



CASE REPORT

Dental Science

ENDODONTIC MANAGEMENT OF THREE ROOTED SECOND MAXILLARY AND MANDIBULAR PREMOLARS UNDER ENDODONTIC MICROSCOPE

KEY WORDS: Three rooted maxillary & mandibular premolars, Endodontic treatment, Diagnosis, endodontic microscope.

Dr. Suman Kar	BDS(CAL), MDS(CAL), M.Phil, Ph.D.(Scholar) Associate. Professor, ADCH (Jamshedpur), Jharkhand, India.
Dr. Barnali Mandal (Misra)	BDS(CAL), MDS(CAL), Private practitioner, Kolkata, India
Dr. Parthasarathi Mondal	BDS(CAL), MDS(CAL), Associate. Professor, Dept. of Conservative Dentistry and Endodontics, Dr. R. Ahmed Dental College and Hospital, Kolkata, India
Dr. Debjyoti Karmakar*	BDS(CAL), MDS(CAL), DHM (NEW DELHI), Associate. Professor, Dept. of Dentistry, Malda Medical College & Hospital, Malda, West Bengal, India *Corresponding Author

ABSTRACT Maxillary and mandibular premolars are one of the most difficult teeth to treat endodontically because of the variances in root canal structure. The root canal procedure on these teeth is complicated by morphological anomalies. To correctly treat the entire root canal system in such circumstances, it is crucial to be aware of any potential anatomic variations. This article describes the diagnosis and clinical management of two clinical cases of three rooted premolars.

INTRODUCTION

Comprehensive mechanical and chemical debridement of the entire canal system followed by three-dimensional obturation is the ideal treatment plan for successful endodontic treatment. The failure of the treatment strategy is further complicated by anatomical variances with complicated root canal morphology in teeth.

The term "small molars" or "radiculous" is used to describe the rare (0.5–1%) three-rooted maxillary first premolars that are identical to the adjacent maxillary molars.^{19,20} Vertucci et al. and Pecora et al. estimate the incidence of three canals in the maxillary second premolar to be between 3% and 2%.^{1,2} Up until 2001, there was just one case report of a maxillary second premolar with three canals and three separate roots.^{3,4} The changes in root canal anatomy make mandibular premolars one of the difficult teeth to treat endodontically.⁹ Different studies have reported a fairly high percentage of these teeth to have more than one canal. Although the probability of having three roots in mandibular second premolars is rare (0.1%).¹¹ Incidence of 0.4% of mandibular second premolars with three canals reported by Zillich and Dowson.¹²

When planning a root canal procedure, clinicians must be very conscious of extra roots and canals because missing canals and undiagnosed extra roots would reduce the success rates of endodontic treatments. To learn about the location of hidden roots or canals, thorough radiological and clinical exams should be carried out. Using magnifying visual aids is one possible non-invasive technique for finding more canals. The operational microscope, which provides multiple high- and low-power magnifications, is one such tool. Operating microscopes provide uniform light without shadows and three-dimensional views, which together make it possible to see the area being examined.¹³ The visualization of the pulp chamber and additional canal orifices can be further improved with the use of an operating microscope or loop.

Case Reports

Case-1

A 25-year boy was referred by a general dental practitioner for endodontic treatment of his maxillary right second premolar. On clinical examination, 15 was found temporarily restored by zinc oxide eugenol. The tooth was tender on

percussion. There was no evidence of either swelling or sinus tract. On radiographic examination, three roots were suspected. Mesial and distal-angled radiographic views confirmed the presence of three roots (figure 1a). Local anesthesia was administered and isolation was done with a rubber dam. Slightly larger access was prepared and the canals were located with 10 no K file (Mani, Inc., Tochigi, Japan) under the endodontic microscope (MOELLER DENTA 300). Working length was determined with an apex locator (Propex-2, Dentsply Maillefer, Ballaigues, Switzerland). Canal was enlarged with the crown down technique using a protaper rotary instrument (Dentsply Maillefer, Ballaigues, Switzerland) along with 17% EDTA and irrigated frequently with 5.25% NaOCl solution. Obturation was done with protaper g.p. using AH-Plus sealer (AH Plus, Dentsply Maillefer, Ballaigues, Switzerland). The coronal access was restored with resin composite (3M ESPE, St. Paul, MN, USA) and was followed by a metal ceramic crown

