Case Report

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Endodontic management of two palatal roots in maxillary first molars- A case series

Abstract:

The present case series highlights the endodontic management of four rooted maxillary first molars with two palatal roots and two buccal root canals, with a one-year follow-up. The diagnosis of root and root canal configuration was confirmed using cone-beam computed tomography (CBCT), and the management of the additional second palatal canal was performed under the dental operating microscope. The prevalence of maxillary first molars with two palatal roots is extremely rare, with a global occurrence rate of only 0.047%. Therefore, awareness of such uncommon anatomical variations and familiarity with the latest technologies is crucial for accurate diagnosis and to improve the success rate of root canal treatments.

Key-words: Cone-beam computed tomography, Dental operating microscope, Maxillary first molar, Palatal roots.

Introduction:

It is essential to have a thorough understanding of the tooth anatomy and its variations.[1] According to Ingle, for successful root canal therapy it is important to create a fluid tight seal by obturation technique which is impossible without complete debridement of all the canals.[2]

Maxillary first molar presents a broad spectrum of anatomical variations in root morphology. An inadequate understanding of root canal morphology can lead to numerous endodontic treatment failures.[3]

The presence of a fourth root, particularly an additional palatal root, represents a rare anatomical variation Shahi et al.[4] reported 0.73% of the first molars with two palatal canals using clinical dye studies and Zheng et al.[5]reported a prevalence rate of 1.12 %for the presence of an extra palatal canal using CBCT in maxillary first molars.

Slowey[6] made a pioneering observation by documenting the first instance in the literature with two palatal roots in the second maxillary molar

Stone & Stroner[7] conducted a comprehensive evaluation of approx. 500 extracted maxillary molars, revealing less than 2% of the prevalence rate of additional palatal roots.

This present case series depicts the management of four rooted maxillary first molars with two palatal and two buccal root canals.

Case I

A 26-year-old male patient reported to the Department of conservative dentistry and Endodontics with a complaint of mild intermittent pain in upper left back tooth region for the last month. History revealed intermittent pain and no contributory medical history.

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Clinical assessment revealed, caries on the mesio proximal side of maxillary left first molar #26. The crown of the tooth exhibited an unusually wider size with 5 cusps. Despite this, the tooth did not show tenderness upon percussion, and vitality testing of tooth #26 using a cold testdid not elicit any response.

An initial preoperative radiograph showed a mesio-proximal radiolucency involving pulp along with an atypical anatomical morphology of roots (Figure1-A) Based on clinical and radiographic evaluation, a diagnosis of symptomatic irreversible pulpitis with asymptomatic apical periodontitis was made for tooth #26. Subsequently root canal treatment was advised to the patient, and informed consent was taken at the start of the procedure.

CBCT confirmed the presence of four roots in the tooth, Mesiobuccal and Distobuccal, Mesiopalatal, and Distopalatal (Figure 1-E) The tooth was anesthetized followed by Rubber Dam isolation, and the tooth was adjusted under a dental operating Microscope at 10X magnification (Leica M320).

Initially, the molar access triangular cavity was made with Endo Access bur. Clinical examination of the pulpal floor was done with a DG16 endodontic explorer and the three main canals (MB, DB, P) were located.

The conventional access triangle was modified to a trapezoidal access design, and a small orifice was then observed on the floor of the pulp chamber. (Figure1-F)

Then coronal flaring was done using the Protaper SX rotary file to establish straight-line access into the canals, followed by the Proglider file (Dentsply Maillefer, Ballaigues, Switzerland).

Then working length was determined by using an apex locator (Root ZX, Morita, Tokyo, Japan) and further checked by multiple angled radiographs. (Figure 1-B)

Root canal preparation was done using Protaper files, enlarging all the canals to the finishing file F2 (Dentsply, Maillefer, Switzerland) in crown down method with copious irrigation with 2.5% of NaOCl and 17% EDTA along with normal saline.

In subsequent visits, the master cone fit was checked radiographically (Figure1-C) and obturation was performed employing cold lateral compaction obturation technique using Bio-C Sealer (Angelus, Londrina, PR, Brazil) then post endo restoration was done using composite resin (Beautifil II, SHOFU Dental GmbH, Japan) (Figure1-D).

Case II

A 30-year-old female patient reported with the chief complaint of pain in the upper left back tooth region for, 10 days. Onclinical examination mesio proximal caries was observed, tenderness on percussion was present and the tooth was non-responsive to cold test #26. The diagnosis was made symptomatic irreversible pulpitis symptomatic apical periodontitis for #26

The preoperative IOPA showed periapical radiolucency (Figure 1-G) and wider palatal root with divergence between buccal and palatal canals

CBCT axial view revealed four distinct roots.(Figure 1-K). A nonsurgical root canal therapy was advised.

The patient's informed consent was obtained and further case was carried out as described in case 1 (Figure 1 H-L)

Case III

A 24-year-old female patient reported with the complaint of pain in the upper right back tooth region since six days. On detailed clinical examination, deep occlusal caries were seen. The Tooth was not tender on percussion, and the response for the cold test was negative #16. The diagnosis established was symptomatic irreversible pulpitis asymptomatic apical periodontitis with #16, non-surgical root canal treatment was planned.

Periapical radiograph #16 showed deep occlusal caries(Figure 1-M) with a wider palatal canal that was indicative of anatomic variation in roots

CBCT axial view showed the distinct two buccal roots mesiobuccal and distobuccal roots from the cervical third to the apex, and a wide single palatal root have two separate canal orifices merging at the mid-root level (Figure 1-Q)

The patient's informed consent was obtained andfurther case was carried out as described in case 1 (Figure-1-N-P)

Discussion:

The following case series discusses the endodontic treatment of maxillary first molars with additional palatal canals. Anomalies in the development of maxillary molars are attributed to the unusual fusion of the tooth with an independently formed structure known as paradentalis, also referred to as a paramolar.

