

The present study addressed the labor activities of endodontists, specifically the use of manual and motor-driven instruments for the preparation of root canals. Therefore, the results cannot be extrapolated to other specialties involving different movements of the hands, wrists and arms.

Conclusion

Based on the present findings, endodontists are exposed to risk factors for WMSDs due to the fact that the daily practice of the profession involves incorrect posture, repetitive movements, the mechanical compression of tissues, long hours in the same position and the use

of manual endodontic instruments. The most affected anatomic regions are the upper back, lower back and neck, which are related to the rotation of the body and incorrect posture. Endodontists who only use manual instruments have more frequent pain in the shoulders, arms, wrists, hands and fingers due to continual movements involving pressure in the root canal. Endodontists who only use rotary instruments for the preparation of root canals report less pain in the fingers, hands, wrists, elbows and arms. Thus, professional orientation and the adoption of ergonomic measures in daily clinical practice are fundamental to the avoidance of injuries and the promotion of health among endodontists.

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Analysis of simulated lateral canals sealing by MTA-Fillapex and AH Plus endodontic sealers

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ABSTRACT

Introduction: Obturation consists of the three-dimensional filling of the root canal system and requires good sealing by the endodontic sealer. In the search for an ideal material the MTA Fillapex has been introduced in the market, which is an MTA-based biocompatible endodontic sealer that still lacks analysis of its physicochemical properties. This study analyzed and compared the sealing provided by sealers MTA Fillapex and AH Plus. **Material and method:** The study was conducted on 20 human mandibular premolars, whose crowns were sectioned leaving a standardized remnant of 20 mm. After biomechanical preparation with Pro Taper files, three lateral canals were fabricated on the mesial and distal aspects of the root portion, with a

5-mm distance between them. Following, the teeth were divided into two groups with 10 specimens each according to the sealer employed and filled by the lateral condensation technique. After filling, digital radiographs were obtained for analysis of sealing of the three fabricated lateral canals.

Results: There was discrepancy between the sealers analyzed. The MTA Fillapex exhibited lower scores in the filling of fabricated lateral canals compared to AH/Plus for all thirds analyzed, especially at the apical and middle regions.

Conclusion: The sealer AH Plus presented better capacity of filling of simulated lateral canals than MTA Fillapex, regardless of the third analyzed.

Keywords: Root canal treatment. Endodontics. Root canal filling.

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Introduction

Obturation is an extremely important step in endodontic treatment that aims at three-dimensional sealing of the root canal system, preventing the percolation of fluids from the gingival tissues and root canal contamination due to penetration of microorganisms from the oral cavity.¹

To achieve this goal, this stage of endodontic treatment involves the use of sealer and gutta-percha. Since the gutta-percha is not adhesive, the sealing capacity of endodontic sealers plays an important role to fill the remaining spaces between gutta-percha and the root canal wall, in order to provide better quality of sealing by filling of lateral canals and isthmuses.²

However, the chemical composition of some sealers may be irritating to the periapical tissues, inducing a persistent inflammatory response after obturation and even inhibiting the repair. Therefore, the success of endodontic treatment requires root canal obturation using a material to provide the most complete sealing as possible of the root canal system while also presenting a bioactive performance, inducing the apical mineralization.³

The MTA sealer (mineral trioxide aggregate) is an example of bioceramic material, being biocompatible and bioactive, and forms calcium hydroxide when in contact with water.⁴ In the search to combine the biological properties of MTA and the physicochemical properties of an endodontic sealer, the MTA Fillapex has been introduced in the market, which is an endodontic sealer containing MTA or calcium silicate. According to Melo,⁵ even though this material apparently presents good physicochemical properties, further studies are necessary to demonstrate this. The sealer AH Plus has been marketer for longer time and is considered one of the most used sealers in investigations. It is composed of an epoxy-amine resin and presents satisfactory results concerning its physicochemical and biological properties. This sealer is widely employed in several studies as parameter for comparison with new sealers. The great sealing provided by AH Plus favors an excellent union between sealer and dentin and good capacity of biological sealing, consequently with lower root canal infiltration.⁶

Considering the anatomical complexity of root canals provided by the presence of ramifications, in which mechanical access with endodontic instru-

ments is impossible, the endodontic sealer must present good sealing capacity. This study analyzed the sealer MTA Fillapex as to its capacity of filling of fabricated accessory canals, compared to the performance of sealer AH Plus, which is considered the gold standard in Endodontics.

Material and method

This study was conducted on 20 human freshly extracted single-rooted mandibular premolars, obtained from the Discipline of Oral and Maxillofacial Surgery of the School of Dentistry of Unipar - Umuarama Campus, which were kept in a flask containing formalin until accomplishment of the following procedures.

