

# Masterclass in Clinical Practice

## Endodontics

with

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## The MB2 canal in Maxillary Molars - Part 2: Canal Negotiation and Preparation



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A study by Ibarrola et al<sup>1</sup> identifies the main reasons for difficulty when negotiating MB2 canal systems. Canal negotiation can be impeded by the presence of pulp stones, diffuse calcifications, and anatomical variations such as transverse anastomoses and cul-de-sacs. Dentinal mud created during negotiation of challenging MB2 canals accounts for several canals that could only be partially negotiated in their study.

In addition, it is suggested that the use of lubricating and chelating agents and ultrasonic irrigation can be beneficial in the elimination of dentinal mud that often prevent negotiation of canal systems. In some of these cases, previously treated endodontically with missed MB2 canals, the negotiation of the missed MB2 canals were affected by sealer and debris created during root canal preparation and obturation of the MB1 canal.

MB2 canals often join the MB canal at an acute angle that pose an extremely high risk for instrument fracture.<sup>2</sup> It is therefore recommended to first prepare the MB1 canal to full working length before any attempt to negotiate the MB2 canal system, after or before location of the MB2 canal as discussed in Part 1 of this series.<sup>3</sup>

### Problems with conventional hand instruments

When using conventional stainless-steel size 06, 08 or 10 K-files that has a constant taper of 2%, it must be realized that the file becomes progressively larger compared to the tip. A size 08 K-file has an 0.08 tip (D=0) but at 10 mm (D=10) from the tip the file the dimensions change to 0.28 mm (Figure 1). There is no data to the authors' knowledge available on the dimensions of MB2 canal systems in maxillary molars. Marton et al<sup>4</sup> reported a mean diameter of 0.25 mm in a mesiodistal diameter and 0.61 mm in a buccolingual direction for a mesiobuccal root canal systems at a level 3 mm from the root apex. From clinical experience we know that the dimensions of MB2 canal systems must be at least 50-75% smaller compared to the reported dimensions for a MB1 canal systems. Even if we enter a canal with a 0.6 K-file, the file will travel only a short distance before the sides of the instrument will bind with the walls of a narrow canal. Clinicians often think that the canal is blocked or calcified at this point, as it is very difficult to distinguish between taper lock of the file in the canal or a true obstacle. This is usually the time when clinicians give up on the negotiation of the MB2 canals.

The next obstacle in negotiating MB2 canal systems is the fact that these canals often present with an abrupt curvature<sup>2</sup>, in or after the first 1-4 mm of the root canal system (Figure 2). When conventional size 06, 08 or 10 K-files are used for initial canal negotiation, it is often found that the file meets severe resistance without any progress. These small files lack rigidity required to transverse constricted spaces and often buckle when negotiation forces are apically directed.<sup>5</sup>

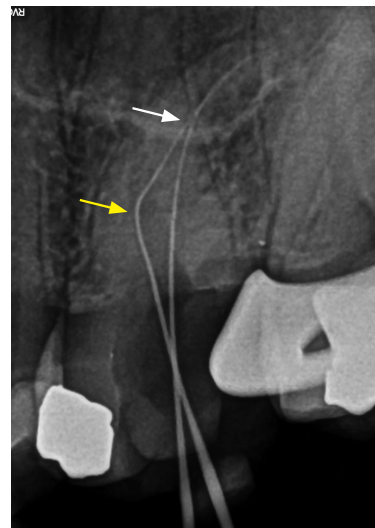
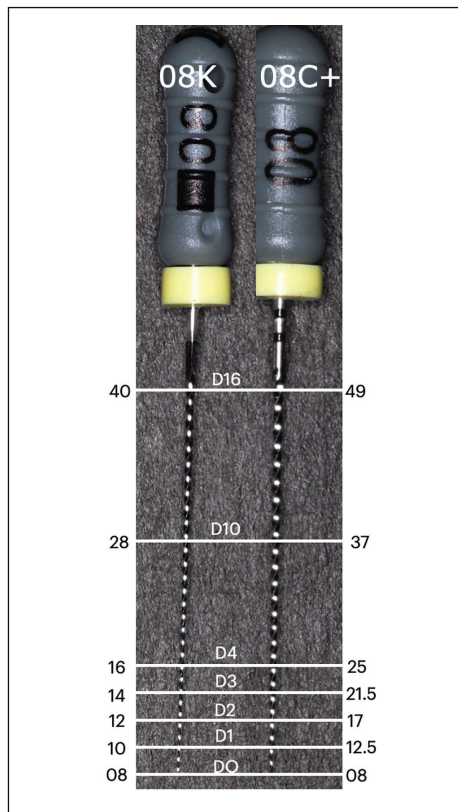


