Scientific Research Publishing

Open Journal of Stomatology, 2023, 13, 25-31
https://www.scirp.org/journal/ojst
ISSN Online: 2160-8717
ISSN Print: 2160-8709

Root Canal System Variation in Mandibular Second Molar: Middle-Mesial Canal

Juan G. Robledo, María Pía Visconti Farkas, Pablo A. Rodríguez

Endodontics Department, School of Dentistry, University of Buenos Aires, Buenos Aires, Argentina
Email: juan.robledo@odontologia.uba.ar

How to cite this paper: Robledo, J.G., Farkas, M.P.V. and Rodríguez, P.A. (2023) Root Canal System Variation in Mandibular Second Molar: Middle-Mesial Canal. *Open Journal of Stomatology*, **13**, 25-31.
https://doi.org/10.4236/ojst.2023.131003

Received: November 29, 2022
Accepted: January 14, 2023
Published: January 17, 2023

Abstract

Middle-mesial canals in mandibular molars are present in the population depending on age, sex and ethnicity. However, limited literature alludes to its prevalence. Troughing procedures may enhance identification, cleaning and shaping. This case report expresses the recognition and management of middle-mesial canal in a mandibular second molar of 24 years old Hispanic-Latino male.

Keywords

Anatomical Variation, Middle-Mesial Canal, Root Canal Morphology, Mandibular Second Molar

1. Introduction

Successful outcomes in endodontics are conditioned by the effective removal of debrids, necrotic pulp tissue and bacteria. However, internal complexities in root canal systems and anatomical variations have an effect on the full elimination process. In previous studies, several anatomical variations were found in mandibular molars, such as C-shaped morphology of the roots, a separate distolingual root, the presence of isthmus connecting mesiobuccal (MB) and mesiolingual (ML) canals and middle mesial (MM) canal in the mesial root [1] [2].

The prevalence of MM canals is not clearly delineated, different methods have been used for its detection in mandibular molars. Recent studies have shown prevalence ranges from 1% to 46% with high incidence in younger patients, this may be due to continuous dentin deposition process that occurs with an increment of age in humans [3] [4]. Pomeranz *et al.* [5] classified MM canals as 1) fin: the instrument passes freely between MB or ML canal and MM canal, 2) confluent: MM canal has a separate orifice and joins MB or ML canal apically and 3)

independent: MM canal has a separate orifice and separate foramen.

Cone-beam computed tomographic (CBCT) imaging becomes a valuable tool when compared with 2-dimensional radiographic modalities in detection of extra canals. CBCT is commonly used in endodontic field for different procedures such as diagnosis, root canal shaping evaluation, root canal filling assessment and surgical endodontics [2].

Root canal orifices should be detected after full elimination of the pulp chamber roof. They can be localized at the angles in the floor wall junction. In addition, magnification can be used for "reading" the pulp chamber floor and identifying canal orifices [6]. This clinical case report describes the detection and management of MM canal in a mesial root of a second mandibular molar.

2. Case Report

A 24-year-old Hispanic-latino male in good general health attended the Endodontics Department, School of Dentistry, University of Buenos Aires for assessment and treatment of tooth 4.7. The patient complained of "pain in my right side jaw". Medical history was non-contributory, and he was not taking any medications at the initial visit. Clinical intraoral examination revealed no swelling and discomfort increased by percussion with an instrument and thermal stimulation on tooth 4.7. Radiographic examination revealed occlusal caries and widened periodontal ligament (PDL), reachable pulp chamber and root canals. The endodontic diagnosis was pulp necrosis and symptomatic apical periodontitis (**Figure 1**).

Local infiltration anesthesia was administered with 4% carticaine and 1:100.000 adrenaline (Anescart Forte, SIDUS, Buenos Aires, Argentina) and single-tooth dental dam isolation was completed. After caries elimination with high-speed hand-piece and round bur, the pulp chamber was accessed and irrigated with 5.25% of sodium hypoclorite (NaOCl). Dental operating microscope (Newton SRL, Buenos Aires, Argentina) and a DG16 endodontic explorer (Hu-Friedy, Chicago, IL, USA) were used to localize and identify the orifices of the root canals. An initial glidepath in all root canals was performed using #10 stainless steel K-files (Dentsply, Ballaigues, Switzerland) and the working length was confirmed using an electronic apex locator (Root ZX, J.Morita, Kyoto,

Figure 1. Pre-operative radiograph.

