystals resulting from laser irradiation tremendously increase the acid-resistance of dentin treated by laser. Also, It has been stated that Er:YAG laser radiation changing calcium\phosphorus ratio, decreasing carbon\ phosphorus ratio and resulting in the formation of more stable and less acid-soluble compounds, thus decreasing dentin ability to acid attack (Hossain, 2000). Therefore, it seems reasonable to speculate that etching with a strong acid, such as 37% phosphoric acid is predicted to present higher ability to remove layers of dentin modifying by the laser than etching with weaker acid, such as the acidic monomer (Tetric N bond self-etching). This agrees with Eguro *et al*. (2002) who stated that self-etch after laser conditioning had lower marginal adaptation value than the total etch following the laser conditioning. The group that conditioned with total etch by application of 37% phosphoric acid gave good marginal adaptation values, thus reducing microleakage (Leite *et al*., 2005). As the application of the phosphoric acid acting by removing the smear layer, demineralizing the dentin structure and resulting in exposing fibers of collagen to allow the formation of the hybrid layer. Establishment of a thick hybrid layer occurs due to micromechanical mesh work formation between the resin monomers and etched dentin (Perdigao, 2007) According to Van-Meerbeek *et al.* (2010), treating enamel surface with total-etch technique allowing bonding to enamel by two types of resin tags. Resin macro-tags penetrate the interprismatic enamel structure whereas micro-tags penetrate the inter-crystal enamel prism space. Total-etch adhesives are considered to be a sensitive technique for accurate bonding of dentin, because over drying of dentin had effect on demineralized fibers of collagen allowing these fibers to collapse and this reducing the diffusion of monomer among the collagen fibers. Also if there is an excessive humidity, incomplete polymerization of monomer and water absorption in the hybrid layer may be result (Manuja *et al.,* 2012). The use of the self-etch adhesives in this study is based on its ability to simplify the bonding procedures and reduce the technique sensitivity of the adhesive systems by eliminating the need for acid conditioning technique, rinsing and drying of etched dental substrate, as a result, the clinician does not need to be concerned about the level of dentin wetness .One-step, self-etch adhesive has low bonding strength to both enamel/dentin and has larger marginal gap than total-etch adhesives (Ulker *et al.*, 2010). This is due to the fact that One-step, self-etch adhesives are extremely hydrophilic as they had higher concentrations of both hydrophilic and ionic monomers also had big amount of water that been added to it. So there is a difficulty in evaporation of water from these one-step self-etch adhesives, so they behave as semipermeable membranes by permitting water to move through the adhesive layer and contributing to the destruction of the bonding among the resin/tooth (Nalcaci *et al.,* 2006), also Self-etching adhesives penetrate through the smear layer, not removing it completely, fixing smear plugs at the entrance of the tubules , After its application, the phosphate ions will neutralized the acid during demineralization this lead to poor micro-retention. Self-etch technique gives micro-tags where resin macro-tags are missing. It is also believed as a result of not rinsing the self-etch with water its primer permanently incorporated into dental surface. This explains the lower bonding quality of self-etching technique. This result agrees with Siegward *et al*. (2007) who stated that the using of 37% Phosphoric acid has better bonding ability than the self-etch adhesive system and disagrees with Simon *et al*. (2004) who stated that there is no statistically significant difference in microleakage when using total etch and self-etch technique and Fabio *et al*.

(2008) who found that ,there is no difference between the total etch and self-etch technique in reducing the gap when viewed under SEM.

Marginal adaptation at occlusal and gingival regions for each tested group: From the result of this study the lowest marginal adaptation were found in the gingival region of all groups as compared with the occlusal regions of all groups of this study. This is possibly related to in class V cavities mostly have gingival margins with thin enamel thickness or in dentin only while the occlusal margin in enamel, as a result the adhesion of the restorative materials would be more retention at ocluusal margin as compared to gingival margin (Coli and Brannstrom, 1993). Enamel have high mineral content which make bonding to it stable and predictable. In contrast, Dentin contains a substantial proportion of water and organic material, primarily Type I collagen. Dentin also contains a dense network of tubules that connect the pulp with the dentin-enamel junction. Near the amelodentinal junctions these tubules may branch. Heterogeneous dentin structure results in different surface chemistries and morphologies. Also, the orientation of dentin tubules can affect the formation of the hybrid layer. In areas with perpendicular tubule orientation, the hybrid layer was significantly thicker than areas with parallel tubule orientation. Therefore, the dentin surface on the gingival floor of class V preparations may be a surface on which good hybrid layer formation is difficult (Bogra *et al*., 2012). These findings come in agreement with the study of Al-Sayed *et al*. (2014), Who measured marginal microleakage of composite resin restoration bonded by desensitizing one step self – etch adhesive and reported that, the gingival margins in enamel have more microleakage than occlusal margins.

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