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CASE REPORT

Endodontic Treatment of First Mandibular Molar with Severely Curved Roots

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ABSTRACT

The apical foramen (AF) varies in size and configuration with maturity. Before maturation, the AF is open. With time and deposition of dentin and cementum, it becomes smaller and funneled. Significantly, the foramen usually does not exit at the true (anatomic) root apex, but it is offset by approximately 0.5 mm and seldom more than 1.0 mm from the true apex. The degree of deviation is unpredictable and may vary considerably from the average, particularly in the older tooth that has undergone cementum apposition. For this reason, root canal preparation and obturation end short of the anatomic root apex as seen in the radiograph. Usually, the AF is not visible radiographically. The clinician relies on averages or electronic measuring devices to determine the extent of canal preparation and obturation.

Keywords: Apical foramen, Curved root canal, Root canal treatment, Warm vertical compaction.

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CASE REPORT

A 30-year-old female was referred from the general dental practitioner clinic. The tooth was opened and formocresol pulpotomy was done; neither fistulae nor edema was observed.

A standard endodontic procedure was carried out after local anesthesia of 2% lidocaine hydrochloride containing 1:100,000 epinephrine. A rubber dam was placed for endodontic access; then, the temporary restoration was removed clearly.

Examination of the pulp floor with an endodontic explorer revealed three distinct canals – mesiobuccal (MB), mesiolingual (ML), and distal canals (D). A K-type file (Maillefer, Switzerland) was used for gross removal of pulp tissue from the three main canals. The canals were negotiated using a small file size 10 (Maillefer, Switzerland), using 17% ethylenediaminetetraacetic acid (EDTA) (Technical + General LTD London, UK) solution, and then irrigating with 5.25% sodium hypochlorite solution (NaOCl).

Determination of working length by Advanced Apex Locator NSK IPEX 2 Locator (Fig. 1) was as follows: MB: 18.5 mm, ML: 18 mm, and D: 21 mm.

ProTaper SX (Dentsply Maillefer) was then used to enlarge the orifices of the canals. All canals were chemomechanically prepared using crown-down technique. ProTaper nickel–titanium (NiTi) file sized S1, S2, and F1 were used successively (Fig. 2). The canals were then irrigated by NaOCl and 17% EDTA as irrigating solution.

Fig. 1: NSK IPEX2 apex locator

Fig. 2: ProTaper Universal NiTi rotary instrument (Dentsply Maillefer)

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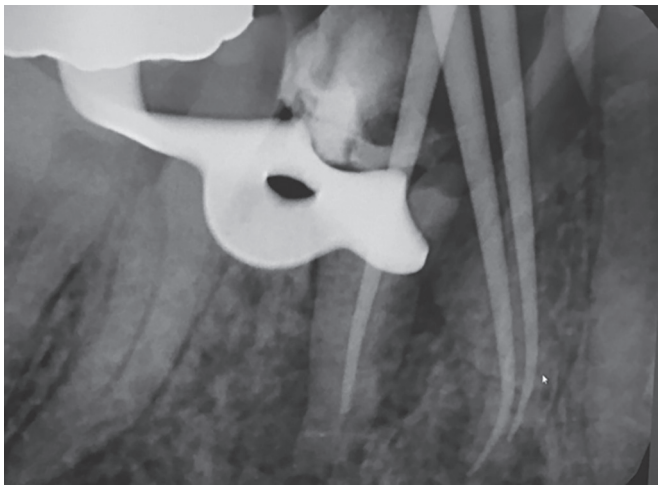

Fig. 3: Horizontal periapical radiograph showing gutta-percha inside the canals before condensation; also note the severely curved MB and ML canals

Fig. 4: Calamus Dual used for warm vertical compaction of the gutta-percha

Figure 3 shows master apical cone radiograph prepared canals were obturated using the warmed vertical compaction technique by Calamus Dual Maillefer Dentsply (Fig. 4) and AH 26 was used as a sealer. Filled orifices were sealed adhesively with glass ionomer (Ketac Fil) used as a coronal seal to avoid any coronal bacterial penetration into the canal system. Postobturation radiograph was taken and it showed filling of steeply curved distal canal by the warmed gutta-percha after warmed vertical compaction (Fig. 5).