Japan) and corroborated radiographically. Under copious irrigation with 5.25% NaOCl, the root canals were instrumented with hand files and nickel-titanium (NiTi) rotary files with heat activation treatment (DENCO Super Files III, Longhua, Shenzhen, China). Obturation was completed with gutta-percha (GP) points size 30.04 and 30.06 (Meta Biomed, South Korea) and root canal sealer (ADSEAL, Meta Biomed, South Korea) (**Figure 2**). The pulp chamber was then sealed with restorative material. A post-operative periapical radiograph was taken after root canal treatment (**Figure 3**).

After three months follow-up, definitive restoration was installed (**Figure 4**) (**Figure 5**) and CBCT revealed anatomical configurations of root canal systems (**Figures 6-8**).

Figure 2. Root canal filling with GP. Note disposition of three mesial canals.

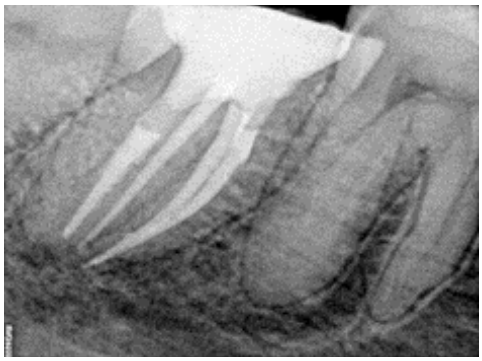

Figure 3. Post-operative radiograph.

Figure 4. Coronal restoration before installation.

Figure 5. Clinical view of coronal restoration.

Figure 6. CBCT lingual view (note confluence of MM and ML canals).

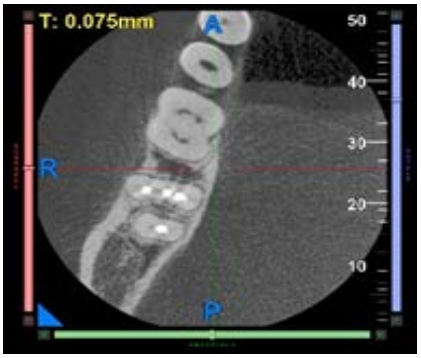

Figure 7. CBCT axial view.

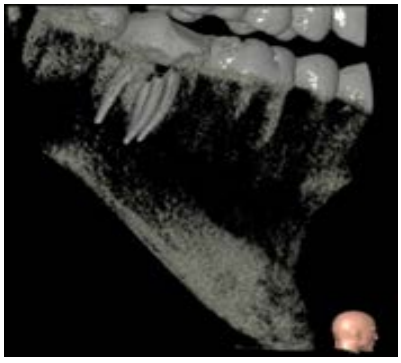

Figure 8. CBCT buccal view.

3. Discussion

Incomplete elimination of bacterial biofilms from complexities of root canals system can lead in persistent endodontic infection. Clear identification of root canal orifices, isthmuses and root canal morphology are key factors for predictable outcomes. However, high incidence of mandibular molars were extracted after root canal treatment than any other tooth type due to persistent biofilms present in isthmuses that were not clinically negotiable [1] [7]. There is a connection between untreated canals and isthmus and apical periodontitis. Infected canals enclose biofilms; if those areas are not efficiently disinfected by instrumentation and irrigants, root canal system remain uncleaned [4].

The most frequent configuration for mandibular second molar is two-roots and three-root canals. Vertucci type IV followed by Vertucci type II is the most prevalent root canal configuration in the mesial root. However, the implementation of contemporary diagnostic procedures showed that some complex anatomical variations do not fit into the eight categories of the Vertucci's classification, for example mandibular molars with various configurations in the mesial root [8].

MM canals have been reported showing a small orifice within the isthmus between the two orifices of the MB and ML canals. Some authors observed that the orifice of MM canals are mostly located close to ML canal, this disagree with this clinical case report where the orifice of MM canal was found close to MB canal, furthermore MM canal was confluent with ML canal, while MB canal was independent in accordance with Pomeranz's classification [1] [5]. Troughing procedures and minimal dentin removal between ML and MB canals (away from the furcal danger zone), may enhances the chance of locating MM canals, dental microscope with clear visibility and illumination and specialized instruments can contribute with effectiveness in removing biofilms [9].

Operating dental microscope could be convenient for expose root canal orifices. Suda *et al.* [10] in their study over 260 teeth, found that the difference in orifice canals identification was higher when dental microscope was used compared with naked eye and surgical loupes. However, detection rate may be influenced by internal anatomic variations of root canal systems.

