Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/jptcp.v29i03.2311

Atypical anatomy of premolars in Saudi population, It's prevalence and treatment: A case report series

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Submitted: 19 June 2022; Accepted: 08 July 2022; Published: 10 August 2022

ABSTRACT

The anatomical variations of canal configuration is a challenging clinical situation, both at the diagnostic and treatment levels. The present case series aims to describe the management of mandibular and maxillary premolars with extra roots and different anatomy configurations. Five Saudi patients were referred to the Endodontic department for the management of mandibular and maxillary premolars that appeared unusual radiographically. To negotiate, clean, and shape the root canal system, modern endodontic tools such as a dental operating microscope and nickel-titanium files were used. A follow-up period ranging from 6 months to 1 year revealed ongoing periapical healing of premolars with lesions, while the premolars without periapical lesions were free of any signs and symptoms with normal apical tissues.

Keywords: *anatomy, population, typical, radiographically, system*

INTRODUCTION

The success of endodontic treatment depends upon adequate chemo-mechanical canal preparation followed by three-dimensional obturation. Adequate chemo-mechanical preparation is influenced by the thorough knowledge of the morphology of the root canal systems and their complexities. Premolars have been one of the most challenging teeth to treat in context with their varied root canal morphology. The unpredictable root canal anatomy of premolars, especially mandibular molars, has been addressed by SLOWEY as the "endodontist enigma". Similarly, maxillary premolars exhibit an unusual variety of root canal systems[1.]

It is imperative for an astute clinician to have a thorough knowledge of this varying and highly complex root canal system in human permanent premolars. Failing to do so may cause poor endodontic outcomes like endodontic failures. Thereby, it is essential for the clinician to have an expectation of these possible variations. It has been reported in the literature previously that premolars can have single root to multiple roots. Alfawaz et al[2] documented one root (96.4%), two-roots (3.1%), and three-roots (0.5%) in mandibular first premolars.

They also found one root (95.6%), two-roots (3.8%), and three-roots (0.6%) in mandibular second premolars. As reported in a study by Mashyakhy[3] on maxillary first premolars, around 40.7% of teeth had one root, 57.5% had two roots, and 1.7% had three roots. They also found that among maxillary second premolars, 88% had one root and 12 % had two roots.

The possibility of finding an additional root or canal is undeniable, even in teeth with a low frequency of aberrant root canal anatomy. This article is a case series of maxillary and mandibular premolars with unusual anatomy that was successfully treated with root canal therapy. This case series deals with the endodontic treatment of such morphological rarities in maxillary and mandibular premolars and emphasizes on correct root canal morphology identification.

Case -1

A 22-year-old Saudi male presented to the Qassim University Postgraduate Endodontic Clinics Qassim, Saudi Arabia, with a history of mild pain on biting on the left side of the mouth that began a month ago and had worsened in the last 24 hours. His medical history was noncontributory. On intraoral assessment, the tooth was found to be restored with a porcelain fused to metal (PFM) crown. Tooth #24 was tender to percussion and palpation. On radiographic examination, #24 was found to be endodontically treated with periapical pathology. Moreover, a tooth restoration gap was noted on the distal aspect with a defective margin of the PFM crown. (Figure 1 A and C) A diagnosis of the previously treated tooth with symptomatic apical periodontitis was made (AAE Diagnostic Terminology). The treatment options, with their advantages and disadvantages, were discussed with the patient. The patient opted for nonsurgical endodontic re-treatment (NSER), followed by fiber post/core and a full ceramic crown.

The PFM crown was sectioned and removed on the first visit using a round-end diamond bur (MEDIN, Czech). Caries and old restoration on the distal aspect of the tooth (Figure 1 D) were removed. The rubber dam isolation was applied, and the root canal orifices were located using an endodontic explorer (DG 16, HARFINS GmbH, Germany).

The clinical examination revealed a missed canal, and an additional canal was found, making a total of 3 canals- mesiobuccal (MB), distobuccal (DB), and palatal (P). A size 2 gates glidden bur (MANI, Japan) was used to remove the coronal part of the old root canal filling and make a path for manual instruments to remove all of the gutta-percha.

An oil-based GP solvent (Eugenatedes obturator Produits Dentaires SA, PDTM. Switzerland) was placed in the canals for 10 seconds and used along with H file size (THOMAS, France) size #15 up to #25 to remove the old GP with copious irrigation of normal saline solution. Once the old GP was removed, a periapical radiograph was taken to confirm complete removal. (Figure 2) Calcium hydroxide intracanal medicament (Metapaste, Meta Biomed, Republic of Korea) was applied into the canals and a temporary filling (TF) (Coltosol® F) was placed. Subsequently, a provisional crown (3M ESPE, protempTM4) was cemented with provisional cement.

