



Study of a self-adhesive composite, in dentin surfaces prepared with Er,Cr:YSGG laser.

Introduction

The self-adhesive flowable resin composites combine a bonding system and a flowable composite. The dentin is a mineralized substrate of the tooth which has an intricate three-dimensional frame, with tubules extending from the pulp to the dentino-enamel junction, intratubular and peritubular dentin. Erbium lasers cavity preparation results in the absence of smear layer, opened dentinal tubules, and micro irregularities on the dentin in result of the removal of the intertubular dentin, outcoming in a dentin surface more suitable to the adhesive procedures. The Er,Cr:YSGG laser has a wavelength of 2,79 μm . The ablation threshold in human dentin is 2,69 – 3,66 J/cm².

Materials and Methods

The sample consists of 15 non carious molars extracted by periodontal or orthodontic reasons. To obtain the samples for the electron microscopy, were removed from two teeth from each group, the coronal occlusal third and the roots, resulting in discs with 2mm high, that were later on transformed in hemidisks. To obtain the samples to the Tensile Bond Strength (TBS) Test, three teeth from each group, were longitudinally sectioned into two parts where the proximal enamel was removed by a disk to expose the dentin. The self-adhesive flowable resin composite used in this study was the Vertise™ Flow (VF) from Kerr and was used following the manufactures instructions.

Groups

The laser samples were submitted to an Er,Cr:YSGG laser (Waterlase iPlus – Biolase Technology Inc., Irvine, California). The dentin samples from the control group, weren't submitted to any laser treatment:

Group 1: Control Group (n = 10)

Material: Vertise™ Flow (Kerr, Orange, CA, USA) – (without laser surface treatment)

Group 2: Settings 4,5W, 50 Hz, 50 μs , 70% air, 90% water (n = 10)

Material: Vertise™ Flow (Kerr, Orange, CA, USA)

Group 3: Settings 4,5W, 75 Hz, 50 μs , 70% air, 90% water (n = 10)

Material: Vertise™ Flow (Kerr, Orange, CA, USA)

The Vertise™ Flow self-adhesive flowable composite was applied in the dentin surface from each sample, about 3 mm, and lighted cured for 20 seconds with a LED curing light Bluephase® C8 (Ivoclar Vivadent) 800 mW/cm².

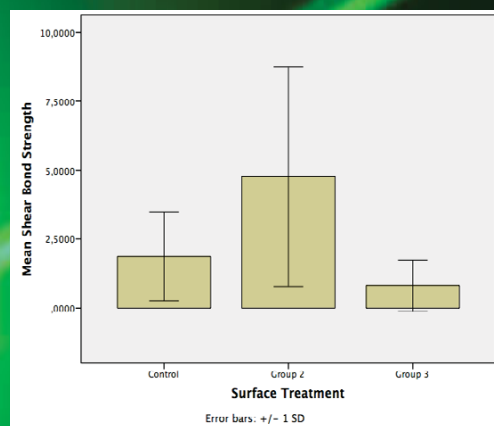
Objective

The main objective of this study was to evaluate the bond strength of self-adhesive flowable composite Vertise™ Flow, in dentin surfaces prepared with Er,Cr:YSGG laser with two different settings.

Results

Shear Bond Strength Test (SBS Test)

The Group 2 was the one with the highest Shear Bond Strength mean (4,76 \pm 3,99 MPa), although the standard deviation is the highest, and the Group 3 had the lowest Shear Bond Strength mean (0,81 \pm 0,93 MPa), as we can see in the graph below. (Graph 1)



Graph 1 – Mean and Standard Deviation of the Shear Bond Strength (MPa) in the three groups.

Scanning Electron Microscopy

Control Group

It was possible to observe a regular surface with resin tags in the surface of the dentin going through the open dentinal tubules. (Fig.1a)) The resin tags appeared to be sectioned, showing an adhesive failure. (→) (Fig 1b))

Group 2

It was able to see a rougher dentin surface, with several resin tags. (→) (Fig 1 c)) Also an hybrid layer formation and the presence of resin tags with lateral branches. (→) A gap along the interface between the VF and the dentin surface was seen in two of the samples (⇨) (Fig.1 d))

Group 3

It was possible to observe what it seems to be melted dentin, with a few open dentinal tubules, and a gap along the interface. (⇨) (Fig. 1 f) and e))

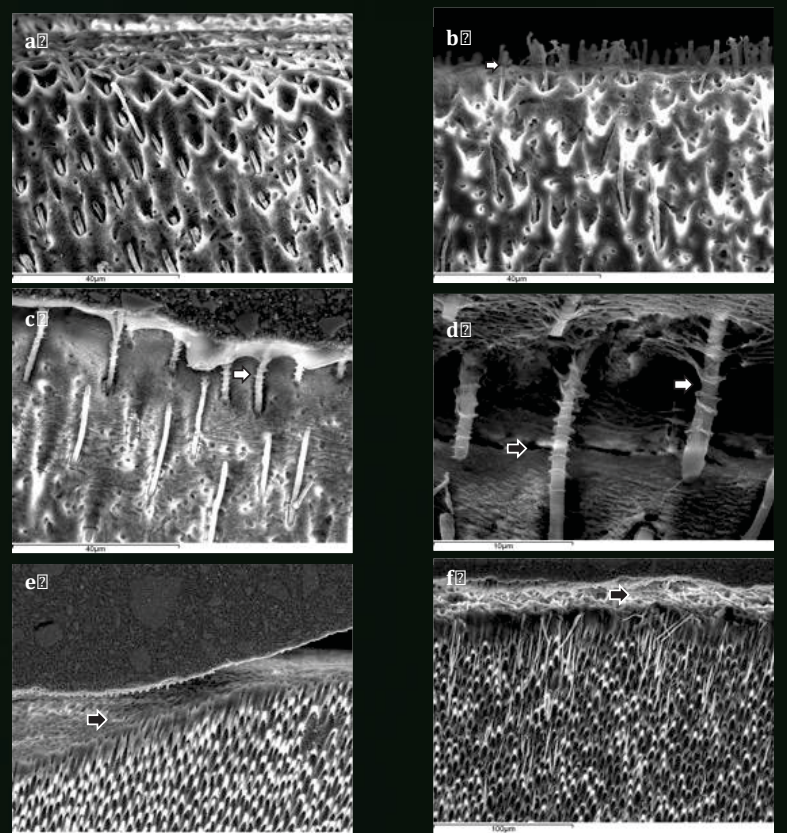


Fig.1 - (a) Control Group (x1500) (b) Control Group (x1500). (c) Group 2. (x1500). (d) Group 2 (x5000). (e) Group 3 (x500). (f) Group 3 (x500).

Discussion

The results showed that even if you get a smoother surface with the increasing of the laser frequency, as we can see in the SEM micrographs, the SBS is lower, comparing with the Group 2 and Control Group. These results are according to the study performed by Samad-Zadeh *et al.* where they concluded that the SBS was higher in the laser-textured dentin substrate with greater spacing patterns.

The high standard deviation present in Group 2 shows that probably there was more variability in the sample than the expected influencing the results.

All the dental products in the market were produced to work in the dental surfaces prepared with the conventional methods, like the bur. This study tested materials available in the market, and the results should be used to develop new products, with the laser dental surface in mind.

Conclusions

Although the bond strength of the Vertise™ Flow was influenced by the type of dentin surface and the laser parameters, the results of each group were not statistically different between each other ($p > 0,05$), showing no significative difference concerning the dentin surface treatment.

The increase of only the laser frequency, resulted in lower SBS.