After approval by the Institutional Review Board of Universidade Paranaense - Umuarama Campus under protocol n. 76529517.3.0000.0109, the teeth were sectioned perpendicular to the long axis, using carborundum discs, to remove the coronal portion providing a standardized remnant of 20 mm from the root apex. Following, instrumentation was performed with manual Kerr files n. 8, 10 and 15 to achieve patency of the apical foramen. During this process, the root canal was irrigated with 2 ml of 1% sodium hypochlorite at each change of instrument.

Biomechanical preparation was performed using rotary files of the Pro Taper system, with crosshead speed and torque defined according to the manufacturer's instructions. The first instrument of the system, file SX, had its penetration limit established at 14 mm to restrict its action to the cervical and middle thirds, while the other instruments from file S1 up to F3 were introduced at the working length standardized at 19 mm.

Throughout preparation, the root canal space received irrigation with 2 ml of 1% sodium hypochlorite for removal of debris, after utilization of each instrument. Then, three lateral canals were fabricated with a 5-mm distance between them on the mesial and distal root surfaces (one at each third), using a device mounted using a file n. 10 ground until achieving 0.15 mm at its end, fixated with acrylic resin to a low-speed adapter. After completion of biomechanical preparation and fabrication of lateral canals, final irrigation was performed with three application cycles alternately using EDTA-T (Fórmula e Ação) and 1% sodium hypochlorite energized by

an ultrasound tip Irrisonic (Helse) for 20 seconds each, initiating and concluding with the sodium hypochlorite solution.

The teeth were randomly divided into two groups with 10 teeth each using the lateral condensation technique, applying one of the endodontic sealers on the root canal walls: Group 1 = MTA Fillapex; Group 2 = AH Plus.

Immediately after obturation, a digital radiograph of the teeth was obtained in buccolingual direction and the image was analyzed by three independent and previously calibrated examiners, who assigned scores according to the filling of fabricated ramifications: score 0 indicated no sealing, score 1 indicated partial sealing and score 2 indicated complete sealing. These scores were assigned to each lateral canal. The most frequent score for each canal was considered in case of discrepancy between examiners.

The scores were compared between groups AH plus and Fillapex at the cervical, middle and apical thirds by the Cochran-Armitage test for trend.

Results

Analysis of radiographic images revealed discrepancies between sealers. The MTA Fillapex (Fig 1) exhibited worse filling of fabricated lateral canals

compared to AH Plus (Fig 2), for all thirds analyzed, especially at the apical and middle regions.

Table 1 presents the comparison of scores between groups AH Plus and MTA Fillapex for each third, in which the following findings may be highlighted. At the cervical third, there was significant difference ($p=0.041$) in scores between AH Plus and MTA Fillapex groups, with higher percentage of score 2 for AH Plus group. In AH Plus group, 90% presented score 2, 0% score 1, and 10% score 0, while in the MTA Fillapex group these percentages were 55%, 20% and 25%, respectively.

In the middle third, there was significant difference ($p=0.000$) in scores between AH Plus and MTA Fillapex groups, in which the AH Plus group presented higher percentage of score 2. In AH Plus group, 80% exhibited score 2, 20% score 1, and 0% score 0, compared to 30%, 30% and 40%, respectively, for the MTA Fillapex group.

In the apical third, there was significant difference ($p=0.006$) in scores between AH Plus and MTA Fillapex groups, in which the AH Plus group presented higher percentage of score 2. In AH plus group, 65% presented score 2, 25% score 1, and 10% score 0, while in the MTA Fillapex group these percentages were 25%, 35% and 40%, respectively.

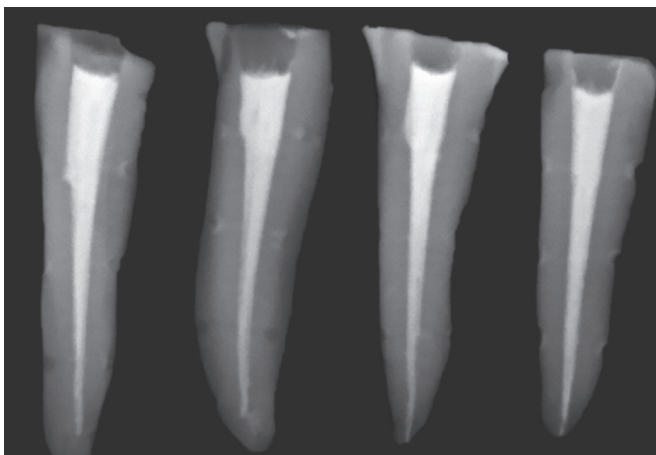


Figure 1. Digital radiograph of mandibular premolars obturated with MTA Fillapex sealer