During the second visit, after the removal of the provisional crown and TF, calcium hydroxide was removed with K files (THOMAS, France) along with EDTA liquid irrigation and a final flush of 5.25% sodium hypochlorite (NaOCl). Later, an apex locator (Root ZX II, Morita, Japan) was used to determine the estimated working length of the canals, which was confirmed by an intraoral periapical radiograph. Subsequently, biomechanical instrumentation was done by using ProTaper Next Ni-Ti rotary files (Dentsply Maillefer, USA) up to X3 in the DB and P canals and up to X4 in the MB canal. During the preparation of the canals, an EDTA lubricant gel (Dia-Prep Pro, DiaDent, South Korea) was put on the files, and 5.25% NaOCl was used to rinse the canals. The canals were then rinsed with 17% ethylenediamine tetraacetic acid as a final flush. The canals were dried using paper points sized to correspond to the respective master apical files. A paper point was used to block the unfilled canal during obturation. The Bioceramic sealer (CeraSeal, Meta Biomed, Republic of Korea) was used to obturate the DB and P canals with GP size X3 cones and the MB canal with GP X4 cone (ProTaper Next gutta percha points, Dentsply Maillefer, USA). (Figure 2) Two weeks later, the patient was recalled for a follow-up. A periapical radiograph was taken to monitor the progress of the treatment and to place

the post and crown. A fiber post was cemented with resin cement in the palatal canal, and a core build-up was done with a flowable composite. The tooth was restored with an all-ceramic crown. (Figure 2)

At 1 year follow-up, the tooth was painless on percussion and palpation. The periapical radiographs and CBCT scans showed no sign of healing of apical radiolucency. However, no increase in the size of the periapical lesion was noted. (Figure 2) This periapical radiolucency can be attributed to apical healing by scar tissue.

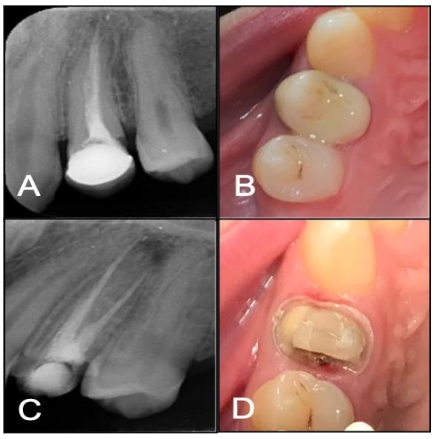

FIGURE 1: #24 (A) Preoperative periapical radiograph; (B) Preoperative clinical photograph; (C) Preoperative distal angulated radiograph; (D) Clinical photograph after crown removal.

FIGURE 2: (E) periapical radiograph with old GP removed and working length determined; (F) periapical radiograph with master cones; (G) periapical radiograph showing final obturation and clearly showed the third canal, which was missed previously; (H) periapical radiograph after two weeks and; (I) periapical radiograph after 1 year follow-up.

Case -2

The second case is of a 22 years old Saudi female who was presented to Qassim University Postgraduate Endodontic Clinics, Qassim, Saudi Arabia, complaining of sharp, spontaneous pain on the upper right side. On intraoral assessment, #14 was found to have distal caries approaching the pulp. A diagnosis of symptomatic irreversible pulpits and symptomatic apical periodontitis was established (AAE Diagnostic Terminology). After careful examination of the root outline on a periapical radiograph, a shadow of third root was detected. Root canal treatment was done following standard protocols under magnification, as discussed in case 1. (Figure 3)

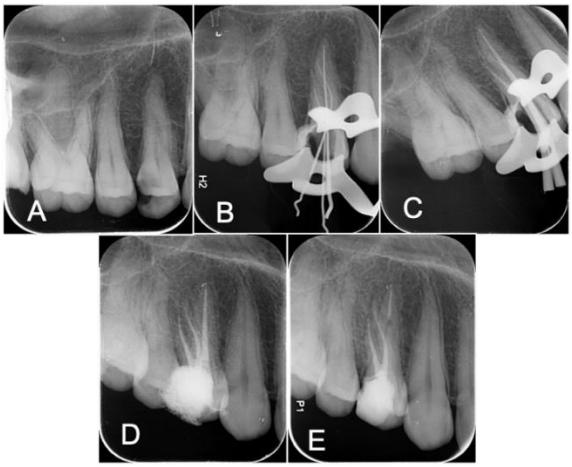

FIGURE 3: #14: (A) Preoperative periapical radiograph; (B) peripical radiograph with working length; (C) periapical radiograph with master cones; (D) periapical radiograph showing final obturation; (D) periapical radiograph after 6 months follow-up.

