

The middle mesial canal of mandibular first molars

Dr Paul McCabe addresses the less well known middle mesial canal, which can lead to endodontic problems in mandibular first molars.

Introduction

Root canal system anatomy plays a significant role in endodontic success and failure.^{1,2} A statistically significant percentage of failures are related to missed root canal systems. Missed canal systems potentially hold tissue, bacteria and related irritants that inevitably contribute to clinical symptoms and lesions of endodontic origin.^{2,3}

Several tooth groups have roots that notoriously hold additional canal systems such as the:

- maxillary first premolars,
- the maxillary first molars,
- the mandibular incisors, and
- the mandibular molars.⁴

Mandibular first molar anatomy

The mandibular first molar most commonly has three canals: two mesial canals (mesiolingual, mesiobuccal) and one distal canal (Figure 1). In approximately 30 per cent of mandibular first molars there is a second distal canal system (Figure 2).^{4,5,6} When two distal canals are present, they are called the distobuccal and the distolingual canals. A less well known but nonetheless important canal, the **mid mesial canal system** may also be present.

The majority of literature pertaining to the anatomy of the mandibular first molars overlooks the possible presence of a *mid mesial canal system* focusing instead on the possibility of two distal canals. This canal may be located anywhere between the mesiobuccal and mesiolingual orifices. The canal itself may be independent with a separate foramen or may join apically with either the mesiobuccal or mesiolingual canals.

In 1974 Vertucci and Williams as well as Barker et al described the presence of an independent middle mesial canal.^{7,8} More recently in 1989, Fabra-Campos in a study of 760 teeth found that the mid mesial canal was present in 2.6 per cent of the cases examined.⁹

The purpose of this article is to highlight the presence of this mid mesial canal system and to assist in its identification during root canal treatment.

Armamentarium and techniques for identification of the mid mesial canal

Anatomic familiarity is a prerequisite and a good access cavity is essential. In the case of the mandibular first molar with three

Author:

Paul S. McCabe B.D.S. (N.U.I.)
MSc (V.U. Manc) M.G.D.S. (R.C.S.I.)
MScD (U.W.C.M.)
1 Cloonarkin Drive
Oranmore
County Galway
Ireland
Tel: 00353-91-790609
Fax: 00353-91-796883

Correspondence to:

Paul S. McCabe
1 Cloonarkin Drive
Oranmore
County Galway
Ireland

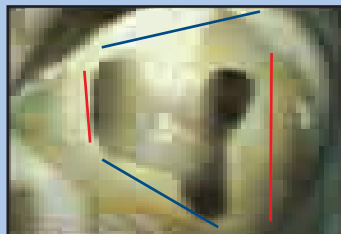


Figure 1: The classical access cavity outline for a mandibular first molar with three canals - mesiobuccal, mesiolingual, and one distal canal.



Figure 2: The classical access cavity outline for a mandibular first molar with two distal canals (distobuccal, distolingual).

canals, a roughly rectangular cavity outline tapering distally is the ideal cavity outline (Figure 1).

When there is a second distal canal system (30 per cent mandibular first molars), the access cavity should be modified and appropriately extended i.e. widened buccolingually on the distal aspect (Figure 2).

With regards to the mid mesial canal, the mesial extension of the

access cavity should extend to almost incorporate the mesiobuccal and mesiolingual cusp tips and run parallel to the mesial marginal ridge (Figure 2).

Pre-operative radiographic analysis is critical for endodontics. Multiple angled periapical views help reveal the presence of roots and canal systems. However, these may be of little value in the identification of a mid mesial canal system in a mandibular molar



Figure 3: Angled pre-operative periapical radiograph of a mandibular first molar requiring root canal treatment. The primary canal systems can be difficult to identify and the smaller accessory systems e.g. the mid mesial canal even more so.

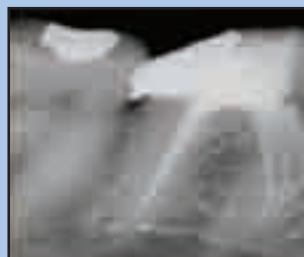


Figure 4: Angled post-operative view of same tooth showing three separate mesial canals (mesibuccal, midlingual and mid mesial).



Figure 5: Actual access cavity showing the three fully prepared mesial canals of the same tooth.



Figure 6: Access cavity of a mandibular left first molar showing the orifice for the mid mesial canal (black arrow) positioned in the mesiolingual canal orifice (red arrow).

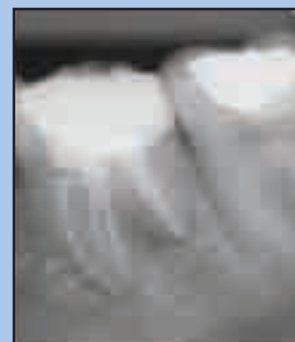


Figure 7: Radiograph showing the completed root canal treatment of the tooth in Figure 6.



Figure 8: The classical appearance of the 'white line' in the isthmus between the mesiobuccal and mesiolingual orifices. This is the same case as is illustrated in Figure 5.



Figure 9: Illustrates the impact of root canal preparation in the mid root section of the mesial root of a lower molar. The 'danger zone' is the concavity denoted by the red arrows. As the root canal space is prepared, the preparation advances towards the 'danger zone'. This may be more exaggerated in the case of the mid mesial canal system.

because it is essentially radiographically invisible (Figures 3, 4 and 5).

Illumination and magnification will play a huge role in the identification of this anatomical feature if present. It can be found anywhere in the pulp chamber wall/floor fold between the mesiobuccal canal and the mesiolingual canal orifices. Studies have shown the impact illumination and magnification has on uncovering the presence of the second mesiobuccal canal system in maxillary molars (Figures 6 and 7).^{10,11}

The use of ultrasonic tips with their abrasive coatings helps remove (sand away) dentine conservatively. The working end of these tips are 10-times smaller than the smallest round bur and consequently they can be introduced into the wall/floor angles of the pulp chamber to look for hidden systems.

The use of such tips eliminates the bulky heads of conventional handpieces which often obstruct vision and allows this 'chasing' to be carried out under direct vision. Any instrumentation on the floor of the pulp chamber should only be carried out under direct vision because of the risk of perforation.

The classical 'white line' between the mesiobuccal and mesiolingual orifices should invite further exploration in this area (Figure 8). This area can be chased and subsequently explored with small hand files for a 'catch'.

The preparation of this accessory canal system should be done cautiously and conservatively. With the increased use of rotary nickel titanium instruments in root canal preparation, the resulting preparations are better centred in the root. This may bring the preparation closer to the so called 'danger zone' which is the furcation side of the mesial root. The geometry of the mesial root shows it to be hourglass shaped and so a preparation in the mid section of the root is automatically closer to the danger zone increasing the possibility of a perforation.

Conclusions

The presence of the mid mesial canal in the mesial root of the mandibular first molar is reported to have an incidence of one to 15 per cent.^{8,12,13} This canal may be located anywhere between the mesiobuccal and mesiolingual orifices. The canal itself may be independent with a separate foramen or may join apically with either the mesiobuccal or mesiolingual canals. Canal preparation is a key factor in endodontic success. Failure to prepare a canal system will often result in endodontic failure. The dentist should be aware of the possibility of a mid mesial canal and should explore for its presence rather than leave it to chance.

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