Figure 2: Length determination periapical radiograph of a left maxillary first molar with size 08 K-files in the MB1 and MB2 canals that confirm that the two canals join in apical third of the root (white arrow). Note the abrupt curvature in the MB2 canal system (yellow arrow).

Figure 1: Comparison of file diameter between size 08 K and 08 C+ files (21mm) from D0 – D16. The 08 K-file has a constant increase taper of 2% compared to the 08 C+ file that have 4.5% taper increase from D0-D4 and thereafter a constant 2% taper increase up to D16.

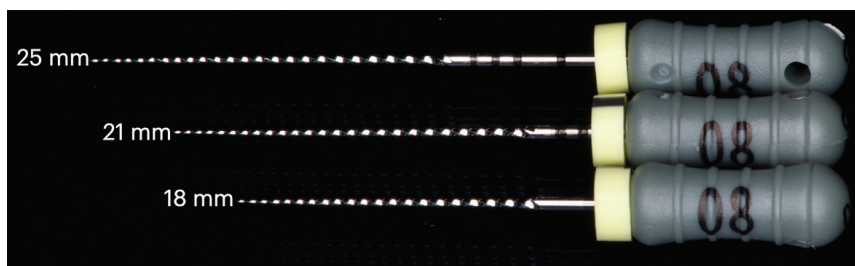


Figure 3: Different lengths of size 08 C+ files (Dentsply Sirona)(18, 21 and 25 mm)

### C+ files for canal negotiation

The authors suggest using an 18 mm long, size 08 C+ file (Dentsply Sirona)(Figure 3), to negotiate the canal up to the first 4-5 mm of canal length or past the abrupt curvature. C+ files are machined from heat-tempered stainless-steel blanks with a square cross section to improve resistance to distortion. The apical 4 mm of each file size is tapered to make the file more rigid with 300% more gain in resistance to buckling. A pyramidal tip design allows for better negotiation of constricted canals because of the increased cutting ability.<sup>5</sup>

### Clinical protocol for negotiating MB2 canals

The size 08 C+ file must be used by keeping the file straight without curving the body of the file to allow finger manipulation of the instrument. When a file enters the orifice

of the MB2 canal you will notice that the handle of the file always projects 30-50 degrees towards the distal aspect of tooth (Figure 4a).

A common error clinicians make is to grasp the handle of the file bringing it more mesial to allow for finger manipulation, as space is limited so far back in the patient's mouth. This results in a bend in the middle of the working part of the instrument (Figure 4b), and it negates all the negotiation potential at the tip of the instrument resulting in a lack of progression.

The abovementioned scenario happens especially when 21- or 25 mm file lengths are used to initiate canal negotiation. The size 08 C+ file, 18 mm in length, is 3 mm shorter compared to the 21 mm files (Figure 3) and often makes the difference between success and failure during

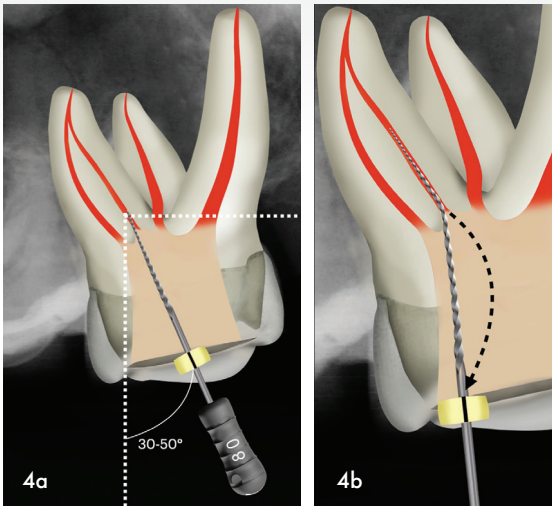


Figure 4: (a) Size 08 C+ file must be kept straight without curving the body of the file. When a file enters the orifice of the MB2 canal the handle of the file always projects 30-50 degrees towards distal; (b) If clinicians grasp the handle of the file initiate manipulation it results in a bend in the middle of the working part of the instrument and negates all the negotiation potential at the tip of the instrument.