Case -3

The third case is of a 31 years old Saudi female patient who presented to Qassim University Postgraduate Endodontic Clinics, Qassim, Saudi Arabia, with symptomatic apical periodontitis of #34. The periapical radiograph showed that it was previously treated (AAE Diagnostic Terminology). The radiographic examination suggested an extra root, which was a possible cause of failure. Retreatment was done following standard protocol under magnification as discussed in case 1. (Figure 4)

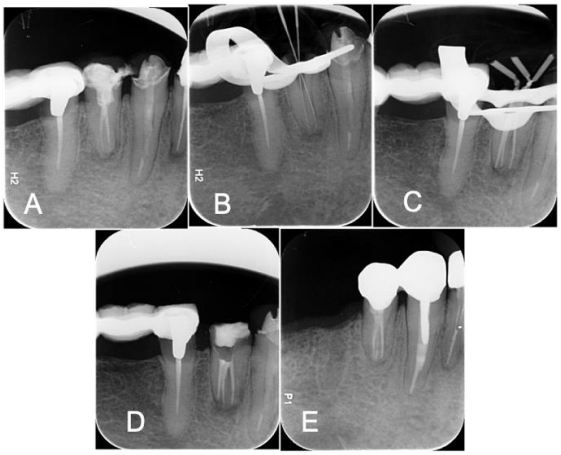

FIGURE 4: #34: (A) Preoperative periapical radiograph; (B) periapical radiograph with old GP removed and working length determined; (C) periapical radiograph with master cones; (D) periapical radiograph showing final obturation; (D) periapical radiograph after 6 months follow-up.

Case -4

The fourth case is of a 26 years old Saudi male patient who presented to Qassim University Postgraduate Endodontic Clinics, Qassim, Saudi Arabia, with dull chronic pain in the upper right side of the mouth. On intraoral assessment, #25 was found to have a large carious lesion mesially approaching the pulp. A diagnosis of pulp necrosis and symptomatic apical periodontitis was established with #25 (AAE Diagnostic Terminology). The radiographic examination suggested a fast break in the root canal which led to the detection of the presence of three canals. Root canal treatment was done following standard protocols under magnification, as discussed in case 1. (Figure 5)

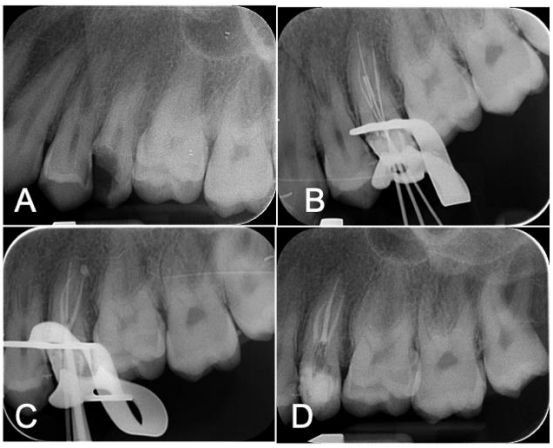

FIGURE 5: #25: (A) Preoperative periapical radiograph; (B) peripical radiograph with working length; (C) periapical radiograph with master cones; (D) periapical radiograph showing final obturation.

Case -5

The fifth case is of a 45 years old Saudi male patient who presented to Qassim University Postgraduate Endodontic Clinics, Qassim, Saudi Arabia, for routine dental scaling procedures. On intraoral examination, #24 was found to be restored. The periapical radiograph showed that it was previously treated (AAE Diagnostic Terminology) with asymptomatic apical periodontitis. The radiographic examination also suggested the presence of an extra root. Retreatment was done following standard protocol under magnification as discussed in case 1. (Figure 6)

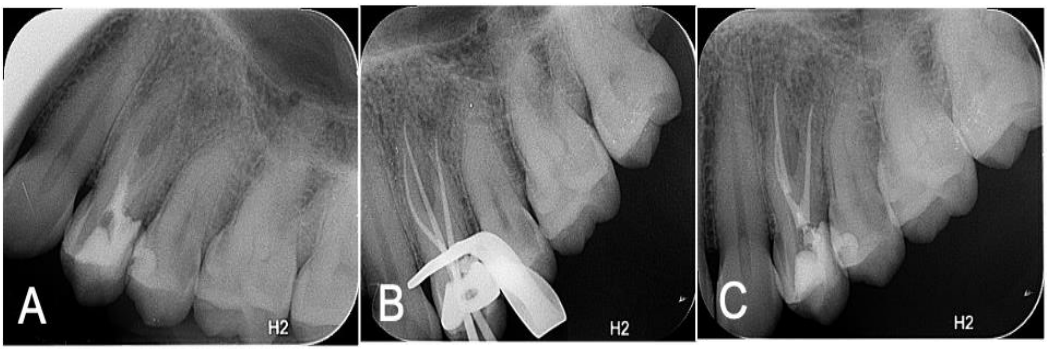

FIGURE 6: #24: (A) Preoperative periapical radiograph with old GP; (B) periapical radiograph with GP removed and master cones placed confirming presence of three canals; (D) periapical radiograph showing final obturation.

