

The radiculous' premolars: Case reports of a maxillary and mandibular premolar with three canals

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Abstract

Successful root canal therapy requires an accurate diagnosis and management of complex root canal morphology. Although the occurrence of three root canals in maxillary and mandibular premolars is very rare, the clinician must be able to identify it clinically and radiographically to make the necessary changes in his shaping and obturation techniques. We present the endodontic management of a maxillary first premolar with three separate roots and canals, which was diagnosed with the aberrant anatomy only after the access preparation. Then, a mandibular premolar with three root canals and fused roots, which were diagnosed radiographically, is presented. The necessary modifications of the routine clinical steps and the application of dental operating microscope for successful management of the complex anatomy, with emphasis on access modifications and radiographic interpretations are also explained. Teeth with extra roots and/or canals pose a challenge in clinical management. Identifying them early is necessary to facilitate appropriate modifications in treatment protocol, armamentarium to be used and plan optimal number of treatment sittings.

Key words: Anatomic variation, dental operating microscope, mandibular premolar, maxillary premolar, root canal treatment

INTRODUCTION

Successful root canal therapy requires a thorough knowledge of root and root canal morphology. Indeed, the major causes of endodontic treatment failure are incorrect canal instrumentation, incomplete canal obturation, and untreated major canals.^[1] Additional canals may be detected by clinical investigation of the floor of the pulp chamber and radiographic examination of the roots.^[2] The maxillary first premolar typically has two canals (64-88%) and sometimes a single canal (9-36%). Three-rooted maxillary first premolars are uncommon (0.5-1%) and are similar to that of adjacent maxillary molars, and are referred to as “small molars” or “radiculous”.^[3,4] Mandibular second premolar has one root canal at the apex in 97.5% and two canals in only 2.5% of the cases.^[5] However, only a 0.4% incidence of three root canals are reported.^[6] One promising noninvasive method of detecting these enigmatic variations involves the use of magnifying visual aids such as the operating microscope, which offers homogeneous illumination and magnified view, to allow a clear visualization of the site. We present here case series reports of rare variations in root canal configuration of the maxillary first premolar and mandibular second premolar and their management.

CASE REPORTS

Case 1

A 50-year-old Indian male with a noncontributory medical history sought treatment at the Department of Conservative Dentistry and Endodontics, Bapuji Dental College and Hospital, Davangere Karnataka, India. His chief complaint was ‘pus drainage in the upper right back teeth region’. Clinical examination of soft tissues revealed a patent draining sinus tract in the labial alveolar mucosa in 14 region. Dental examination revealed deep class II caries mesial occlusal (MO) with respect to the right maxillary first premolar, and radiographic examination revealed mesio-coronal radiolucency in close proximity to pulp chamber with diffuse periapical radiolucency [Figure 1a]. The preoperative IOPAR did not reveal any information about extra roots or canals. A diagnosis of necrotic pulp with chronic periradicular abscess was made. Nonsurgical endodontic treatment was planned in 14 over two visits. After excavation of caries and preendodontic management, entry into the pulp chamber was made, where 2 distinct canal orifices were found (buccal and lingual). Gates Glidden drills 4, 3, 2, with a brushing motion were used in a crown-down fashion to enlarge the canal orifices. Canals were scouted using a 10k file (Mani, Inc., Tochigi, Japan) using

RC prep (Premier Products Co.) as a lubricant. A mild ledge like obstruction was felt at the cervical thirds of the buccal canal. The working length IOPAR taken at an eccentric angle revealed that mesio-distal width of mid root was equal to that of crown and double periodontal ligament space (distally) was found in radiograph, which gave evidence of the presence of another root distally [Figure 1b]. At this juncture, the access preparation was reevaluated under microscope and explored with DG-16 [Figure 1c]. The buccal end of the access was extended mesio-distally using an Endo Z bur (Dentsply) in order to explore for the mesiobuccal or distobuccal orifices. A distobuccal orifice was located and scouted with 10k file, which revealed an off-axis handle position. Access opening was extended distobuccally just coronal to the buccal bifurcation. Working lengths were reconfirmed with apex locator and another working length IOPAR was taken revealing the mesiobuccal, distobuccal and palatal canals in Vertucci’s type 5 with three roots configuration.^[7] The canals were cleaned and shaped with hand K files and nickel titanium rotary files (Protaper, Dentsply). Calcium Hydroxide (Ultracal, Ultradent) was used as interappointment dressing for a period of 4 weeks, following which the canals obturated with standardized gutta-percha points [Figure 1d] and AH plus sealer by lateral condensation technique [Figure 1e]. A dual-cure composite resin (Luxacore Z-Dual, DMG) postendodontic restoration was given. A small amount of sealer extrusion was seen through the palatal canal. The patient was followed-up regularly for 6 months, which revealed complete closure of sinus tract.