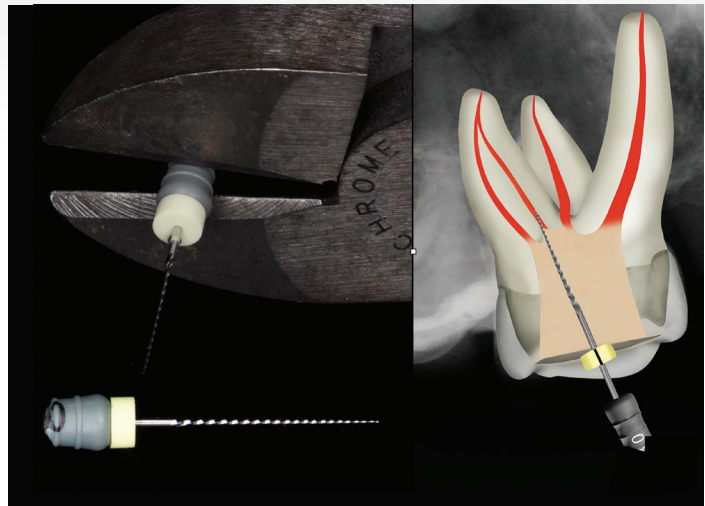


Figure 5: The handle of a size 08 C+ file is cut off using a cutting plier to reduce the length of the file to ensure that the file is kept in a straight line during initial canal negotiation.

canal negotiation. If the space is very limited, for example negotiating the MB2 system on a second maxillary molar, 50% of the handle length can be cut off using a cutting plier to reduce the file length even more (Figure 5). This will ensure that the file can be kept in a straight line during the initial stages of canal negotiation.

Because the 08 C+ file is tapered 3.5% in the last 4mm of the file, it is expected to experience resistance to further canal negotiation as the file tip drastically enlarges in diameter compared to conventional 2% tapered instruments.

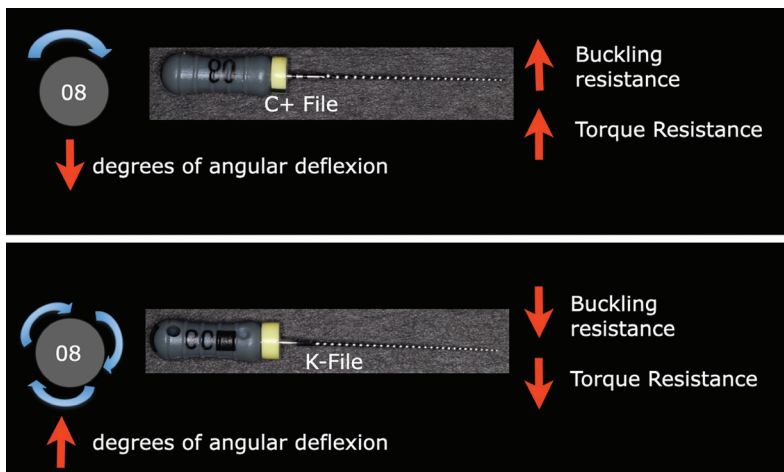


Figure 6: C+ files demonstrate high buckling and torque resistance with low angular deflexion compared to stainless steel K-files that show the exact opposite characteristics.

To summarise, C+ files are stiffer files (high buckling and torque resistance) with pyramidal tips that can engage and cut dentine faster and more efficiently in calcific conditions, compared to conventional K-files. K-files usually “kink” or bend (low buckling and torque resistance) when it hits blocked or calcified areas in canals (Figure 6).<sup>6</sup> A disadvantage of C+ files is its low angular deflection (low degrees or revolutions to failure) compared to conventional K-files that present with a high angular deflection (high degrees or revolutions to failure).<sup>6</sup>

The method in which these files are used in narrow canal systems is very important to prevent instrument fracture. It is recommended that the C+ file is used in a clockwise, 90 degree motion with apical pressure (Figure 7a), before disengaging by pulling the file back in a counterclockwise direction (Figure 7b). These motions can be repeated until the file has progressed a maximum of 1.5-2 mm before the file is removed and inspected under magnification. If the file shows any