A paramolar cusp is an atypical dental trait characterized by a supernumerary cusp on the buccal or lingual surfaces of molars, which develops from secondary enamel knots.

There is a high incidence of a paramolar root when the paramolar cusp is well-developed. In our cases, the maxillary first molars exhibited a well-developed palatal paramolar cusp, increasing the likelihood of the presence of a supernumerary palatal root. The teeth also displayed a larger cusp diameter in both the mesiodistal and buccolingual planes, along with a prominent cusp of Carabelli.[8]

Christie's et al.[9] described the four-rooted maxillary molar classification, which includes the following types:

Type I: These maxillary molars have two widely divergent palatal roots, often long and tortuous, with buccal roots that are "cow-horn" shaped and less divergent.

Type II: Maxillary molars with four separate individual roots, which are often shorter, run parallel, and have both buccal and lingual root morphology with blunt root apices.

Type III: Maxillary molars with roots showing constriction, forming a web-like structure with the mesiobuccal, mesiopalatal, and distopalatal root dentin.

Additionally, Baratto-Filho et al.[10] introduced an additional Type IV, where the mesiobuccal and palatal roots may be fused in the coronal two-thirds.

Versiani et al.[11] introduced a pulpal chamber floor classification, describing the geometric localization of root canal orifices as Type A (irregular quadrilateral shaped), Type B (trapezoid-shaped), Type C (lozenge-shaped), and Type D (kite shaped). (Figure 2-A)

A review of the literature by G. Magnucki et al.[12] concluded that the prevalence of maxillary first molars with four roots is 0.047%, evaluated through CBCT studies and case studies.

Their findings indicated that Christie's Type I constituted 52.83%, Type II comprised 18.87%, Type III accounted for 18.87%, and Type IV represented 1.88% of the cases. The pulpal chamber floor of all three cases was similar to Versiani type A classification, which is irregular and quadrilateral-shaped (see Figure 2-C).

To confirm the presence of additional root canal morphologies in maxillary molars, one should consider the following:

- The presence of an extra cusp or wider/unusual crown anatomy may indicate the presence of additional canal.
- Modification of access cavity preparation from the conventional maxillary triangle into clover-leaf (Shamrock), trapezoidal, rectangular, or rhomboidal shapes.
- Use of piezoelectric ultrasonic device
- Magnification loupes such as telescopic loupes with an optimal magnification of 2.5x, endoscopes, and orascopes
- CT and spiral CT scan[13]

In this case series, Case I and Case II show similarities to Christie's type I morphology. In these cases, the root canal morphology displayed widely divergent palatal roots that are long and tortuous, while the buccal roots of the teeth exhibited "cow-horn" shaped canals (see Figure 2-A).

Case III demonstrates an unusual variation in the maxillary first molar in which the palatal root has two canals merging at mid root, falling under Christie's type III (see Figure 2-A). The mesiobuccal, distobuccal, distopalatal, and mesiopalatal roots form a web-like structure.

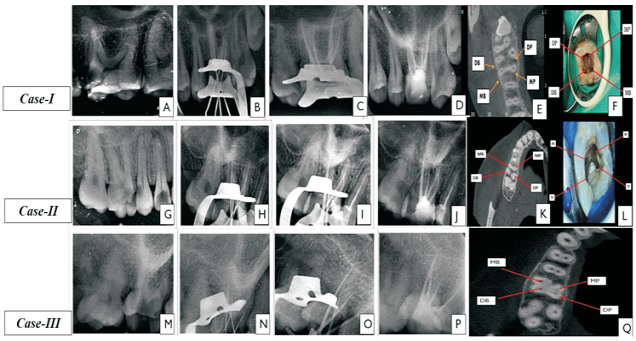

Figure 1. A, G and M showing pre operative radiograph, B,H and N showing working length determination, C,I and O Master cone, D,J and P- Post-Operative radiograph, E,K and Q-CBCT Axial View, F and L-Clinical Microscopic View at 10X showing mesiobuccal, Distobuccal, Mesiopalatal and]

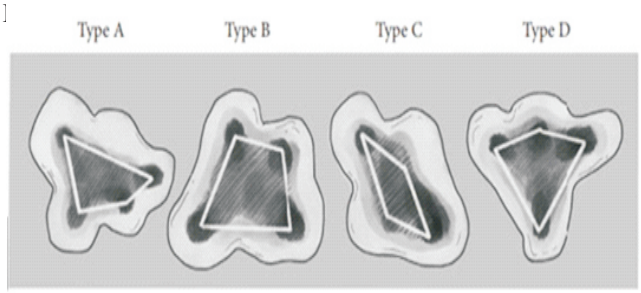

Figure 2. Schematic drawing of Versiani's configuration of canal orifices in four-rooted maxillary second molars. orifices were classified in relation to the pulpal chamber floor as Type A (irregular quadrilateral-shaped), Type B (trapezoid-shaped), Type C (lozenge shaped), and Type D (kite-shaped).

Conclusion :

The diversity in root and root canal morphology poses challenges in terms of diagnosis and achieving successful endodontic treatment. Understanding the uncommon anatomical variations such as additional cusp, and wider crown dimensions of the tooth can simplify the identification of altered internal root morphology even before any radiographic examination

After confirming the anatomy in CBCT it is more important to locate and treat the tooth without compromising the prognosis, hence the role of DOM is also important which increases the overall success rate of treatment

Having an extensive understanding of the anatomy of teeth can prove valuable in such rare cases

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