Case 2

A 37-year-old Indian male with a noncontributory medical history sought treatment at the clinic with a history of irreversible pulpitis. Dental examination revealed intact composite class 2 restorations (MO and DO) with respect to left mandibular second premolar (35). Radiographic examination revealed mesio-coronal radiopacity and a distocoronal radiopacity with underlying radiolucency in close proximity to pulp chamber [Figure 2a]. The preoperative IOPAR revealed a sudden disappearance of the main canal at middle one thirds of the root, indicative of splitting of root canals at that level. A radiolucent line running vertically from midroot level to the apex, indicated evidence of another root [Figure 2b].

Nonsurgical endodontic treatment was started for 35 and on entering the pulp chamber a large canal orifice was observed. Canal was carefully scouted using a 10k file where a buccal canal was easily located, while straight line access to the mesiolingual and distolingual canals were difficult. Hence, the access was reevaluated under microscope, and the main canal was enlarged

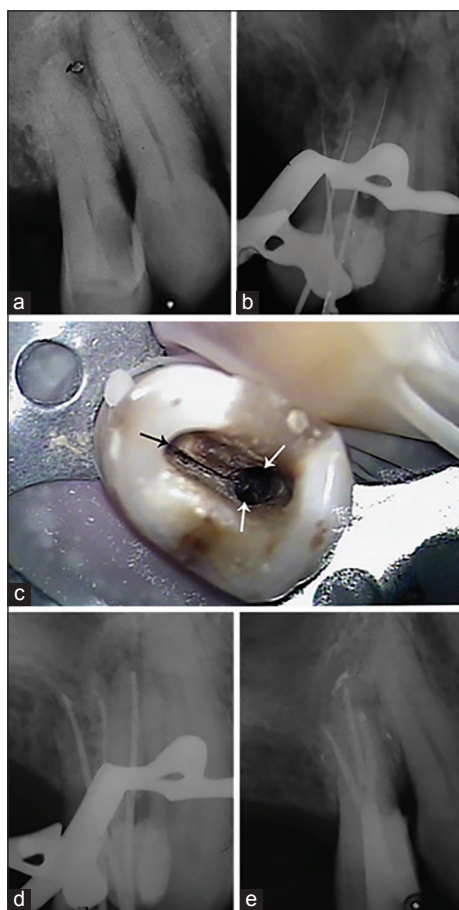


Figure 1: (a) Pre-operative IOPAR. (b) Initial working length IOPAR taken at a mesial horizontal angulation, revealing a double periodontal ligament space (distally) giving a suspicion for an extra root. (c) View of pulp chamber and root canal orifices under magnification. (d) Master cone radiograph. (e) Obturation radiograph

using a peeso reamer 3 and 4 toward the lingual wall. This improved the access for the lingual canals at the trifurcation. The canals were then negotiated up to working length using 08 size k files. Working length IOPAR taken with 15 k files revealed type IX root canal morphology according to Sert and Bayirli's additional types to Vertucci classification [Figure 2b].^[8] The canals were cleaned and shaped with hand K files and Hyflex CM rotary files (Coltène Whaledent). After drying the canals with paper points, they were obturated with laterally compacted gutta-percha and AH plus sealer [Figure 2c and d]. At 1-month follow-up, patient was completely asymptomatic.

