

Clinical and microscopic analysis of the incidence of a fourth canal and its trajectory in the maxillary first molar

Análise clínica e microscópica da incidência do quarto canal e sua trajetória em primeiros molares superiores

Mateus Silveira Martins HARTMANN¹
 Patrícia FERREIRA²
 Flares BARATTO-FILHO³
 Luíz Fernando FARINIUK²
 Orlando LIMONGI⁴
 Eduardo PIZZATTO³

ABSTRACT

Objective: This study evaluated the incidence of a fourth canal in the mesiobuccal root of maxillary first molars, investigating the importance of microscopic analysis of its trajectory in relation to the mesiobuccal canal.

Methods: The analysis was performed of 65 randomly extracted maxillary first molars, with previous endodontic coronal opening, obtained from the Univille University tooth bank. The teeth were numbered and kept hydrated in distilled water. Compensatory wear was performed to widen the cavity in the mesiobuccal direction, foreseeing the presence of the mesiopalatal canal. A dental microscope was used to confirm presence of a groove (or "fin") and orifices in canals in the mesiobuccal root, and evaluate the presence of anastomosis between the root canals, following the modified method of Stropko¹.

Results: The incidence of the fourth canal (52.3%) was higher when microscopically observed, than clinically observed (29.3%). The results achieved by the modified method of Stropko demonstrated that most root canals (67.6%) presented union.

Conclusion: There was higher incidence of the mesiopalatal canal (52.3%) observed in the microscopic analysis when compared with that observed in the clinical analysis (29.2%). The drying method allowed confirmation of union between canals in 67.6% of teeth. The combination of information achieved by radiographic examination of the trajectories of the mesiobuccal root and microscopic evaluation by the drying method allows the professional to gain better knowledge of the tooth under treatment, providing.

Indexing terms: endodontics; root canal preparation; root canal therapy.

RESUMO

Objetivo: Este estudo avaliou a incidência do quarto canal em raízes méso-vestibulares de primeiros molares superiores, investigando a importância da análise microscópica na sua trajetória em relação ao canal méso-vestibular.

Métodos: A análise foi executada em 65 primeiros molares superiores extraídos, que apresentavam abertura coronária prévia, obtidos no Banco de Dentes da Universidade Univille. Os dentes foram numerados, hidratados e conservados em água destilada. O desgaste compensatório foi executado ampliando a cavidade na direção méso-vestibular, procurando a presença do canal méso-palatino. Um microscópio clínico foi empregado para confirmar a presença de sulcos e a existência de orifícios nos locais correspondentes às entradas dos canais das raízes méso-vestibulares e para avaliar a presença de anastomoses entre os canais radiculares, através de uma modificação do método de Stropko¹.

Resultados: A incidência do quarto canal, com a observação microscópica (52,3%), foi maior do que a observada clinicamente (29,3%). Os resultados encontrados pela modificação do método de Stropko¹ demonstraram que a maioria dos canais radiculares (67,6%) apresentou ligação entre si.

Conclusão: A incidência do canal méso-palatino (52,3%), observada na análise microscópica, foi alta, quando comparada com a análise clínica (29,2%). O método da secagem permitiu a confirmação da união dos canais em 67,6% dos dentes. A combinação das informações adquiridas pelo exame radiográfico das trajetórias das raízes méso-vestibulares e a avaliação microscópica pelo método da secagem permitiu ao profissional um melhor conhecimento dos dentes a serem tratados, tendo condições para alcançar melhores resultados.

Termos de indexação: endodontia; preparo de canal radicular; tratamento do canal radicular.

