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Assessment of shear bond strength of composite resin to enamel surface with laser etching and acid etching: A comparative study

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Abstract
Background: The principal aim of restorative dentistry was to restore the tooth to its form and function. Laser technology has improved significantly in the past 30 years. Lasers have been employed for tooth surface modification and improving restoration bonding. Hence; the present study was undertaken for assessing and comparing shear bond strength of composite resin to enamel surface with laser etching and acid etching.
Materials & methods: A total of 60 freshly extracted permanent maxillary canines were included. All the specimens were divided broadly into two study groups as follows: Group 1: Specimens in which enamel bonding was done after acid etching, and Group 2: Specimens in which enamel bonding was done after laser etching. Bonding of composite to enamel surface was done both the study groups according to their respective methods of etching. Afterwards; composite resin was bonded to all the specimens. All the specimens were then placed in universal force testing machine for checking the shear bond strength.
Results: Mean shear bond strength among specimens of group 1 and group 2 was found to be 28.46 MPa and 15.99 MPa respectively. While analysing statistically, it was seen that mean shear bond strength specimens of the acid etching group was significantly higher in comparison to the patients of the laser etching group.
Conclusion: Mean shear bond strength of composite bonded after acid etching was significantly higher in comparison to composite bonded after laser etching. However; further studies are recommended.

Keywords: Bond strength, Enamel Surface, Etching

Introduction
The principal aim of restorative dentistry was to restore the tooth to its form and function. The longevity of the restoration is dependent upon many factors such as the capability to adapt well to a cavity when it is properly placed and good adhesion to the cavity walls. Failure of restorative materials to completely bond to enamel and dentin, causing micro leakage, is a concern in restorative dentistry. Treatment of dental tissues prior to adhesive restorative procedures is an extremely important step in the bonding protocol and determines the clinical success of restorations. Retention of dental resin materials is enhanced greatly by pre-treatment of the enamel surfaces with certain inorganic acids or chelators [1, 2].
Laser technology has improved significantly in the past 30 years. Basic investigations on the effects of laser impacts on teeth were carried out by Goldman and Stern in the 1960s. Basic studies with Nd: YAG and CO2 lasers followed in the 1970s. As a result of these investigations, unavoidable disadvantages such as damage to the dental pulp, and crack formation in enamel were discussed as limitations in cavity preparation [3, 4]. In search for more advantageous tooth surface conditioning techniques to replace acid-etching, recent investigations have focused on laser application. During laser treatment, light is converted into heat, which causes ablation and dentin etching. Lasers have been employed for tooth surface modification and improving restoration bonding [5, 6]. Hence; the present study was undertaken for assessing and comparing shear bond strength of composite resin to enamel surface with laser etching and acid etching.

Materials & methods

The present study was undertaken for assessing and comparing shear bond strength of composite resin to enamel surface with laser etching and acid etching. A total of 60 freshly extracted permanent maxillary canines were included. Carious, deformed and specimens with structural anomaly were excluded. Cracked tooth specimens were also rejected. All the specimens were stored in normal saline followed by cleaning with gauge piece. Resin blocks of uniform dimensions were made and all the specimens were embedded in them leaving behind exposed coronal portion. All the specimens were divided broadly into two study groups as follows:

Group 1: Specimens in which enamel bonding was done after acid etching, and

Group 2: Specimens in which enamel bonding was done after laser etching

Bonding of composite to enamel surface was done both the study groups according to their respective methods of etching. After completion of etching procedure, drying of the teeth specimens was done, followed by application of light cured bonding agent. Afterwards; composite resin was bonded to all the specimens. All the specimens were then placed in universal force testing machine for checking the shear bond strength. All the results were recorded in Microsoft excel sheet and were analysed by SPSS software. Student t test was used for evaluation of level of significance.

Results

In the present study, a total of 60 freshly extracted permanent maxillary canines were included and were divided broadly into two study groups as follows: Group 1: Specimens in which enamel bonding was done after acid etching, and Group 2: Specimens in which enamel bonding was done after laser etching. Mean shear bond strength among specimens of group 1 and group 2 was found to be 28.46 MPa and 15.99 MPa respectively. While analysing statistically, it was seen that mean shear bond strength specimens of the acid etching group was significantly higher in comparison to the patients of the laser etching group.

Table 1: Mean shear bond strength among specimens of both the study groups

Group	Mean shear bond strength (MPa)	SD	T-value	P-value
Group 1	28.46	1.24	49.82	0.00 (Significant)
Group 2	15.99	2.07		

Discussion

Current understanding of the adhesion of dental restorative materials is based on two fundamental theories. One theory is based on chemical adhesion, describing intermolecular forces at the interface and the other theory is based on micro-mechanical retention; attributing adhesion to the inter-penetration of components of the two surfaces. Cavity preparation with rotary instruments or manual Scalers leaves a smear layer on the dental surface. The low surface energy of this layer hinders the impregnation of the tissue with the adhesive agent and thus prevents adequate adhesion [5, 6].

Since the report of Buonocuore, the standard approach to this problem has been acid etching. The use of lasers like high power diode laser and neodymium-doped yttrium aluminium garnet (Nd:YAG) in endodontics is an innovative approach for disinfection, providing access to formerly unreachable parts of the tubular network, due to their ability to penetrate dental tissues better than Irrigant solutions [7-9]. Hence; the present study was undertaken for assessing and comparing shear bond strength of composite resin to enamel surface with laser etching and acid etching.

