Evaluation of the flow rate of 3 endodontic sealers: Sealer 26, AH Plus, and MTA Obtura

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Objective. The aim of this study was to evaluate the flow rate of 3 endodontic sealers: Sealer 26, AH Plus, and MTA Obtura.

Study design. According to the method proposed by the American Dental Association (ADA specification no. 57), the sealers were placed between 2 glass slabs under a weight of 120 g. The diameters of the formed discs were measured with a digital paquimeter. The test was repeated 5 times for each sealer.

Results. The results were expressed as arithmetic means, and the statistical analysis was performed through Tukey test. AH Plus showed significantly superior flow rate compared with Sealer 26 and MTA Obtura. There was no statistically significant difference between flow rates presented by Sealer 26 and MTA Obtura.

Conclusion. Within the limitations of this in vitro study, it was concluded that all of the endodontic sealers tested presented greater flow than the minimum recommended in the ADA 57 specification. (Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2010;109:e47-e49)

Success in endodontic treatment depends on the prevention and control of root canal infection, which is achieved by adequate cleaning, shaping, and filling. A poor filling could lead to endodontic failure despite the accomplishment of a meticulous biomechanical root canal preparation by an atraumatic and aseptic technique. Complete obliteration of the root canal system is considered to be essential to obtain success in endodontic therapy.1-2

A Root canal filling material must present appropriate biologic and physicochemical properties. First of all, it must not irritate the periradicular tissues. Ideally, it would be desirable that it stimulates reparation and biologic sealing by mineralized tissue deposition in the apical foramen. An appropriate endodontic sealer should present adhesivity and dimensional stability to avoid fluid circulation between canal compartment and the periapex. In addition, it should be both insoluble in tissue fluids and able to fill all the empty spaces, which is expected from a material with an adequate flow property.1-5

Flow is the ability of a sealer cement to penetrate into irregularities and accessory canals of the root canal system, and it is considered to be a very important property. The greater the flow, the greater the ability to penetrate into irregularities. Conversely, if the flow is excessive, the risk of material extravasation to the periapex is increased, which could damage periodontal tissues.5

Several studies have been carried out to evaluate this property, which can vary according to the sealer composition or to the powder/liquid proportion.6-9 The most frequently used endodontic cements are resin-based sealers, zinc oxide–eugenol sealers, calcium hydroxide–containing sealers, glass ionomer–based sealers, and, more recently, mineral trioxide aggregate (MTA)–based sealers, which are in development.

The aim of the present study was to evaluate the flow rate of 2 epoxic resin-based endodontic sealers, Sealer 26 (which contains calcium hydroxide) and AH Plus, and an MTA-based one, MTA Obtura.

MATERIALS AND METHODS

Endodontic sealers

The endodontic sealers used in this study were Sealer 26 (Dentsply/Mailefe, Petrópolis, Brazil), AH Plus (Dentsply/De Trey, Konstanz, Germany) and MTA Obtura (Angelus, Londrina, Brazil). Immediately before
testing, all materials were prepared according to the manufacturers’ instructions: 2:1 (powder:resin, by volume), 1:1 (paste:paste, by volume), and 1:4 (scoop: drops), respectively.

Flow test
An international standard was used to conduct the flow test: American Dental Association (ADA) specification no. 57. According to this specification, the sealers were spatulated until obtaining a homogeneous mixture, and 0.5 mL of each one was dropped on the center of a polished glass slab (100 × 150 mm). Three minutes later, another glass plate was placed centrally on top of the sealer, followed by a weight giving a total mass of 120 g. Ten minutes after initiating the mixing, the weight was removed and the maximum and minimum diameters of the compressed discs of sealers were measured using a digital paquimeter. Two conditions were necessary to validate the tests: The difference between the maximum and minimum diameters could not exceed 1.0 mm; and the compressed disc should have uniform shape. If these conditions were not met, the test was repeated. Five determinations were carried out and the mean value was calculated to the nearest millimeter. Finally, the arithmetic average was calculated, obtaining the flow rates. These results were statistically analyzed by Tukey test. The disc diameter should be ≥20 mm. The only differences between ADA and ISO standards are the volume analyzed and the minimum diameter of spread; thus, to test with the ISO 6876 specification, the volume of sealer is 0.05 mL (±0.005 mL) and each compressed disc should have a diameter of ≥20 mm.