INTRODUCTION

Apart from rare exceptions, the maxillary first molar presents three well differentiated roots. The mesiobuccal root presents a larger diameter in comparison with the

distobuccal root, being flattened in mesiodistal direction. Weine & Nga² reported that correct positioning of the opening of the fourth canal in the maxillary first molar is distobuccal in relation to the main canal (mesiobuccal) and thus the best name for such a canal would be the mesiopalatal canal. Pasternack Júnior et al.³ described the maxillary

¹ Faculdade Ingá, Faculdade de Odontologia. Rua Senador Pinheiro, 224, Praça Santa Terezinha, Vila Rodrigues, 99070-220, Passo Fundo, RS, Brasil. Correspondência para / Correspondence to: MSM HARTMANN. E-mail: <mateushartmann@terra.com.br>.

² Pontifícia Universidade Católica do Paraná, Faculdade de Odontologia. Curitiba, PR, Brasil.

³ Universidade Positivo, Faculdade de Odontologia. Curitiba, PR, Brasil.

⁴ Universidade Luterana do Brasil, Faculdade de Odontologia, Departamento de Dentística e Endodontia. Canoas, RS, Brasil.

molars as a great challenge even to the most experienced professional, since the mesiobuccal root presents a fourth canal in a significant number of cases.

The difficult location of the mesiopalatal canal is worsened by its proximity to the mesiobuccal canal and restricted ability to observe it in the radiographic examination. Use of the clinical microscope is a good option to enhance the location of root canals. Cohen & Hargreaves⁴ stated that the advantage of using a clinical microscope was that, procedures are performed with a higher level of lighting and magnification, avoiding unnecessary wear of tooth structure.

This study evaluated the incidence of a fourth canal in the mesiobuccal root of maxillary first molars, investigated the importance of microscopic analysis of its trajectory in relation to the mesiobuccal canal and observing the groove in the pulp chamber floor.

METHODS

The 65 extracted maxillary first molars obtained from the Univille University tooth bank. Were randomly selected and submitted to a cleaning and sterilization process. The specimens presenting endodontic coronal openings previously performed by undergraduate dental students, were numbered with a black pen. To assure hydration, they were kept in distilled water.

The endodontic coronal openings were analyzed and corrected with diamond burs n. 3083 (FKG Sorensen, Amazonas, Brazil). With aid of a Luer-Lock syringe and irrigation cannula n. 25/03, the mesial root canals were thoroughly irrigated with 1% sodium hypochlorite. Compensatory wear of the dentin was performed to widen the cavity in the mesiobuccal direction, favoring observation of the mesiopalatal canal. The pulp chamber floor was "wiped" with long round burs n. 4 burs at low speed (Dyna CE, GS, Brazil).

After the pulp chamber contents were suctioned with a cannula n. 6 and metal point, the pulp chamber was directly inspected to observe of the groove uniting the orifice of the mesiopalatal canal to the mesiobuccal canal (Figure 1).

Dental probes n. 05 and modified probes n. 47 (Duflex, São Paulo, Brazil) were used to confirm the location of the root canals and evaluate whether compensatory wear performed was sufficient. Endodontic K files (Dentsply/Maillefer-Ballaigues, Switzerland) n. 06, 08 and 10 were used to explore the root canals, except the fourth canal, attempting to eliminate possible calcifications and confirm their patency up to the apical foramen.

In the second step, a clinical microscope (DF Vasconcelos model MC-A186, São Paulo, Brazil) was used to confirm the presence of a groove between the root canals, or "fin" (corresponding to an elongate, instead of round root canal opening) and presence of orifices in the canals of the mesiobuccal root (12.5x magnification). In this step, the root canals were explored with K files (Dentsply/Maillefer-Ballaigues, Switzerland) n. 10 to check their length and verify their accessibility. If the canals could not be fully explored, 17% EDTA solution was applied, followed by further exploration (Figure 2).

With aid of the clinical microscope also, the presence of anastomosis between the root canals was assessed, using the drying method proposed by Stropko¹ with variation of drying with cannulas. The mesiobuccal and mesiopalatal canals were thoroughly irrigated with 1% sodium hypochlorite, and the foramen was obliterated with utility wax. The solution applied in the mesiopalatal canal was removed with a thin cannula n. 04, and movement of the liquid in the other canal was observed with aid of the clinical microscope at 12.5x magnification. Presence of communication between the canals (isthmus) was confirmed by the alteration in volume of the liquid present in the mesiobuccal canal, observed during drying of the mesiopalatal canal.

