EFFECT OF IRRIGATION ON THE PUSH-OUT BOND STRENGTH OF THREE BIOACTIVE MATERIALS TO RADICULAR DENTIN

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INTRODUCTION
An apexification procedure with Ca(OH)₂ for the treatment of an incompletely developed root has lost popularity. Reasons for this include the long treatment time and the denaturation of root canal dentin with increased risk of root fracture. Several “monoblock” root canal filling materials have been introduced to overcome these disadvantages. Important goals of these filling materials are to remain in place under dislodging forces and to create a hermetical seal that prevents irritants and micro-organisms from entering the peri-radicular tissues (1, 2). The bond strength of these materials inside the root canal depends on the properties of the radicular dentin, which may be affected by the irrigation protocol used to clean and disinfect the root canal (3).

AIM
To evaluate the push-out bond strength of two calcium-silicate cements (Biodentine and ProRoot MTA) and a conventionally setting glass ionomer cement (Fuji IX), in comparison with gutta percha/resin sealer after different irrigating protocols within wide root canals.

MATERIALS AND METHODS
180 freshly extracted lower single rooted bovine incisors were decoronated and the root canal was prepared to size 200/10 apically. The teeth were divided in three groups according to the irrigating protocol: (A) NaOCl 3%, (B) NaOCl 3% - EDTA 17% and (C) NaOCl 3% - EDTA 17% - NaOCl 3%. Ultrasonically activated irrigation was applied in all three groups. Roots within each group were divided in four subgroups according to the obturation material: (1) gutta percha/ AH Plus, (2) ProRoot MTA, (3) Biodentine and (4) Fuji IX. After setting, a slice of 1.6 +/- 0.2 mm was obtained from each root at an identical level and push-out bond strength tests were carried out using a universal testing device (figure 1). The bond failure mode was investigated under an optical microscope at a magnification of 31.25x.

RESULTS
1. Push-out bond strength
The mean push-out bond strength values for each group are given in table 1 and figure 2. Push-out bond strength was significantly influenced by the obturation material and by the irrigation protocol (P < 0.05). The lowest push-out bond strengths were found within the gutta percha group, and this was not influenced by the irrigation protocol. The highest push-out bond strengths were found in the NaOCl/Biodentine group. When comparing MTA with Biodentine, MTA presented with lower push-out bond strengths, but this was only significant for the NaOCl-EDTA irrigation protocol.

2. Bond failure mode
Failure modes are presented in table 2. In the gutta percha group, failures were all adhesive. In the MTA/Biodentine group, failures were mainly cohesive and combined. In the GIC group, failures were mainly adhesive and combined (except for the NaOCl-EDTA-NaOCl pretreatment).

DISCUSSION
The presence of the smear layer positively influenced the push-out bond strength of MTA and Biodentine. These findings coincide with El Ma'a’ita et al (4). For MTA, a final rinse with EDTA resulted in a significantly lower push-out bond value demonstrating that MTA adhesion is more influenced by EDTA as the final rinsing solution in comparison to Biodentine. In the Biodentine group, no adhesive failures were noted. Leakages of the Biodentine were often observed in the root canal dentin (figure 3). Within the MTA group the NaOCl-EDTA-NaOCl group revealed more combined failures, less cohesive failures and a higher push-out bond strength in comparison with the NaOCl-EDTA group. This indicates that the material became stronger and failure now occurred more at the bonding interface.

CONCLUSIONS
Within the limitations of the present study Biodentine and MTA yielded the highest push-out bond strengths, gutta percha/AH Plus the lowest. In the case of GIC, MTA and Biodentine, irrigation protocols had a significant influence on the push-out bond strengths. For Biodentine and MTA maintaining the smear layer created a stronger bond.

REFERENCES

Table 1: The mean and standard deviation push-out bond strength values for all group with significant differences between the testgroups

Table 2: Modes of failure for every testgroup

Figure 1: Test set-up

Figure 2: The main and standard deviation push-out bond strength values for each group

Figure 3: Push-out bond test of Biodentine often resulted in root canal dentin fracture