Friday 9:00 a.m. – 9:30 a.m., Rooms 109-110

Dr. Eugene Seidner Student Scholarship Presentation Acid Etching, Mechanical Debridement, and Different Bonding Generations for Enamel Prepared by Er,Cr:YSGG Laser

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Erbium lasers have shown the potential to remove dental hard tissues without, or at least fewer, associated negative stimuli than conventional methods that can cause patient discomfort, vibration, and pain. But an important issue in restoring cavities is the bond strength of composite resins to tooth structure prepared by laser. Bond strength has been reported weaker due to unfavorable microstructural changes, microfissure propagation, fused or recrystallized material formations after laser irradiation, which may affect the performance of the adhesive systems.
Based on our previous studies, we have found that mechanical and/or chemical alteration of the superficial laser-irradiated enamel surface can enhance the bonding of different bonding agents to enamel. In this, a continuation of a series of studies, we have tested 4 different bonding systems from different generations to evaluate the effect of chemical/mechanical alteration: (1) Scotchbond Multi-Purpose (3M ESPE) was used as the clinical golden standard and a representative of 4th generation of Bondings (3 bottle, Acid + Primer + Bonding); (2) OptiBond FL (Kerr) as representative of 5th generation (2 bottle, Acid etch + Primer and bonding); (3) OptiBond Solo Plus (Kerr) as representative of 6th generation (2 bottle, Acid Etch and Primer + Bonding); and (4) OptiBond All-In-One (Kerr) was used to represent 7th generation (1 bottle, Acid Etch + Primer + Bonding).The purpose of this study was to evaluate the effects of extra acid etching (as chemical alteration) and/or debridement and excavation (as mechanical alteration) of enamel surface irradiated by an Er,Cr:YSGG laser in different bonding systems/generations and to compare it with conventional bur preparation.

Method

192 enamel samples were prepared, molded, ground, and polished. Samples were divided into 4 groups (n = 12): Bur (control), Laser only, Laser + Mechanical Excavation (Exc), and Laser + Mechanical Excavation + Acid Etching.

An Er,Cr:YSGG laser (Waterlase MD, Biolase) (λ = 2780 nm, 4.5 W, 80% water, 60% air) was used for 10 seconds on the enamel surface. Four bonding agents were used: Scotchbond Multi-Purpose (SBMP), OptiBond FL (OFL), OptiBond Solo Plus (OSP), and OptiBond All-In-One (OAO). The bonding procedures were performed in strict adherence to the manufacturers' directions. Standard procedures for a shear bond strength (SBS) test were followed by using an Ultradent mold. Samples were then subjected to shear force (Instron®) after 24 hours storage in an incubator (37°C, 100% humidity).

Results

Means ± SD (MPa) are presented in the following table:

Material	Bonding Generation	Laser	Laser + Exc	Laser + Exc + Acid Etch	Bur
SBMP	4	24.25 ± 6.14	24.27 ± 6.70	20.64 ± 4.23	28.91 ± 4.75
OFL	5	25.53 ± 4.71	30.24 ± 7.44	32.00 ± 7.01	31.53 ± 10.25
OSP	6	27.37 ± 5.22	28.71 ± 7.52	27.32 ± 7.98	23.29 ± 5.74
OAO	7	18.23 ± 4.27	15.12 ± 5.17	19.04 ± 5.30	12.96 ± 4.77

Statistical analysis by ANOVA and Tukey test showed higher SBS for Bur than Laser-Exc-Etch in group SBMP (P = 0.0084). In contrast, group OAO, Laser + Exc + Etch showed higher SBS than the Control (P = 0.021). There was no significant difference found between other groups and techniques.

Conclusions

Within the limits of this *in vitro* study, it may be concluded that, when using bonding agents such as Scotch Bond Multi-Purpose, OptiBond FL, and OptiBond Solo Plus for bonding to Er,Cr:YSGG laser-prepared enamel, standard procedures would be enough (no more intervention required), but when using OptiBond All-In-One, extra interventions (mechanical debridement and acid etching) are required before application of bonding to achieve an optimum result.

Educational Objectives

1. Compare bonding strengths of different bonding generations to laser-prepared enamel.
2. Indicate effects of mechanical and/or chemical alteration on bonding to enamel irradiated by an erbium laser.
3. Discover the compatibility of techniques and materials used in this study.
4. Compare the bond strength of each bonding agent to laser-prepared enamel with its bur-prepared counterpart.