RESULTS

Presence of the groove uniting the orifice of the mesiobuccal canal to the palatal canal and of the orifices of canals in the mesiobuccal root was clinically observed. The groove was white or reddish and observing it helped to observe the mesiopalatal canal. Presence of the groove was observed in 27 teeth (41.5%), and presence of the mesiopalatal canal was confirmed in 15 teeth (23%). This groove often did not indicate presence of the mesiopalatal canal and was named a "fin" (Figure 3) (projection close to the mesiobuccal canal), as described by Stropko¹. The "fin" was present in 8 teeth (12.3%). The incidence of the mesiopalatal canal was clinically observed in 19 teeth (29.2%).

Microscopically, the specimens were analyzed as regards the presence of a groove uniting the openings of the mesiobuccal and palatal canals. In this step, presence of the groove could be confirmed in 62 teeth or 95.3% (Figure 1). The mesiopalatal canal was observed in 34 teeth (52.3%).

The presence anastomosis between the root canals of the mesiobuccal root was evaluated, with aid of the clinical microscope, by the drying method proposed by Stropko¹, but with the variation of using suction cannulas and thin points n. 04. Observation of anastomosis was confirmed in 23 teeth (67.6%) (Table 1).

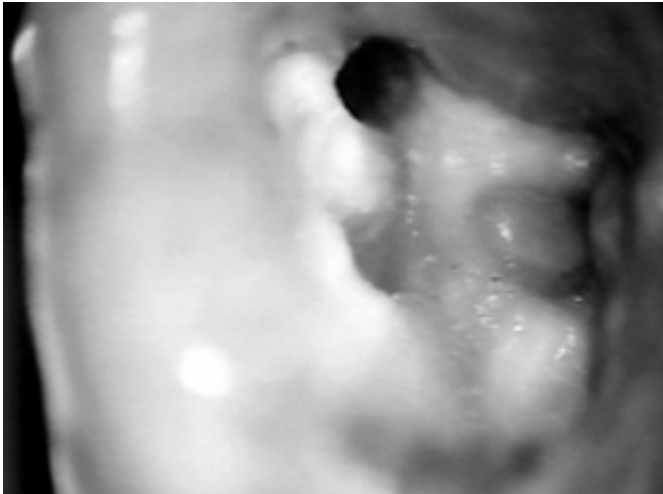


Figure 1. Orifices of the mesiobuccal and mesiopalatal canals and presence of a groove uniting the two orifices.



Figure 2. Observation of mesiobuccal and mesiopalatal canal orifices and presence of irrigating solution.

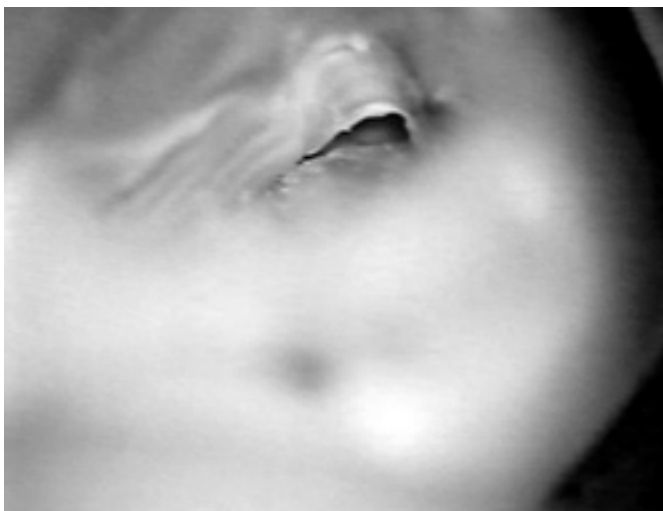


Figure 3. Observation of projection of the mesiobuccal canal, characterizing the "fin".