DISCUSSION

Gulabivala et al (2001) stated that untreated canals or missed canals could lead to endodontic treatment failure. This mandates a detailed radiographic and clinical analysis to achieve a favourable endodontic outcome. This case report series describes the management of cases with anatomic variations. In two cases, the teeth were previously treated, and the lack of knowledge to identify the unique morphology led to missed canals and failure of treatment.

Multiple studies reported the incidence of three canals in the Saudi sub-population ranging from 0% to 11.7% [5-9]. Other researchers suggest that around 6% of the upper first premolars have three canals [10,11]. This case study demonstrates that, while the likelihood of root canal variation is low, it cannot be ignored. It is recommended to follow the standard treatment protocol in every case. Radiographs taken with the shift are critical and should not be ignored in routine endodontic practice. In a study by the University of Washington, the failure rate of non-surgical root canal therapy in all teeth was examined, and it was found that the mandibular first premolar had the highest failure rate in the study at 11.45%. One of the major causes of failure-was a lack of knowledge about root canal variations.

Before the start of endodontic treatment, the earlier the identification of root canal configuration is done, the more likely the clinician will be able to achieve a favourable endodontic outcome. [12] An IOPA X-ray is a two-dimensional (2D) radiograph of a three-dimensional (3D) tooth. During radiographic interpretation, awareness of these limitations is required. [13,14] Although the preoperative radiographs give a 2D view of a 3D object, some guidelines suggest the existence of a third canal or root. A third canal is suspected when there is a loss of radiolucent or abrupt straightening canal in the pulp chamber, either in the same root or in a separate root [15]. Straight periapical radiographs showing the mesiodistal width of the mid-root image equal to or greater than the mesiodistal width of the crown image give an indication to the existence of third root.

A sudden narrowing or disappearance of the canal when studying the direct periapical exposure film renders a hint that the canal is dividing at this point. [16] Moreover, tracing each individual root periodontal ligament space would be helpful. Based on the aforementioned guides, the third root canal in all of the cases presented here was conceived during the initial radiographic examination. In all the cases discussed above, careful interpretation with the aid of radiographs was done to identify the missing canal. After adequate access cavity preparations, a detailed analysis of the interior of the tooth was done. The pulp chamber floor was examined with the help of DG-16 endodontic explorer. [17] The use of apex locator was the choice here to get an estimated working length in all the cases. Brunton et al (2001)18 suggested the usefulness of apex locators in such cases prior to taking confirmatory working length due to the close proximity of canals with each other and another factor like the superimposition of the roots. Albuquerque et al (2014)19 suggested that if the working length file appeared off-centre, then the presence of multiple canals could be suspected.

The biomechanical instrumentation was done by using ProTaper Next Ni-Ti rotary files (Dentsply Maillefer, USA) in all the cases. The presence of sharp curves when additional root canals are present leads to instrument fatigue and, eventually instrument separation if caution is not exercised. The use of fresh and flexible rotary Ni-Ti instruments has been suggested to prevent any iatrogenic error. This aids in lowering the incidence of file separation in a complex canal system. [19] The removal of calcium hydroxide was done with the help of K files, liquid EDTA, and NaOCl irrigation in the cases discussed above, as described by Rodig et al (2010).[20] It is a critical step as any remnant of calcium hydroxide may lead to an inferior seal due to interaction with the root canal sealer.[21] During obturation, care was taken to accidentally block the unfilled canal with any remnants of gutta-percha or flowing sealer. As recommended by Hermann (2009)[22], a paper point was carefully placed in the canals to be filled later while obturating one by one each canal.

CONCLUSION

In conclusion, it is emphasized that even though the recorded percentage of root canal variation may be low in certain teeth, the possibility cannot be ignored, especially in cases of failed treatment. The evaluation of the root canal morphology is most precise when the clinician utilizes all possible information using multiple radiographs along with a clinical reconnoitering

of the internal and external of the tooth. Accurate interpretation of the digital radiographs in various angulations, using more advanced techniques like cone-beam computed tomography (CBCT), using a magnifying tool, and careful inspection of the pulpal floor can reduce the chances of missing important anatomic features.

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