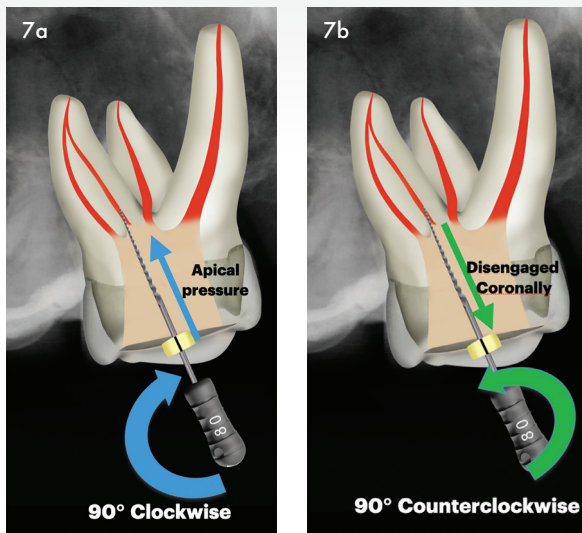


Figure 7: (a) It is recommended that the C+ file is used in a clockwise, 90 degrees motion with apical pressure; (b) before disengaging by pulling the file back in a counterclockwise direction.

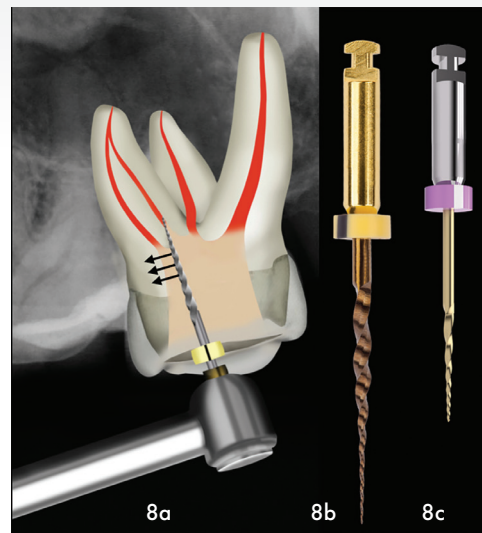


Figure 8: (a) ProTaper Universal SX Orifice Opener is used in a back-stroke brushing motion away from furcal danger to relocate the orifice in a more mesial direction, creating more coronal space for smaller hand files to progress further down the canal; (b) ProTaper Ultimate SX Orifice Opener; (c) TruNatomy Orifice Modifier.

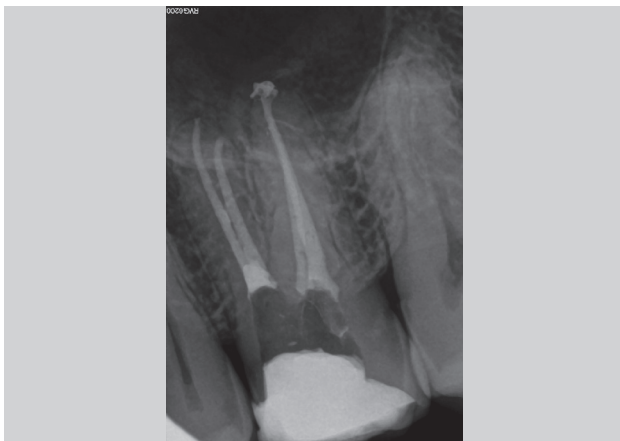


Figure 9: Postobturation periapical radiograph of a left first maxillary molar that presented with separate MB1 and MB2 canal systems. Note that the MB2 was shorter compared to the MB1 canal system.

signs of a sharp bend in the apical 4 mm or unwinding of flutes then it should be discarded. The canal must irrigated and recapitulated with a size 08 K-file before attempting another negotiation cycle. Canal negotiation is maintained until a depth of approximately 4 mm is reached from the pulp floor level.

The pre-negotiated coronal part of the canal can now be flared with a rotary ProTaper Universal (Dentsply Sirona) or ProTaper Ultimate SX Orifice Openers (Dentsply Sirona) or a TruNatomy Orifice Modifier (Dentsply Sirona) (Figure 8). These instruments can be used in a back-stroke brushing motion away from furcal danger, relocating the orifice in a

more mesial direction and creating more coronal space for smaller hand files to progress further down the canal.