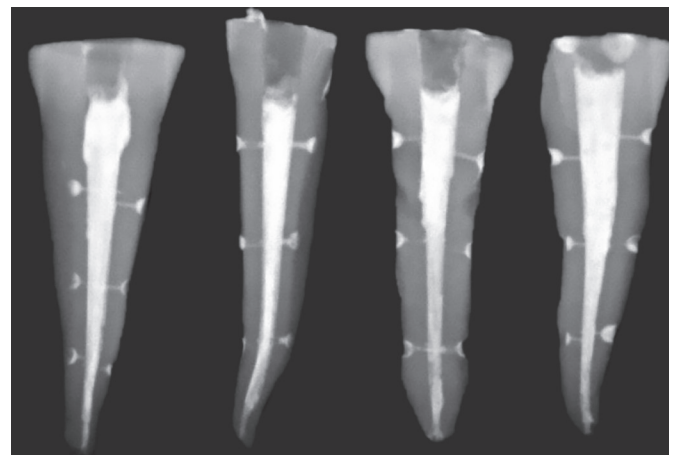


Figure 2. Digital radiograph of mandibular premolars obturated with AH Plus sealer

Table 1. Comparison of the scores between groups in each third.

Variables		AH Plus		Fillapex		p ¹
		n	%	n	%	
Cervical Third	Score 2	18	90%	11	55%	0,041
	Score 1	0	0%	4	20%	
	Score 0	2	10%	5	25%	
Middle Third	Score 2	16	80%	6	30%	0,000
	Score 1	4	20%	6	30%	
	Score 0	0	0%	8	40%	
Apical Third	Score 2	13	65%	5	25%	0,006
	Score 1	5	25%	7	35%	
	Score 0	2	10%	8	40%	

¹ Cochran Armitage Test.

Discussion

A new category of endodontic sealers has been recently introduced in the dental market, whose main component is calcium silicate. These materials have presented excellent biological performance and promising physical characteristics. Currently, AH Plus is the endodontic sealer that better meets the requirements for a sealer, being considered the gold standard in Endodontics. Therefore, it has been used as parameter for comparison in the evaluation of quality of any characteristic, such as sealing.⁶

Concerning this characteristic, Baldissera⁷ did not observe statistically significant difference between AH Plus and MTA Fillapex when using laser scanning confocal microscopy to analyze the penetration of two endodontic sealers, with similar results between both. Faraoni⁹ compared the sealing and setting time between sealers Sealer 26, Sealapex, MTA Fillapex and AH Plus. For analysis of sealing, the sealers were prepared and placed between two glass slabs with a 120-g weight on one of them. After 10 minutes, the largest and smallest diameters of sealers were measured, and MTA Fillapex exhibited the best arithmetic means among all materials analyzed. Using a similar methodology as the present study, Melo⁵ evaluated the ability of filling of fabricated lateral canals of sealers Sealer 26, Endofill and MTA Fillapex, not observing statistically significant differences between them concerning the positions of lateral canals, except for those fabricated at 7 mm from the apex, in which the MTA Fillapex exhibited significantly bet-

ter sealing than Sealer 26. These results do not agree with the present study, which revealed better capacity of sealing of fabricated lateral canals by the sealer AH Plus compared to MTA Fillapex, especially at the middle and apical thirds, in which the rate of unfilled ramifications exhibited significant difference. This agrees with the study of Cechella,⁶ who compared the sealing achieved by the sealers AH Plus and MTA Fillapex by penetration of India ink applied under pressure. After dental diaphanization, it was observed that both sealers exhibited cases of dye penetration, however this infiltration reached only the apical third for MTA Fillapex, demonstrating better sealing than AH Plus. Similar performance was reported by Baechtold,² who observed smaller formation of tags with MTA Fillapex compared to AH Plus by scanning electron microscopy, concluding that it presents low binding force with dentin. Lisboa⁹ also observed better results for AH Plus with statistically significant values when analyzing the depth of penetration into the dentinal tubules and bacteria leakage.

Long working time and setting time were also observed after handling of MTA Fillapex, in agreement with the report of Faraoni,⁹ who demonstrated that MTA Fillapex achieved initial setting in a longer time of 20 hours and 30 minutes compared to Sealer 26, Sealapex and AH Plus, and did not achieve final setting. It should be highlighted that, according to the manufacturer, the setting time is 2 hours and 30 minutes, and complete setting requires contact with moisture from the dentinal canaliculi and periapical tissues.