

Original Research

Assessment of shear bond strength between composite resin and enamel surface after treating with acid etching and laser etching: a comparative study

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ABSTRACT:

Background: The objective of this study was to assess the shear bond strength between composite resin and enamel surface using laser etching as well as acid etching techniques. **Materials and methods:** For the purpose of this experiment, a total of 100 freshly excised maxillary canines were utilized. Subsequently, the subjects were primarily categorized into two distinct groups: Group 1 participants underwent acid etching followed by enamel bonding, while Group 2 participants underwent laser etching followed by enamel bonding. The composite bonding procedure was performed on the enamel surface, following the approach of each group. **Results:** The average shear bond strength of Group 1 was determined to be 39.55 MPa, while Group 2 had an average shear bond strength of 24.12 MPa. Upon doing statistical analysis, it was noted that the acid etching group had a considerably higher average shear bond strength compared to the laser etching group. **Conclusion:** The average shear bond strength of the composite material was greater following acid etching in comparison to the composite material bonded after laser etching.

Keywords: Composite resin, acid etching, laser etching

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INTRODUCTION

Since 1954 that Bonocore introduced acid etching procedure as a pretreatment method that enhances the strength bonding of composite resins to enamel for the first time¹, and then it's clinical application presented in 1976 by Cueto and Bonocore², many trials have been done to improve the quality of composites and adhesives and several pretreatment methods were discovered and presented.

In fact, adhesive generations from first to seventh, are the results of these studies that became more modified and their application became easier step by step, so that along with sixth generation of adhesives, the term self-etch came into the world of restorative dentistry.³ Self-etching is based on the use of acidic resin monomers that allow simultaneous demineralization and infiltration of the partially demineralized substrate by resin monomers.⁴

Composite resin restorations are commonly used to restore dental structures, but they typically illustrate

lower bond strength when used on dentin compared with enamel.⁵ Progressing to increase the strength of this bond, several adhesive systems have been introduced.⁶ Per the technique used and also the mechanism of adhesion, adhesive systems are broadly categorized into two main categories: total-etch and self-etch adhesive systems.⁷

Hence; the present study was conducted for assessing and comparing the shear bond strength of composite resin to enamel surface with laser etching and acid etching.

Materials and methods

For the purpose of this experiment, a total of 100 freshly excised maxillary canines were utilized. Subsequently, the subjects were primarily categorized into two cohorts: Group 1 subjects experienced acid etching followed by enamel bonding, while Group 2 subjects underwent laser etching followed by enamel

bonding. The composite bonding to the enamel surface was performed according to the approach of each group. Following the etching technique, the teeth were dried and subsequently treated with a light-curable bonding agent. A universal force testing machine was employed to assess and compare the shear bond strengths of all specimens. The results were stored in Microsoft Excel spreadsheets, and they were analyzed using SPSS software.

Results

The average shear bond strength of Group 1 was determined to be 39.55 MPa, while Group 2 had an average shear bond strength of 24.12 MPa. Upon doing statistical analysis, it was noted that the acid etching group had a considerably higher average shear bond strength compared to the laser etching group.

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

Group	Mean shear bond strength (MPa)	p- value
Group 1	39.55	0.001 (Significant)
Group 2	24.12	

Discussion

Laminate technique or sandwich restoration is one of the methods used in dental composite restoration⁸, in which two different materials namely glass-ionomer cement (GIC) and composite resin are used. In this technique, the GIC or resin-modified glass-ionomer cement (RMGIC) is placed between the dentin gingival margins and occlusal composite restoration.⁹ The proper bond between GIC and resin composite is necessary for successful restoration. This method is mainly applied to benefit from both the physical and aesthetic properties of these materials. GIC presents two interesting features in restorations by bonding spontaneously to the dentin and releasing fluoride. Some disadvantages of these materials include poor physical-mechanical properties and esthetics which can be compensated by the overlying composite resin.^{10,11} Hence; the present study was conducted for assessing and comparing the shear bond strength of composite resin to enamel surface with laser etching and acid etching.

Group 1 was found to have mean shear bond strength of 39.55 MPa whereas group 2 was found to have mean shear bond strength of 24.12 MPa. The aim of the study conducted by Shirani F et al¹² was to investigate the effect of Er:YAG laser irradiation distance from enamel and dentin surfaces on the shear bond strength of composite with self-etch and etch and rinse bonding systems compared with conventional preparation method. Two hundred caries-free human third molars were randomly divided into twenty groups (n = 10). Ten groups were designated for enamel surface (E1-E10) and ten for dentin surface (D1-D10). Er: YAG laser (2940 nm) was used on the E1-E8 (240 mJ, 25

Hz) and D1-D8 (140 mJ, 30 Hz) groups at four different distances of 0.5 (standard), 2, 4 and 11 mm. Control groups (E9, E10, D9 and D10) were ground with medium grit diamond bur. The enamel and dentin specimens were divided into two subgroups that were bonded with either Single Bond or Clearfil SE Bond. Resin composite (Z100) was dispensed on prepared dentin and enamel. The shear bond strengths were tested using a universal testing machine. Data were analyzed by SPSS12 statistical software using three way analysis of variance, Tukey and independent t-test. P < 0.05 was considered as significant. There was a significant difference between enamel and dentin substrates (P < 0.001) and between laser and un-laser groups; the un-laser group had significantly higher bond strength (P < 0.001). Shear bond strength increased significantly with an increase in the laser irradiation distance (P < 0.05) on enamel surfaces (in both bonding agent subgroups) and on dentin surfaces (in the Single Bond subgroup).

Conclusion

The mean shear bond strength of composite was higher after acid etching as compared to composite bonded after laser etching.

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