After irrigation and recapitulation of the root canal system, a conventional pre-curved 2% tapered size 08 K-file can then be used to negotiate the rest of the canal up to full working length. If another obstruction or resistance is encountered a C+ file can be used again to negotiate another 1.5 - 2 mm of canal length to break through any calcifications. This can be followed by a conventional precurved size 08 K-file for further canal negotiation.

### Converging root canal systems

If the MB1 and MB2 canals are separate, the MB2 canal is generally shorter compared to the principal canal (Figure 9).<sup>1</sup> However, if it suspected that the two canals join in midroot or apical third of the root (Figure 2) then it is suggested to place a gutta percha cone in the prepared MB1 canal and a hand file in the MB2 canal. The hand file is moved up and down to score the gutta percha cone. After removal of the gutta percha cone it is examined under magnification to identify a groove, scratch or channel that indicates convergences of the two canals. The distance from the apical foramen to the marked point of confluence must be subtracted from the original working length of the MB1 canal, to determine the working length for the MB2 canal (Figure 10)<sup>7</sup>. This prevents reaching the common



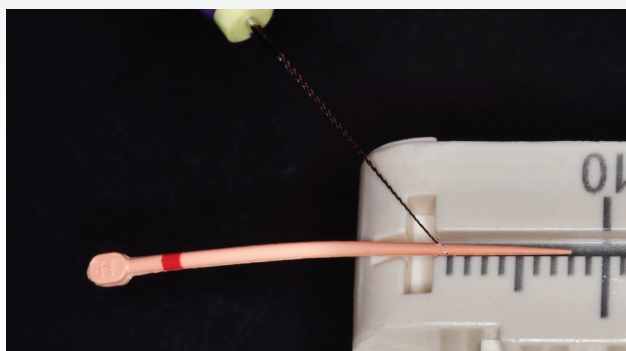


Figure 10: Gutta percha cone from the prepared MB1 canal and scored with a K-file to mark the point of canal convergence. The distance from the tip of the cone to the marked point of confluence must be subtracted from the original working length of the MB1 canal, to determine the working length for the MB2 canal.

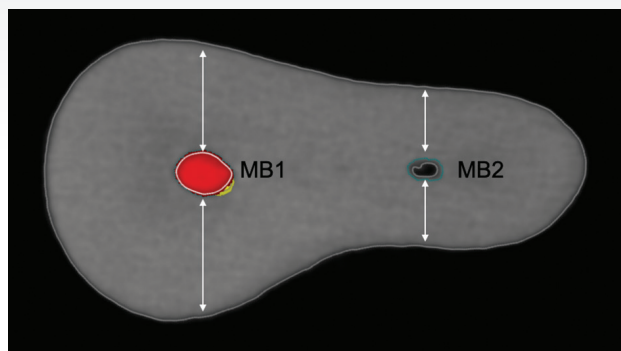


Figure 11: Axial slice of micro-CT image of a midroot section of a mesiobuccal root of a maxillary first molar. Note that there is less dentine structure surrounding the MB2 canal compared to MB1 canal system.



Figure 12: Periapical radiograph of a left first maxillary molar where the MB2 canal's working length was adapted to ensure not reaching the common part of the mesiobuccal canal and foramen from two different angles with preparation instruments avoiding over-instrumentation, unnecessary weakening, and over-stripping of the apical part of the root canal.

part of the canal and foramen from two different angles with preparation instruments, avoiding over-instrumentation, unnecessary weakening, and eventual over-stripping of the apical part of the root canal.<sup>8</sup> A more conservative shaping protocol, to one file size smaller compared to the MB1 canal system is also recommended as there are a natural thinning of the root present in a buccopalatal direction (Figure 11) resulting in less remaining dentine thickness after canal preparation around the MB2 canal.<sup>7</sup> Figure 12 shows a clinical case of a

left first maxillary molar where the MB canals were managed according to above mentioned protocols.

### Conclusion

As discussed in Part 1 of this series, MB2 canal location and negotiation remains a challenging part of clinical endodontics. This Masterclass article highlights the main reasons for difficulty and a protocol for canal negotiation of MB2 canals in maxillary molars.

### References

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