ALD 2009: Lasers in Dentistry
Academy of Laser Dentistry 16th Annual Conference & Exhibition
Green Valley Ranch, Henderson, Nevada
Saturday, April 25, 2009, 9:55 am, Student Scholarship Recipient

Glass Ionomer Bond Strength to Teeth Prepared with an Er:YAG Laser

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Introduction and Purpose
Resin-modified glass ionomers (RMGI) are excellent materials for children and adolescents because of their capability of fluoride recharge and release, however no reports on the bond strength of RMGI to laser-treated teeth have been published. The purpose of this study was to evaluate the shear bond strength of a RMGI to laser-treated enamel and dentin and compare it to bur instrumentation, and determine which conditioner, either a rinse conditioner or a self-etch conditioner, offers better adhesion

Objective 1
Provide original knowledge on the interfacial bond strength of glass ionomer to laser-treated tooth structure.

Objective 2
Answer the following clinical question: How does the bond strength of a glass ionomer to the laser-treated tooth compare to bur-treated surfaces, and which conditioner – a conventional etch-and-rinse conditioner or a nonrinse, self-etch conditioner – is more effective.

Materials and Methods
Forty extracted molars were used. Enamel (E) and dentin (D) specimens were ground with wet 600-grit SiC paper and treated either with a carbide fissure bur (B) or an Er:YAG laser (HOYA ConBio, Fremont, Calif.) (L) at 2940 nm with specific energy settings on enamel (260 mJ, 25 Hz) and dentin (160 mJ, 10 Hz) and one of two different surface conditioners, 20% polyacrylic acid (Cavity Conditioner, GC America, Inc., Alsip, Ill.) (CC) or a no-rinse self-etch conditioner (Self-Conditioner, GC America) (SEC). The bur specimens were prepared with a fissure bur #1157. Specimens were subjected to shear bond test and debonded in tension at a speed of 0.5 mm/min. Means of bond strength were compared using three-way ANOVA, and Fisher's Protected Least Significant Difference (PLSD) ($P < 0.05$) was used to determine differences among surface treatments, tooth substrate, and conditioners.

Results
The Fisher's PLSD interval ($P < 0.005$) for comparison among surface treatments, conditioners, and tooth substrates was 3.45 MPa. The coefficient of variation was 35.9%. Three-way ANOVA showed that conditioner and surface preparation were significant ($P < 0.05$), and dental substrate was not ($P < 0.14$). Interactions among main effects were not statistically significant ($P > 0.05$). Post hoc analysis indicated a significant difference between conditioners and surface preparation treatments. The highest bond strength (21.74 MPa) was laser-treated enamel and the polyacrylic conditioner. The lowest bond strength was found when enamel was prepared with the carbide bur and treated with the self-etching conditioner (6.49 MPa).

Relative Shear Bond Strengths of Tested Parameters as Measured in MPa

	LE	LD	BE	BD
CC	21.74 (11.66)*[e]	16.98 (9.76)[b]	16.36 (7.77)[b]	17.56 (9.0)[b]
SEC	15.80 (6.08)[a]	20.27 (7.33)[f]	6.49 (2.6)[g]	15.74 (3.17)[a]

* Same superscript letters are statistically the same ($P < 0.05$).

Conclusion
The results of this study showed that bond strength of the RMGI increased with the laser preparation compared to bur instrumentation on both enamel and dentin. The Er:YAG laser seems to be a viable alternative to the dental handpiece. Er:YAG laser irradiation did not adversely affect the shear bond

strength of Fuji II LC (GC America, Inc.) to enamel or dentin. The Er:YAG laser increased the shear bond strength values compared to high-speed rotary bur. Further studies of Er:YAG laser irradiation and bond strengths of restorative materials should focus on using other possible energy densities and pulse frequencies.

What you will take away from this presentation: The Er:YAG laser offers a minimally invasive approach for cavity preparation and is well perceived by patients, especially children who would not require anesthesia in the majority of cases as compared to the use of high-speed handpiece. Glass ionomers are suitable materials for their fluoride-releasing and -recharging property, particularly useful in children and adolescents for a caries-inhibiting effect. This research study shows what is the optimum treatment to achieve clinically acceptable bond strength when bonding a resin-reinforced glass ionomer restorative to the laser-treated enamel and dentin using the Er:YAG laser.

Biographies: *Mr. Stephen Tapp is a third-year undergraduate student at the University of Texas Dental Branch at Houston. He has a bachelor's degree from the University of Chicago in chemistry. In addition, he is a registered nurse in the State of Texas. His current interests in dentistry are lasers and esthetic dentistry.*

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Disclosures: *Neither Mr. Tapp nor Mrs. Hamid have any commercial affiliations relative to this presentation.*

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