RESULTS
Considering the mean diameters of the discs formed by the sealers, the global analysis of the results showed that Sealer 26 presented diameters varying from 27.56 to 30.45 mm, AH Plus from 35.26 to 39.53 mm, and MTA Obtura from 25.02 to 29.70 mm. The average of the mean diameters of the sealers Sealer 26, AH Plus, and MTA Obtura were 29.51 mm, 37.47 mm, and 27.65 mm, respectively. Statistical analysis of the results by Tukey test revealed that AH Plus had flow values significantly superior to the other sealers tested (P < .05). There was no significant difference between Sealer 26 and MTA Obtura (P > .05). Tukey test failed to show any other significant differences between the materials (P > .05; Table I).

DISCUSSION
According to ADA specification no. 57 and ISO, in flow tests each disc should have a minimal diameter of 20 mm, considering the same experimental conditions. In the present study, Sealer 26, AH Plus, and MTA Obtura presented higher flow rates than the minimum required by the international standard: 29.51 mm, 37.47 mm, and 27.65 mm, respectively.

The statistical analysis showed that AH Plus had flow values significantly higher than the other sealers and that there was no significant difference between Sealer 26 and MTA Obtura. Sealer 26 showed more homogeneous results than AH Plus and MTA Obtura, showing lower standard deviation values: 0.41, 1.50, and 1.46, respectively. This higher homogeneity of Sealer 26 compared with AH Plus was also observed by Siqueira et al., who described standard deviation values of 0.61 for Sealer 26 and 2.63 for AH Plus.

Higher flow rate was observed in AH Plus. These values are also similar to the ones found for AH Plus in other studies.

AH Plus showed superior flow values to Sealer 26, which was also seen by Siqueira et al. As discussed by Siqueira et al., these differences can be attributed to the peculiar chemical composition of each sealer. The greater concentration of epoxic resin in AH Plus is responsible for its high flow rate. Moreover, the presence of calcium hydroxide in Sealer 26 decreases its flow property.

The flow ability is also influenced by the size of sealer particles. The smaller the particles, the greater the flow ability of the sealer. Ideally, an endodontic sealer must have moderate flow rate, because excessive flow increases the risk of extravasation and insufficient flow reduces the penetration in accessory canals. Wu et al. affirmed that greater flow increases the ability to penetrate into irregularities and accessory canals. As discussed by Siqueira et al., the flow rate plays an important role in allowing sealer penetration within confined areas of the root canal system. Nevertheless, this property is directly proportional to the risk of material extravasation to the periapex, damaging the periodontum. Sealer 26, when compared with other

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<th>Sealer 26</th>
<th>AH Plus</th>
<th>MTA Obtura</th>
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<td>29.51 mm</td>
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Table I. Statistical analysis, by Tukey test, of the flow rates presented by the sealers tested (significance: P ≤ .05)
calcium hydroxide–containing sealers, presented superior flow rates in the vertical analysis, mainly compared with Sealapex. In the horizontal test, the results were the same. Siqueira et al. found lower flow rates for Sealapex compared with Sealer 26. These results, together with its excellent dimensional stability, qualify Sealer 26 as a calcium hydroxide–containing sealer with adequate physical properties.

In the present study, MTA Obtura presented the lower flow rate value; however, it was superior to the minimum demanded by the ADA specification no. 57. Because of this property, MTA Obtura will probably penetrate with more difficulty in ramifications and irregularities of root canal walls than the other sealers tested. It is important to emphasize that it was only possible to contrast the results obtained with MTA Obtura to those obtained with the other sealers. There are no previous observations about MTA Obtura flow rate, because this is one of the pioneer studies about this material.

**CONCLUSION**

According to the experimental conditions under which this study was performed, it is possible to conclude that all of the endodontic sealers tested presented greater flow than the minimum recommended in the ADA specification no. 57. AH Plus presented statistically greater flow rate than Sealer 26 and MTA Obtura, and there was no statistical difference between flow rates presented by Sealer 26 and MTA Obtura.

**REFERENCES**


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