Academy of Laser Dentistry
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STUDENT SCHOLARSHIP

Optimal Er,Cr:YSGG Laser Energy for Adhesion of Glass Ionomer Cement

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Aim of the Study - Besides laser characteristic (wavelength specificity), various parameters used to control laser energy may affect the nature of the tooth surface, in particular wettability and adaptability to restorative dental materials. The purpose of this study was to assess the optimal laser energy of an Er,Cr:YSGG laser required to achieve the maximum bond strength of glass ionomer cement to dentin.

Materials and Methods - Eighty extracted human molar teeth with an exposed flat occlusal dentin surface were prepared by different laser power settings (3, 3.5, 4, 4.5 W) of an Er,Cr:YSGG laser (Waterlase®, Biolase Technology, Inc., Irvine, Calif., USA). The power settings were varying with a fixed repetition rate of 20 Hz and pulse duration of 140 μs. The working distance and irradiation time were 1 mm and 60 sec respectively. The teeth in each of these four different power setting groups were further subdivided into two equal groups for restoration with one of two glass ionomer cements: GC Fuji IX (GC America Inc., Alsip, Ill.) or Ketac™-Molar (3M ESPE, St. Paul, Minn.). Half of the specimens restored with each material were treated with the relevant dentin conditioner (Dentin Conditioner, GC, America, Inc.; Ketac™-Conditioner, 3M ESPE) prior to bonding perpendicular to the dentin surface using gelatin capsules filled with the materials. Shear bond strength was tested after 24 h storage in distilled water by Instron 5567 (Instron Corp., UK) at cross-head speed of 1 mm/min. Subsequently, mode of failure was observed and the fracture surfaces were examined by using scanning electron microscopy (SEM) (Stereoscan 240, Cambridge, UK).

Results - Shear bond strength (MPa) (standard deviations in parentheses (n = 15); mean values with the same superscript were not significantly different (p > .05).

Power settings	Shear bond strength (MPa)			
	Ketac Molar		Fuji IX	
	No Conditioner	Conditioner	No Conditioner	Conditioner
3 W	4.67 (2.29)	6.00 (2.64)	2.88 (1.63)	5.31 (2.56)
3.5 W	5.50 (2.40)	6.59 (3.00)	3.03 (1.95)	4.63 (2.90)
4 W	5.97 (2.78)	5.79 (3.19)	3.78 (1.70)	5.21 (2.47)
4.5 W	5.76 (2.66)	6.05 (4.26)	3.15 (2.56)	5.97 (2.72)

Three-ways ANOVA analysis showed that the power setting did not affect shear bond strength of glass ionomer cement (p > 0.05). Most specimens showed adhesive failure and SEM showed fragments of cement plugged into dentinal tubules and the cement's glass particles attached on the fracture surfaces from the 4 W and 4.5 W groups.

Conclusion - Conditioning dentin with acid caused a significant increase in bond strength, most noticeably for Fuji IX. This seems to be a more important factor than the laser power setting used.

Biography: *Dr. Piyanart Ekworapoj is a PhD student in the School of Dental Science at Newcastle University in the United Kingdom. She obtained her DDS degree from Mahidol University, Bangkok, Thailand, in 1997 and completed her Master's degree in 2002 from Chulalongkorn University, Bangkok, Thailand.*

Disclosure: *Dr. Ekworapoj has no commercial relationships relative to this presentation.*

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