DISCUSSION

The possible anatomic configurations and their incidence of maxillary and mandibular premolars are well documented in the literature. For the first maxillary premolar, the single root configuration is the most

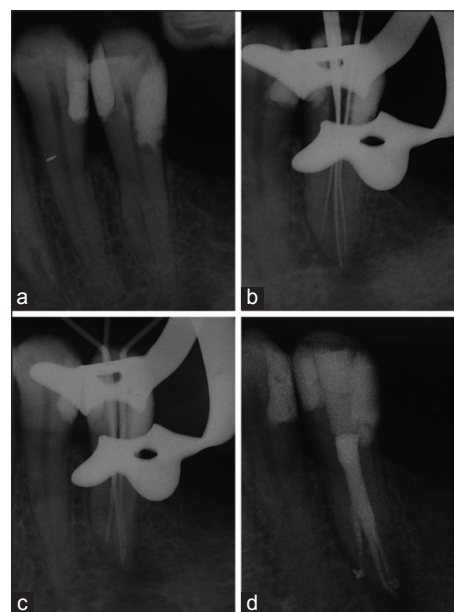


Figure 2: (a) Preoperative radiograph. (b) Working length radiograph. (c) Master cone IOPAR. (d) Obturation radiograph

common configuration among Asians (61.9%). Three-rooted maxillary premolars were reported to be an extremely rare variation in Asian population (0.6%) as compared to nonAsian population (2.1%).^[9] High-quality preoperative radiographs with different angulations (15° to 20° angle mesial or distal horizontal angle) and their careful examination are essential for the detection of additional root canals.^[2]

When there is an abrupt straightening or loss of a radiolucent canal in the pulp cavity, an extra canal should be suspected in the same root or in the other independent roots. Whenever the mesio-distal width of the mid root region is equal to or greater than the mesio-distal width of the crowns, the tooth is likely to have extra roots.^[10] In the treatment of three-rooted maxillary premolar, two buccal orifices will usually be seen which are close to one another and difficult to locate. Hence, the access must be extended bucco proximally from the buccal orifice to cavosurface angles creating a T or triangular shaped access.^[4]

It is important to point out that the bifurcation of canals in the buccal root of maxillary first premolars often results in extremely thin and atresic canals, which are difficult to access, explore and obtain apical patency.^[11] Hence, shape of access and enlargement of coronal thirds is crucial, which was performed here with Gates Glidden (GG) drills, 1-4 and Protaper S1, S2. The minimum wall thickness was less on the palatal aspect (<1 mm) than on the buccal aspect of the coronal two thirds of the buccal roots.^[12] An anticurvature filing technique was used

in this case toward the buccal aspect similar to buccal roots of maxillary molars. Studies have shown that the microscope increases the ability of the dentist to locate and negotiate the canal.^[13,14] This case report shows the successful management of the maxillary premolar under magnification that was especially helpful for selective dentin removal and detecting the extra buccal orifice conservatively.

Traditionally the mandibular premolars have showed the highest failure rate.^[15] Mandibular second premolars have a single root and a canal over 91% of the time. Incidence of two canals was 8.8% while three canals were extremely rare. An incidence of 0.4% for three canals in mandibular second premolar among 938 samples is previously reported.^[6,16] The root canals in mandibular premolars are usually round, small and conical, but inclined to be ribbon-like in the cervical third of the root. Root canals may not be evident radiographically or may look unusual. In this case, root canal space disappeared halfway through the roots (fast break) indicating splitting of canal at midroot level. However, up to 40° mesial angulation from horizontal is required to reliably identifying the extra canals.^[17] Careful interpretation of the periodontal ligament space may suggest the presence of an extra root or canal like in this case, where a tiny mesial root was observed, which appeared to be fused to the larger distal root.

Five different types of canal configuration for mandibular first premolar are described. This case would fall under category 5 (three distinct canals with separate apices) or more accurately type IX root canal morphology (1 main canal splitting into three canals with three separate apices).^[8]

During the initial placement of scouting files (hand k files 8, or 10) in the main canal, obstruction was encountered, and the file deflected to the buccal or lingual before it traveled any further. This may indicate a canal division. It was important, thereafter, to develop a sense of tactile feel and direction with appropriately precurved scouting files to detect the trifurcation. Finally, the access was improved by enlarging the main canal with peeso reamers.

CONCLUSION

Predictable success in endodontics requires knowledge of biology, physiology and root canal anatomy. Teeth with extra roots and/or canals pose a challenge. Probably, the greatest challenge in these kinds of cases is to identify them early so that appropriate modifications in treatment

protocol, armamentarium to be used and the number of sittings can be planned.

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