Table 1. Number of teeth and percentage of the groove, MP canal and anastomosis observed by clinical and microscopic analysis.

	Clinical analysis		Microscopic analysis	
	Number of teeth	%	Number of teeth	%
Presence of groove	27	41.5	62	95.3
MP canal	15	23	34	52.3
Anastomosis	-	-	23	67.6

DISCUSSION

Use of the clinical microscope provided better observation and lighting, enhancing the location of the root canal orifices. Use of the equipment increased the reliability of using rotary instruments, allowing widening of wear on the buccal aspect, with deepening in the area of the groove uniting the root canals if required. There was higher incidence of the mesiopalatal canal (52.3%) when observed in the microscopic analysis when compared with the incidence observed in the clinical analysis (29.2%).

In this study, on the basis of clinical analysis, it can be stated that the groove uniting the orifices of the mesiobuccal to the palatal canals often helped to locate the mesiopalatal canal. Use of round burs at low-speed on the pulp chamber floor at the area of this groove helped in observing it, corroborating the report of Sydney et al.⁵. Often, the opening of the root canal was elongated, which did not indicate the presence of the mesiopalatal canal orifice, and this design was called "fin" (projection close to the mesiobuccal canal), as described by Stropko¹. The "fin" was observed in 12.3% of cases.

The clinical incidence of the mesiopalatal canal observed in this study was 29.2%. In 1969, Weine et al.² observed an incidence of 51.5%; Sydney et al.⁵ reported an incidence of 64% in first molars. Weller et al.⁶, demonstrated an incidence of 60% of maxillary molars with 4 root canals and observed the presence of isthmus in 100% of cases on the mesiobuccal roots of maxillary first molars. Moreover, they compared their data with the results of Pineda (4.9% with interconnections); Green (16%) and Vertucci (52%) highlighting the disagreement, yet their results are close to those found in the present study.

The confirmation of anastomosis by microscopic analysis was observed in 23 teeth (67.6%), differing from Al Shalabi et al.⁷, who observed anastomosis in 16% of cases.

This investigation revealed that 73.5% of the root canals could be explored; Sydney et al.⁵ found that 15.62% could be explored up to the middle third, and Sempira & Hartwell⁸ mentioned that 33.1% of canals in the mesiobuccal root could be explored.

This study evaluated the presence of anastomosis in teeth with canals that could be totally explored and those in which the fourth canal could be partially explored. It should be highlighted that the investigation/analysis methods of the different authors cited differed from those adopted in the present investigation. Similar studies should be conducted in groups of teeth that usually present two root canals in a single root, to demonstrate the incidence of such areas and the importance of this knowledge in the practice of high-quality Endodontics based on solid scientific foundations.

The clinical microscope confirmed presence of the clinically observed groove in 95.3%, and the outcomes demonstrated that the use of this aid is not critical in this step.

There was a higher incidence of the mesiopalatal canal (52.3%) when observed by microscopic analysis, when compared with the incidence observed in the clinical analysis (29.2%).

The drying method allowed confirmation of union between canals in 67.6% of teeth.

The combination of information achieved by radiographic examination of the trajectories of the mesiobuccal root and microscopic evaluation by the drying

method allows the professional to gain better knowledge of the tooth under treatment, providing conditions for achieving the best outcomes.

CONCLUSION

The alteration in shape of the coronal opening and the procedure of “wiping” the pulp chamber roof with round burs at low-speed on the groove connecting the canals in the mesiobuccal root enhanced observation and increased, the chances of locating all the canals of the maxillary first molar.

Collaborators

P FERREIRA, F BARATTO FILHO and LF Fariniuk participated in the execution of the experimental part. MSM HARTMANN, O LIMONGI and E PIZZATTO participated in drafting the article.

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