SUMMARY
The purpose of the present study was to compare the shear bond strength to human dentin of 2 root canal sealers: Sultan U/P (zinc-oxide eugenol) and 2seal (epoxy resin). The dentin specimens were divided randomly into 2 groups (A, B) of 12 specimens each, and etched with 3 ml of EDTA 17% before rinsing with NaOCl 2.5% and distilled water. The 2 sealers were mixed according to the manufacturer instructions and placed on dentin surfaces. Bond strength was tested using a universal test machine at a cross-head speed of 0.5 mm/min.

Data were analyzed with Student t-test. The results indicated that 2seal presented statistically significant higher values of bond strength than Sultan U/P.

Keywords: Shear Bond Strength; Root Canal Sealers

Introduction
The main goal of endodontic treatment is the 3-dimensional obturation of the root canal system with biocompatible materials, such as gutta-percha in combination with a sealer. One of the basic properties of a root canal sealer is to have good sealing ability and to adhere firmly to dentinal walls. The inadequate bond strength of a sealer can lead to an increased possibility of subsequent microleakage and failure of endodontic treatment.

Zinc oxide-eugenol (ZOE) sealers have been used widely in clinical praxis and they are based on Grossman’s formula. However, problems regarding their setting time, microleakage and adhesion to dentin have been reported. Epoxy resin-based root canal sealers are characterized by the reactive epoxy ring and are polymerized by the breaking of this ring. These sealers have good adhesion to dentin and this property is improved by the removal of smear layer. 2-seal is a relatively new epoxy resin-based sealer, and in the literature there is no information about the adhesion of this material to dentin.

The purpose of the present study was to compare the shear bond strength of Sultan U/P (zinc oxide-eugenol sealer, Sultan Chemists, USA) and 2seal (epoxy resin-based sealer) to human root dentin.

Materials and Methods
The dentin substrate was obtained from 12 single-rooted human teeth. The teeth were stored in the distilled water at -20°C. Before use, they were debrided with ultrasonic scalers and washed several times in water. A low-speed diamond disk saw (Isomet, Buehler, USA) was used to cut off the apical and cervical parts of the roots. The remaining sections were split longitudinally in a bucco-lingual direction using the diamond disk. The portions of the root surface where the canal had been located were ground flat against #600 grit SiC paper. Teflon tape with a circular hole 3 mm in diameter was then centred on the dentin surface to standardize the exposed area. The dentin samples were mounted on a single plane shear test assembly, as described by Watanabe et al.

The dentin specimens were divided randomly into 2 groups (A, B) of 12 specimens each and etched with 3 ml of EDTA 17% (Pulpdent) before rinsing with NaOCl 2.5% and distilled water. Finally, the dentin surfaces were dried with paper points.

The 2 sealers (2seal - group A; Sultan - group B) were mixed according to the manufacturer instructions and placed on dentin surfaces. The entire assemblies (plates, dentin specimens, and bonded materials) were transferred to an incubator (37°C, 100% relative humidity) for 1 month.
Bond strength was tested using a test machine (Accuforce III; Ametec) by subjecting samples to a shear load at a cross-head speed of 0.5 mm/min. The force required to break the bond between the cements and dentin was recorded in kg using a personal computer connected to the testing machine. Shear bond strength was calculated in mega-Pascals (MPa) using the formula BSMPa=MVKg/BA * 9.80665 (where BSMPa= bond strength in MPa, MVKg = measured value in kg, BA= bonding area = πr² = 3.14 * 1.52 = 7.065 mm² and 9.80665 is the equivalent in MPa of kg/mm²).

Data were analyzed with Student t-test. The selected level of significance was 0.01.

Results

The results are presented in figure 1. The mean shear bond strength in group A (2seal) was 5.43 MPa ± 1.53 and in group B (Sultan) was 1.97 MPa ± 0.75.

Statistical analysis showed that there a was a statistically significant difference between the 2 groups (p<0.01).

Discussion

Many different methods have been used for measuring the adhesion of endodontic sealers. These methods include tensile strength test, shear testing and push-out test. However, none of them seems to be generally accepted.

The shear test is a common method for the bond strength evaluation. The main problem with this test is the difficulty in the placement of the shear-loading device in close alignment with the bond interface. The load is offset at some distance from the bonded interface, resulting in unpredictable torque loading of the specimen. The single plane shear test assembly, as used in the present study, fixes the shear loading device in-line with the bond interface zone and applies the stress through this zone in a specific plane, thereby minimizing the offsetting problem.

In this study the dentin substrate was pre-treated with NaOCl and EDTA. This combination removes the smear layer from the dentin surface and permits the penetration of sealers into the dentinal tubules, allowing the creation of mechanical interlocking which may increase the bond strength values.

The best results in the present study were observed in the 2seal group. There was a statistically significant difference in bond strength between 2seal and Sultan.

The epoxy resin-based sealers in many studies have shown that they have both good sealing ability and high bond strength to dentin. Lee et al compared the adhesion of 4 root canal sealers both to dentin and gutta-percha. The sealers evaluated were a ZOE root canal sealer (Kerr), an epoxy resin-based root canal sealer (AH-26), a calcium hydroxide sealer (Sealapex) and a glass-ionomer sealer (Ketac-Endo). AH-26 sealer gave better results than the other materials, with statistically significant differences. In another study, the Topseal, an epoxy resin sealer, showed higher adhesion than Endion and CRCS, although the best results were obtained with Fibrefill (a methacrylate resin-based sealer).

The results obtained with epoxy resin-based sealers may be associated with their ability to react with any exposed amino groups in collagen to form covalent bonds between the resin and collagen when the epoxide ring opens, although other mechanisms may also contribute to the observed bond strength.

The results of the present study showed that, the adhesion between Sultan and dentin was very weak. This finding is in agreement with the results of Gettleman et al who found that AH-26 bonded to dentin better than Sultan. One potential problem with the ZOE sealers is their long setting time, which may contribute to their low adhesion to dentin.

It should be stated that the adhesive properties of sealers can not be correlated directly with microleakage; however, the weak bonding of ZOE sealers to dentin may explain their lower sealing ability than epoxy resin sealers.

References


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