Case-2

An 18-year girl was referred with a chief complaint of pain in her lower right jaw. On clinical examination, 45 were found curiously exposed. There was no evidence of either swelling or sinus tract. The mesiodistal dimension of the tooth appeared to be wider than normal. On radiographic examination, three roots were suspected. Mesial and distal-angled radiographic views confirmed the presence of three roots. Local anesthesia was administered and isolation was done with a rubber dam. The access cavity was prepared using round diamond bur after deroofting lateral walls was prepared using endo-z bur (Dentsply Maillefer, Ballaigues, Switzerland). It was noticed mesial and distal files were crossing each other. So the access cavity was widened in the tooth lingual face revealing residual pulp chamber roof. A bleeding point in that area suggested lingual canal presence. The presence of three canals: mesiobuccal, distobuccal, and lingual was confirmed under the microscope working length was determined with the apex locator (Propex-2).

The canal was enlarged with the crown down technique using protaper rotary instrument. Irrigation frequently with 5.25% NaOCl irrigating solution & 17% EDTA. Obturation was done with protaper g.p. using AH-plus sealer. The coronal access was restored with resin composite and was followed by a metal-ceramic crown.

DISCUSSION

The diagnosis and management of extra roots in maxillary and mandibular second premolars is undoubtedly an endodontic challenge. To achieve this, the clinician must have a thorough understanding of the normal root canal anatomy and its common variations. Weine (1995) determined that untreated main canals are the primary factor in endodontic treatment failure.⁶ Cohen & Brown et al. told that failure to recognize additional root canals may result in unsuccessful treatment & may be the origin of acute flare-ups during and after treatment.⁷ High-quality preoperative radiographs and their careful examination are essential for the detection of additional root canals.¹⁵⁻¹⁷ While periapical radiographs show two-dimensional images of three-dimensional root canal systems, the careful interpretation of a radiograph may reveal anatomical details of a root canal system. In this context, if a radiograph shows a sudden narrowing or even a disappearing pulp space, the canal diverges at that point into two parts that may either remain separate or merge before reaching the apex.¹⁴ If the pulp chamber appears to deviate from normal configurations and seems to be either triangular shape or too large on a mesiodistal plane, more than one root canal should be suspected.¹⁵

Mandibular second premolars usually have a single root with a single root canal. Based on the results from various studies, it was observed that mandibular second premolars show a single canal in 65.7%–100%, two root canals in 1.2%–11.7%, and three root canals in 0.4% cases.^{21,22,23} From the above studies, it is evident that mandibular second premolars with three canals is a rare occurrence and needs to be managed strategically.

The root canal system of premolars with three root canals is usually characterized by one large lingual or palatal canal and two smaller canals in the mesiobuccal and distobuccal root.¹² Furthermore, the dentinal map on the pulp chamber floor guides the operator to the precise location of root canal orifices.

Furthermore, enhanced visualization of the root canal intricacies enables the clinician to investigate the root canal system & to clean & shape it more efficiently by Saunders & Saunders.⁸ An endodontic microscope was a huge assistance in treating the instances with assurance and comfort. With its magnification and lighting, a dental operating microscope makes it easier to find concealed canals and provides a clearer view of the internal root canal system.