DISCUSSION

The only consistent aspect of the apex region is its inconsistency.[1-3] The canal may take twists and turns, divide into several canals to form a delta with ramifications on the apical root surface, or exhibit irregularities in the canal wall. Generally, these aberrations are neither detectable nor predictably negotiable, and are neither well debrided nor obturated. The apical region of the canal and apical foramen (AF) are often very irregular. A common concept is that canals round out in this apical region; this is not always true. Canals are frequently long oval or even ribbon-shaped apically.[4]

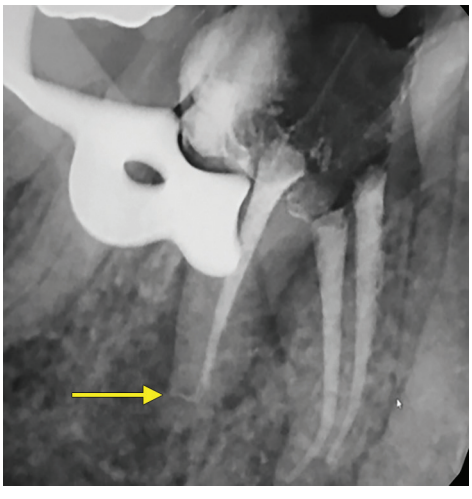

Fig. 5: After warmed vertical compaction, note the steeply curved distal canal filled by the warmed gutta-percha

These nonround canals cannot be enlarged to a round shape without perforating or weakening the root.[4] To debride a region of the canal space completely, the instrument must contact and plane all walls.[5]

Despite continual improvements in design and physical properties, there are still no instruments that totally clean and shape all root canal spaces.

Irregular canal spaces do not correspond to and cannot always be well prepared by an instrument with a regular (round) shape. In addition, stainless steel instruments are relatively inflexible, which renders them not particularly adaptable to canal curvatures. The NiTi instruments are more flexible and adapt more readily to fine, curved canals, but have no advantage over stainless steel files in irregular canal spaces.[6,7] These incongruences between reality and ideal shape require judicious and skillful use of canal preparation instruments to maximize debridement and avoid procedural errors.

Different approaches to obturation are available, depending on the size of the prepared canal, the final shape of the preparation, and irregularities within the canal; the overriding factor is operator preference.[8]

The two traditional techniques are lateral and vertical compaction of gutta-percha; sealability is similar in both.[9,10]

More recent approaches have been introduced that depend on warming and softening formulations of gutta-percha with special devices and instruments and then placing the gutta-percha incrementally.

Lateral compaction of gutta-percha may be used in most situations; exceptions are severely curved or

abnormally shaped canals or those with gross irregularities, such as internal resorption. However, lateral compaction may be combined with other.

The warm vertical compaction technique requires a heat source and various-sized pluggers for compaction of the thermoplasticized gutta-percha.

The technique consists of fitting a gutta-percha cone with a taper similar to the canal, short of the apex, and applying heat using a flame-heated carrier, the gutta-percha is softened by the heat and becomes plastic. Pluggers are then placed in the canal with apical pressure to produce a hydraulic force that moves the gutta-percha apically, against the canal walls, and into canal irregularities, such as accessory canals. Gutta-percha is then added in small increments, and each increment of gutta-percha is heated and softened and packed vertically until the entire canal is filled.[11]

CONCLUSION

Root canals extend the length of the root, beginning as a funneled orifice and exiting as the AF. Most canals are curved, often in a faciolingual direction.[12,13] Therefore, a curved canal is often undetectable on facial projection radiographs. As a result, the uninitiated or uninformed clinician may assume that a canal is straight and may overenlarge, what is in reality a facial or lingual curvature, resulting in ledging or perforation. The operator should always assume that a canal is curved.

Canal shape varies with root shape and size, degree of curvature, and the age and condition of the tooth.

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