

Evaluation of setting time, ions release, sealing ability and adhesion of a novel experimental endodontic cement

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Abstract – This study investigates the physico-chemical properties of a novel experimental root canal filling cement. The setting time, pH, calcium release, conductivity, sealing ability and adhesion are evaluated. The obtained results are compared with root canal filling cement Sealer 26[®]. The results show that the experimental cement has a smaller setting time, higher release of hydroxyl and calcium ions than Sealer 26[®]. On the other hand, statistically no significant difference is observed in the sealing ability and adhesion of two materials.

The mineral trioxide aggregate (MTA) cement is one of the most investigated materials in the dentistry due to its excellent physical, chemical, and biological properties. Nowadays, it is widely used by professionals to seal the communication between the root canal system and the external surface of the tooth. Some studies using the MTA as root canal filling material have been performed [1,2], demonstrating that it exhibits better biological properties when compared to other root filling materials. However, its formulation should be modified to facilitate its use as such. Recently, we developed a novel composite (herein named CEOE) that is essentially constituted of Portland cement, barium sulphate and an epoxy resin, whose function is to promote an appropriate consistency to use it as root canal filling cement.

The purpose of this study was to evaluate the setting time, ions release, sealing ability (or permeability) and adhesion to root walls of CEOE cement. The results were compared to commercial root canal filling cement Sealer 26[®] (Dentsply Ind. e Com Ltda, Petrópolis – Brazil). The setting time was determined in accordance with ANSI/ADA specifications no. 57. The released ions of interest to be analyzed are H^{1+} and Ca^{2+} . The concentration of hydroxyl and calcium ions was evaluated using the pH measurements and the atomic absorption spectroscopy technique, respectively. The permeability was assessed measuring the fluid filtration using a fluid flow device. The adhesion of material to canal walls was evaluated through bonding strength using the push-out technique. The data were analyzed statistically using the analysis of variance and the Tukey test.

The results obtained are illustrated in Table 1 and in figures 1 to 3. The setting time for CEOE cement is 35% smaller than Sealer 26[®] and both meet the British Standard BS (1988) recommendation. No significant difference was observed in the bonding strength and permeability values for both cements. On average, the CEOE released more hydroxyl and calcium ions than Sealer 26[®] up to the first 96 h. With these results we can conclude that the CEOE experimental cement has appropriate setting time to be used as root canal filling material, a good sealing ability and adhesion to root dentin. Furthermore, the cement releases calcium and hydroxyl ions compared to commercial cement.

Table 1: Setting time and bonding strength of studied composites.

Cement	Setting time (h)	Bonding strength (MPa)
CEOE	33 ± 1	22 ± 6
Sealer 26	50.8 ± 0.8	20 ± 4

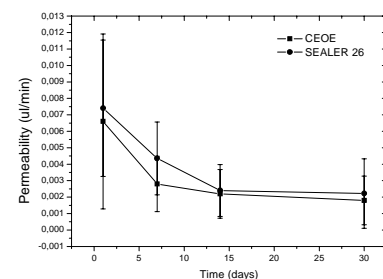
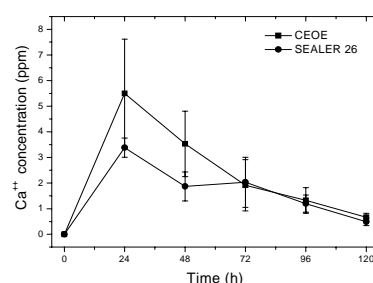
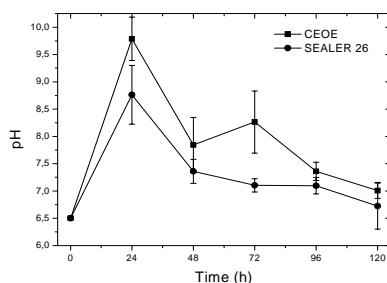


Figure 1: Release of H^{1+} ions versus time

Figure 2: Release of Ca^{2+} ions versus time

Figure 3: Permeability (μ l/min) versus time

References

- [1] P.J. Vizgirda, F.R. Liewehr, W.R. Patton, J.C. McPherson, T.B. Buxton. Journal of Endodontics 30, 2 (2004) 103-106.
- [2] P. Yeung, F.R. Liewehr, P.C. Moon. Journal of Endodontics 32, 5 (2006) 456-459.