Micro-shear bond strength of resin cements to Er,Cr:YSGG laser and acid etched enamel

Nuran ULUSOY*, Laden GÜLEÇ, Fjolla KOSHİ, İzgen HACIOĞULLARI, Esra CENGİZ

Near East University Faculty of Dentistry, Department of Restorative Dentistry

INTRODUCTION

Restorative dentistry has been going through numerous changes as an outcome of clinical applications and development of new materials.[1] Advances in adhesion technology have led dentists to incorporate new adhesives and bonding techniques into their clinical practice.

Resin cements are suitable for the cementation of indirect restorations made of metal, composite and silanated porcelain restorations.The strength of the bond between the resin cement and the enamel surface depends on 2 factors; the surface treatment of the tooth surface and the adhesive material. Enamel etching is the standard protocol to remove the smear layer for successful bonding among the bonding techniques. Among the various techniques currently in use to promote dental surface conditioning[2], it has been suggested that lasers might also be used as an alternative method to selectively remove oral mineralized tissues for restorative purposes to produce an etched surface.[3] Also re-etching with acid phosphoric after Er,Cr:YSGG laser irradiation is recently being used before bonding brackets and fissure sealants.[4,5]

Purpose: The aim of this study was to evaluate the *in vitro* micro-shear bond strength (μSBS) of 2 different resin cements used for the cementation of indirect restorations to human enamel etched with 37% phosphoric acid, Er,Cr: YSGG laser irradiation, or Er,Cr:YSGG laser irradiation followed by acid etching.

MATERIALS AND METHODS

24 caries-free molars were sectioned vertically and the flat buccal surfaces were used . 12 enamel discs for each of the resin cements [Panavia F2.0; Kuraray Noritake Dental Inc. and Variolink N; Ivoclar Vivadent] were randomly divided to 3 subgroups according to the surface pretreatment methods:

1- 37% phosphoric acid application for 20 seconds;
2- Er,Cr:YSGG laser (Waterlase MD, Biolase) irradiation at an energy level of 2 W, a repetition rate of 20 Hz with 55% water and 65% air irradiation for 10 seconds;
3- Er,Cr:YSGG laser irradiation for 10 seconds followed by 20 seconds of 37% phosphoric acid etching.

Three cylinders of resin cements were bonded to each enamel surface and micro-shear bond strength (μSBS) was determined in a universal testing device at a crosshead speed of 1 mm/min. One way analysis of variance (ANOVA) and Tukey post-hoc HSD tests were used to analyze the differences between the groups at a significance level of $p<0.05$

Er,Cr:YSGG laser
(Waterlase MD, Biolase)

Table 1: Mean (MPa) , Standart Deviation (SD) ,Standart Error (SE), Minimum, and Maximum values of resin cements subjected to different surface treatment procedures

Groups	n	Mean	SD	SE	Min	Max
Variolink N laser	12	16,2	4,87	1,41	11,1	26,1
Variolink N acid	12	18,3	6,04	1,74	11,1	29,8
Variolink N laser+acid	12	25,73	5,45	1,57	17,40	37,6
Panavia F 2.0 laser	12	22,35	5,10	1,47	14,3	31,9
Panavia F 2.0 acid	12	27,08	5,42	1,56	20,8	38
Panavia F 2.0 laser+acid	12	35,17	9,31	2,69	21,2	46,5

Table 2: Tukey HSD test results for (μSBS) values of the resin cements subjected to different surface treatment procedures.

Groups	VL	VA	VL+A	PL	PA	PL+A
Variolink N laser	-	NS	*	NS	*	*
Variolink N acid	NS	-	NS	NS	*	*
Variolink N acid	*	NS	-	NS	NS	*
Panavia F 2.0 laser	NS	NS	NS	-	NS	*
Panavia F 2.0 acid	*	*	NS	NS	-	*
Panavia F 2.0 laser+acid	*	*	*	*	*	-

* indicate significant difference ($p < 0.05$)

RESULTS

Er:YAG laser preparation of enamel yielded lower bond strengths compared with traditional acid etch preparation. For the two tested resin cements; the combination of Er,Cr:YSGG laser and phosphoric acid etching produced better μSBS values to enamel than the use of phosphoric acid or Er,Cr:YSGG laser alone. Panavia F2.0 micro shear bond strength to Er,Cr:YSGG laser irradiated and 37% phosphoric acid etched enamel showed significantly higher μSBS values than Variolink N for all the tested surface pretreatment methods ($p<0.05$).

CONCLUSIONS

The results of the present investigation apparently showed that Er,Cr:YSGG laser etching alone can not replace acid etching with similar effect on enamel for the cementation of indirect restorations with resin cements .

On the other hand; the combination of Er,Cr:YSGG laser followed by phosphoric acid etching of enamel holds the potential to become a highly attractive method for routine use because this method produced considerably high μSBS values to enamel than the use of phosphoric acid or Er,Cr:YSGG laser alone.

REFERENCES

1. Sumer E, Deger Y. Contemporary Permanent Luting Agents Used in Dentistry: A Literature Review. Int Dent Res 2011;1:26-31
2. Van Meerbeek B, Van Landuyt K. et al.Technique sensitivity of contemporary adhesives. Dent Mater J 2005;24:1-13.
3. Kim ME, Deuk-Jin J, Kim KS. Effects of water flow on dental hard tissue ablation using Er:YAG laser. J Clin Laser Med Surg 2003;139-144.
4. SASAKI, Luis H. et al. Tensile bond strength and SEM analysis of enamel etched with Er:YAG laser and phosphoric acid: a comparative study In vitro. Braz. Dent. J. 2008; 9(1): 57-61.
4. Turkoz C and Ulusoy C. Evaluation of different enamel conditioning techniques for orthodontic bonding. Korean J Orthod. 2012 Feb; 42(1): 32–38.
5. Ansari ZJ, Fekrazad R et al.The effect of an Er,Cr:YSGG laser on the micro-shear bond strength of composite to the enamel and dentin of human permanent teeth. Lasers Med Sci DOI 10.1007/s10103-011-0961-7