In the present study, a total of 60 freshly extracted permanent maxillary canines were included and were divided broadly into two study groups as follows: Group 1: Specimens in which enamel bonding was done after acid etching, and Group 2: Specimens in which enamel bonding was done after laser etching. Mean shear bond strength among specimens of group 1 and group 2 was found to be 28.46 MPa and 15.99 MPa respectively. Issar R *et al.* compared the etching pattern of Er,Cr:YSGG and conventional etching on extracted human enamel and dentin specimens. Total 40 extracted non-diseased teeth were selected, 20 anterior and 20 posterior teeth each for enamel and dentin specimens respectively. The sectioned samples were polished by 400 grit Silicon Carbide (SiC) paper to a thickness of 1.0±0.5 mm. The enamel and dentin specimens were grouped as: GrE1 & GrD1 as control specimens, GrE2 & GrD2 were acid etched and GrE3 & GrD3 were lased. Acid etching was done using Conditioner 36 (37% phosphoric acid) according to manufacturer instructions. Laser etching was done using Er,Cr:YSGG (Erbium, Chromium: Ytrium Scandium Gallium Garnet) at power settings of 3W, air 70% and water 20%. After surface treatment with assigned agents the specimens were analyzed under ESEM (Environmental Scanning Electron Microscope) at X1000 and X5000 magnification. Chi-square test for removal of smear layer in any of the treated surfaces i.e., GrE2-E3 and GrD2-D3 did not differ significantly ($p>0.05$). While GrE2 showed predominantly type I etching pattern (Chi-square = 2.78, $0.05 <p>0.10$) and GrE3 showed type III etching (Chi-square = 4.50, $p <0.05$). The tubule diameters were measured using GSA (Gesellschaft fur Softwareentwicklung und Analytic, Germany) image analyser and the 't' value of student 't' test was 18.10 which was a highly significant result ($p <.001$). GrD2 had a mean dentinal tubule diameter of 2.78µm and GrD3 of 1.09µm. Their study revealed type I etching pattern after acid etching, while type III etching pattern in enamel after laser etching. The lased dentin showed preferential removal of intertubular dentin while acid etching had more effect on the per tubular dentin [10]. In the present study, while analysing statistically, it was seen that mean shear bond strength specimens of the acid etching group was significantly higher in comparison to the patients of the laser etching group. Shahabi S *et al.* examined the influence of the bonding agent on the shear bond strength to laser and acid-etched enamel. Two current generation bonding systems were used (Scotch bond Multipurpose and Optibond). Shear bond strengths in the order of 10 MPa were consistently obtained using laser etching at "optimal" parameters, in the absence of any other preparation of the natural enamel surface. Although there was a consistent trend for shear bond strengths to be greater with Optibond than for Scotch bond MP in both human and porcine test systems, this difference was only statistically significant with acid etching of no polished human enamel, and suboptimal laser etching of polished human enamel. Prior surface polishing increased the shear bond strength obtained with maleic acid etching and Scotch bond MP by more than 2-fold, and increased bond strength when Optibond was used following optimal laser etching. These results indicated that both the type of surface preparation and the choice of bonding agent can influence bond strengths to laser-etched and acid-etched enamel [11].

Conclusion

From the above results, the authors concluded that mean shear bond strength of composite bonded after acid etching was significantly higher in comparison to composite bonded after laser etching. However; further studies are recommended.

References

1. Kidd EA. Micro leakage: A review J Dent. 1976; 4:199-206.
2. Buonocore MG. A simple method of increasing the adhesion of acrylic filling materials to enamel surfaces J Dent Res. 1995; 34:849-853.
3. Goldman L, Hornby P, Mayer R *et al.* Impact of the laser on the dental caries Nature. 1964; 203:417.
4. Stern RH, Songnnaes RF. Laser beam effects on dental hard tissues J Dent Res. 1964; 43:873±6.
5. Türkmen C, Sazak-Oveçoglu H, Günday M, Güngör G, Durkan M, Oksüz M. Shear bond strength of composite bonded with three adhesives to Er,Cr:YSGG laser-prepared enamel Quintessence Int. 2010; 41:e119–24.
6. Van as G. Erbium lasers in dentistry Dent Clin North Am. 2004; 48(1017–59):8.
7. Secilmis A, Altintas S, Usumez A, Berk G. Evaluation of mineral content of dentin prepared by erbium, chromium: yttrium scandium gallium garnet laser, Lasers Med Sci. 2008; 23:421-5.
8. Preethee T, Kandaswamy D, Arathi G, Hannah R. Bactericidal effect of the 908 nm diode laser on Enterococcus faecalis in infected root canals J Conserv Dent. 2012; 15:46-50.
9. Visuri SR, Gilbert JL, Wright DD, Wigdor HA, Walsh JT. Jr Shear strength of composite bonded to Er:YAG laser-prepared dentin J Dent Res. 1996; 75:599–605.
10. Issar R, Mazumdar D, Ranjan S *et al.* Comparative Evaluation of the Etching Pattern of Er,Cr:YSGG & Acid Etching on Extracted Human Teeth-An ESEM Analysis. J Clin Diagn Res. 2016; 10(5):ZC01–ZC5. DOI: 10.7860/JCDR/2016/19739.7705
11. Shahabi S1, Walsh LJ. Effect of bonding agents on adhesion of composite resin following CO2 laser etching of dental enamel J Clin Laser Med Surg. 1996; 14(4):169-73.