Influence of chemical irrigants on the tensile bond strength of an adhesive system used to cement glass fiber posts to root dentin

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Objective. The aim of this study was to evaluate the influence of endodontic irrigants on the tensile bond strength of an adhesive system used to cement glass fiber posts to dentin.

Study design. Fifty bovine roots were divided into 5 groups according to the solution used during instrumentation: G1, 0.9% NaCl (control); G2, 1.0% NaOCl; G3, 2.5% NaOCl; G4, 5.25% NaOCl; G5, 2% chlorhexidine gel + 0.9% NaCl. The root canals were obturated with gutta-percha and AH Plus sealer, and the glass fiber posts were cemented with Clearfil SE Bond/RelyX ARC. The specimens were submitted to tensile strength testing and the results were analyzed by analysis of variance.

Results. There were no statistically significant differences regarding the irrigant solution factor (P > .70).

Conclusion. It was concluded that the different irrigant solutions did not affect the tensile bond strength of the fixation system used to cement the intraradicular glass fiber posts to dentin. (Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2010;110:e73-e76)

Generally, root-filled teeth present with a greater loss of tooth structure, resulting from caries, earlier restorations, fractures, and endodontic access preparation. The use of posts in endodontically treated teeth with insufficient coronal tooth structure is a universal accepted procedure.1

Initial post systems are retentive to root canals mechanically; therefore, there is much loss of tooth structure.2 With the evolution of adhesive systems, resin cements, and restorative materials, endodontically treated teeth began to be reconstructed conservatively, and many intraradicular post systems have become available for this purpose.3,7 Nevertheless, obtaining an effective adhesion to root canals is a challenge, considering their unfavorable geometry and the limitations inherent to the physical-chemical properties of adhesive materials.8 Many of the limitations are related to polymerization shrinkage, that often exceeds the bond strength of dentin adhesives to dentin, resulting in gap formation along the surfaces with the weakest bonds.9,10

Endodontic procedures performed before the luting of posts also may interfere in adhesiveness to the root canal.2,11-18 The use of irrigant solutions is an essential complement to mechanical preparation, aiding in the removal of pulp remnants and in the elimination of residual bacteria from the complex root canal system.19 The routine use of sodium hypochlorite (NaOCl) in endodontics is justified by its unquestionable importance because of both its wide-spectrum antimicrobial activity20 and its properties as a tissue solvent,8,19,20 although it is known to be highly irritant to the periapical tissues, mainly at high concentrations.21 Chlorhexidine is a potent antiseptic with a broad-spectrum antimicrobial action, substantivity, and low grade of toxicity;22,23 therefore, is unable to dissolve pulp tissue.23 Nonetheless, there is no consensus in the related literature about the possible effects of the irrigant agents commonly used during the biomechanical preparation of root canals regarding adhesive degradation. Bearing in mind that the bonding properties of adhesive materials to the dental substrate are critical for the longevity of posts used as retainers for prosthetic crowns, the objective of the present study was to evaluate the influence of 3 different concentrations of NaOCl and of 2% chlorhexidine gel on the tensile bond strength of an adhesive system used to cement glass fiber posts to root dentin.

MATERIALS AND METHODS

Tooth preparation

Fifty recently extracted bovine roots of similar size and shape were selected by measuring the buccolingual

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and mesiodistal widths in millimeters, allowing a maximum deviation of 10% from the determined mean. The teeth were stored in 0.1% thymol solution (Pharmacia Medicamenta, Campinas, Brazil) for a maximum period of 4 months. The soft tissue deposits were removed with a hand scaler (SS White DuFlex, Rio de Janeiro, Brazil), and the coronal portion of each tooth was sectioned 15.0 mm coronally from the root apex, using a diamond double-faced disk (KG Sorensen, Barueri, Brazil) in a slow-speed handpiece, cooled with air/water spray. The roots were embedded in self-curing acrylic resin (JET, São Paulo, Brazil), the canals were instrumented by the modified step-back technique with manual K-type files (Dentsply/Maillefer, Ballaigues, Switzerland) using a diamond double-faced disk (KG Sorensen, Balsam, Brazil) for a maximum deviation of 10% from the determined mean. 7

Statistical analysis

A 1-factor analysis of variance model was adopted (1-way analysis of variance). Associations that presented $P$ values $\leq 5\%$ (.05) were considered to be statistically significant (type I error probability).

RESULTS

The means and standard deviations of the tensile strength values for each group are shown in Table 1. No statistically significant difference was observed among the irrigant solutions tested ($P > .70$).

DISCUSSION

An unfavorable interaction of NaOCl with adhesive systems, considering the potential of this solution to affect mechanical dentin properties via degradation of organic dentin components, has been reported in sev-
eral studies, whereas others have shown an improvement in adhesion after treatment with NaOCl. In the present study, we tested the NaOCl concentrations commonly used for irrigation of root canals, ranging from 1% to 5.25%.

The results of this study show that NaOCl did not reduce adhesiveness compared with the groups irrigated with chlorhexidine and saline. This adhesiveness similarity was due, at least in part, to its ability to dissolve organic material. Organic tissue remaining favors the formation of a smear layer rich in organic components, making it difficult for acid substances to act, which is essential to adhesive processes.

Sodium chloride is not used as an irrigating solution in endodontic treatment. It was used in this study to establish a control, enabling assessment of the effects of NaOCl and chlorhexidine during endodontic procedures.

In addition to the different concentrations of NaOCl, 2% chlorhexidine gel was also evaluated, because it is an irrigant with an antibacterial activity similar to that of NaOCl. However, owing to the viscosity of the chlorhexidine gel, its application was followed by an additional irrigation with 0.9% NaCl to facilitate removal of the gel during aspiration. Some earlier studies observed no reduction in adhesiveness to dentin when chlorhexidine was used. However, Wachlarowicz et al. observed a significant reduction in adhesiveness in teeth irrigated with chlorhexidine compared with NaOCl. In the present study, the tensile values required to remove the posts when the specimens were submitted to treatment with 2% chlorhexidine gel could probably be attributed to the viscosity of the gel, which might have favored the mechanical cleansing of the root canal walls and its anatomic complexities, thus promoting the effective removal of dentin debris and tissue remnants.

The use of EDTA combined with ultrasonic vibration is an effective method in removing the smear layer, allowing the final irrigant solution to penetrate into dentinal tubules or other confined areas protected by the smear layer. This makes it possible to evaluate the effect of the irrigants tested on post retention via dentin adhesive interaction with dentin walls.

All groups presented appropriate retention, because the posts should present tensile strength values of ≥200 N, a limit considered by Bonfante et al. as the minimum requirement to ensure clinical success. The post configuration (parallel with the apical conicity and with undercuts along its entire length) probably contributed to the values achieved (means ranging from 24.66 to 28.83 kgf, which are equivalent to 241.80 and 282.70 N, respectively).

Despite the particulars of each irrigant solution tested, another hypothesis for the absence of significant statistical differences among the tensile strength means is that the slight etch of the adhesive system used (Clearfil SE Bond) may have provided smaller dentin permeability and, as a consequence, the fluid flow inside the dentinal tubules was probably reduced, thus minimizing the effects of occasional chemical residues in the dentinal tubules.
CONCLUSION
According to the results of this study, it was possible to conclude that the different irrigant solutions tested did not influence the tensile bond strength of the adhesive system used in this study to cement glass fiber posts to root dentin.

REFERENCES

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