Endodontics rotary files are effective for root canal preparation and elimination of infected dentine. Nickel-titanium (NiTi) rotary instruments with flexibility and elasticity features are recommended for instrumentation in curved canals. Manufacturing processes of rotary files from controlled memory NiTi wire (CM Wire) are more resistant to fatigue failure than instruments made from conventional NiTi wire [11]. The main reasons of these procedures are to impart a more martensitic phase into the instruments at normal body temperature, and thus obtain the maximum flexibility [12]. In this present clinical case, after observation of the root canal anatomy on the mesial root, we decided to use NiTi CM wire instruments-blue color (obtained due to titanium oxide layer on the surface after heating-cooling treatment) with softness and ductility features.

4. Conclusion

Anatomical variations in the root canal system are genetically determined and influenced by age. CBCT and magnification are useful for identification of the internal architecture and in consequence, reinforcing the efficient removal of necrotic tissue, bacteria and their byproducts.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Nosrat, A., Deschenes, R.J., Tordik, P.A., Hicks, M.L. and Fouad, A.F. (2015) Middle Mesial Canals in Mandibular Molars: Incidence and Related Factors. *Journal of Endodontics*, **41**, 28-32. https://doi.org/10.1016/j.joen.2014.08.004

[2] Neelakantan, P., Subbarao, C., Ahuja, R., Subbarao, C.V. and Gutmann, J.L. (2010) Cone-Beam Computed Tomography Study of Root and Canal Morphology of Maxillary First and Second Molars in an Indian Population. *Journal of Endodontics*, **36**, 1622-1627. https://doi.org/10.1016/j.joen.2010.07.006

[3] Azim, A.A., Deutsch, A.S. and Solomon, C.S. (2015) Prevalence of Middle Mesial Canals in Mandibular Molars after Guided Troughing under High Magnification: An *in vivo* Investigation. *Journal of Endodontics*, **41**, 164-168. https://doi.org/10.1016/j.joen.2014.09.013

[4] Tahmasbi, M., Jalali, P., Nair, M.K., Barghan, S. and Nair, U.P. (2017) Prevalence of Middle Mesial Canals and Isthmi in the Mesial Root of Mandibular Molars: An *In Vivo* Cone-Beam Computed Tomographic Study. *Journal of Endodontics*, **43**, 1080-1083. https://doi.org/10.1016/j.joen.2017.02.008

[5] Pomeranz, H.H., Eidelman, D.L. and Goldberg, M.G. (1981) Treatment Considerations of the Middle Mesial Canal of Mandibular First and Second Molars. *Journal of Endodontics*, **7**, 565-568. https://doi.org/10.1016/S0099-2399(81)80216-6

[6] Robledo, J. and Rodriguez, P. (2021) Anatomic Variation in Palatal Root of Maxillary Second Molar: Endodontic Management. *Open Journal of Stomatology*, **11**, 159-165. https://doi.org/10.4236/ojst.2021.114013

[7] Toure, B., Faye, B., Kane, A.W., *et al.* (2011) Analysis of Reasons for Extraction of Endodontically Treated Teeth: A Prospective Study. *Journal of Endodontics*, **37**, 1512-1515. https://doi.org/10.1016/j.joen.2011.07.002

[8] Ahmed, H.M.A. and Dummer, P.M.H. (2017) Advantages and Applications of a New System for Classifying Roots and Canal Systems in Research and Clinical Practice. *European Endodontic Journal*, **3**, 9-17. https://doi.org/10.5152/eej.2017.17064

[9] Nagahara, T., Takeda, K., Wada, K., Shirawachi, S., Iwata, T., Kurihara, H. and Shiba, H. (2020) A Mandibular Second Molar with a Middle Mesial Root Canal. *Clinical Case Reports*, **8**, 1015-1020. https://doi.org/10.1002/ccr3.2779

[10] Yoshioka, T., Kobayashi, C. and Suda, H. (2002) Detection Rate of Root Canal Orifices with a Microscope. *Journal of Endodontics*, **28**, 452-453. https://doi.org/10.1097/00004770-200206000-00008

[11] Shen, Y., Qian, W., Abtin, H., Gao, Y. and Haapasalo, M. (2011) Fatigue Testing of Controlled Memory Wire Nickel-Titanium Rotary Instruments. *Journal of Endo-*

dontics, **37**, 997-1001. https://doi.org/10.1016/j.joen.2011.03.023

[12] Tabassum, S., Zafar, K. and Umer, F. (2019) Nickel-Titanium Rotary File Systems: What's New? *European Endodontic Journal*, **4**, 111-117. https://doi.org/10.14744/eej.2019.80664