In endodontics, magnification not only improves eyesight but also makes it easier to reach root canals for preparation and obturation. Additionally, it reduces strain on the eyes, enhances the operator's ergonomics, and thus guards against any operational blunders. Missed canals are recognized as the main reason for the failure of root canal therapy.^{9,10}

Furthermore, the use of magnification with the help of a loupe or a microscope and visual enhancement with the use of fiber optics, sodium hypochlorite bubble technique, and staining with 1% methylene blue dye might help to locate additional root canals.¹⁸

CONCLUSION

Successful and predictable endodontic treatment requires detailed knowledge of the root canal system. A single canal in a tooth is not considered a rule but rather an exception. The use of magnification with the help of a loupe or a microscope and visual enhancement with the use of fiber optics, sodium hypochlorite bubble technique, and staining with 1% methylene blue dye might help to locate additional root canals. Although the incidence of three root canals in the maxillary and mandibular premolars is relatively low, such teeth should be carefully investigated and strategically managed.

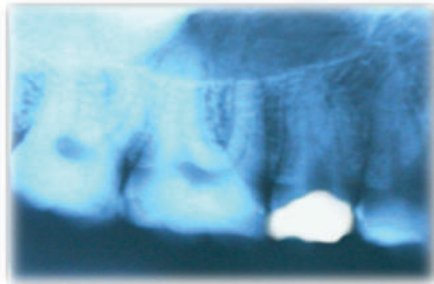
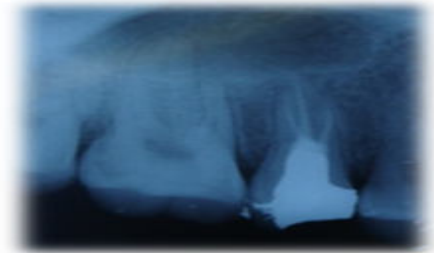


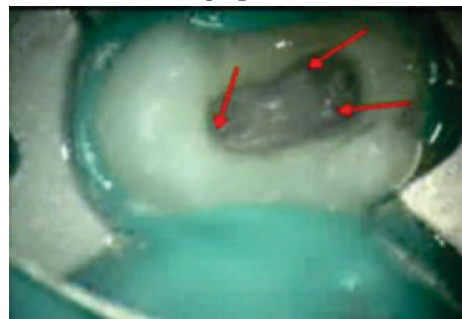
Figure 1A. Preoperative radiograph;



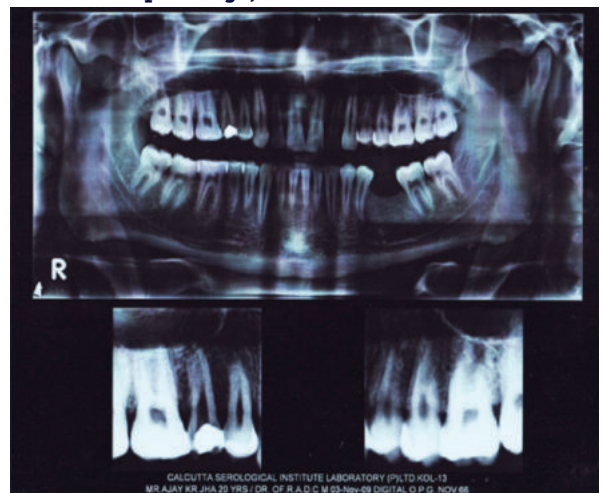
1B. Working Length;



1C. Postobturation Radiograph;



1D. Microscopic Image;

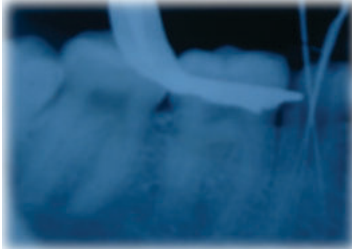


E. Preoperative OPG

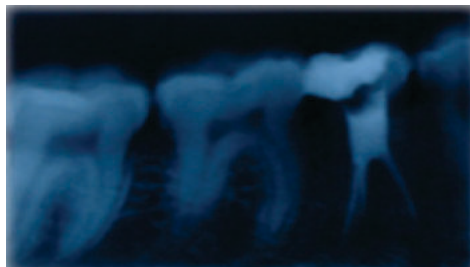
Figure 2:



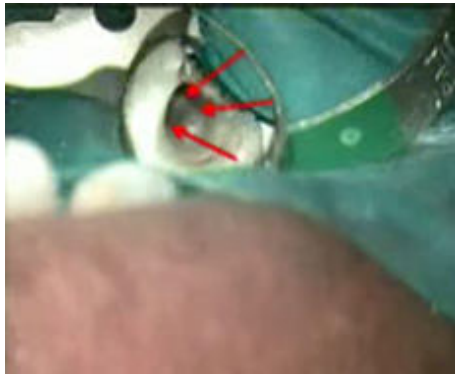
A. Preoperative Radiograph;



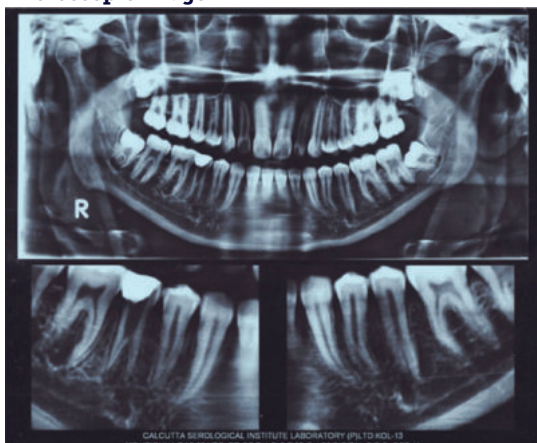
B. Working Length;



C. Postobturation Radiograph



D. Microscopic Image:



E. Preoperative OPG

REFERENCES

1. Root canal morphology of the human maxillary second premolar. F Vertucci,

A Seelig, R Gillis, *Oral Surg Oral Med Oral Pathol.* 1974 Sep; 38(3):456-64
 2. Morphologic study of the maxillary molars. Part II: Internal anatomy. J D Pécora, J B Woelfel, M D Sousa Neto, E P Issa, *Braz Dent J* 1992; 3 (1):53-7.
 3. Three-rooted maxillary second premolar. C M Ferreira, I G de Moraes, N Bernardineli, *J Endod*, 2000 Feb; 26(2):105-6
 4. Unusual maxillary second premolar morphology: a case report. D Low Quintessence Int. 2001 Sep; 32 (8):626-8.
 5. Root canal morphology of mandibular first and second premolars. R Zillich, J Dowson, *Oral Surg Oral Med Oral Pathol.* 1973 Nov; 36(5):738-44
 6. Weine FS. Nonsurgical re-treatment of endodontic failures. *Compend Contin Educ Dent.* 1995; 16:324-326-35.
 7. Cohen AS, Brown DC. Orofacial dental pain emergencies: Endodontic diagnoses and management. In: Cohen S, Burns RC, editors. *Pathways of the Pulp.* 8th ed. Boston, MA, USA: Mosby; 2002. pp.31-75.
 8. Technical standard of root canal treatment in an adult Scottish sub-population W P Saunders, E M Saunders, J Sadiq, E Cruickshank. *Br Dent J.* 1997 May 24; 182(10):382-6
 9. Slowey R. Root canal anatomy: a road map to successful endodontics. *Dental Clin North Am.* 1979; 23:555-73.
 10. Iqbal A. The factors responsible for endodontic treatment failure in the permanent dentitions of the patients were reported to the College of Dentistry, The University of Aljouf Kingdom of Saudi Arabia. *J Clin Diagn Res* 2016; 10(5):146-48
 11. Zillich R, Dowson J. Root canal morphology of mandibular first and second premolars. *Oral Surg Oral Med Oral Pathol.* 1973; 36:738-44.
 12. Rödig T, Hülsmann M. Diagnosis and root canal treatment of a mandibular second premolar with three root canals. *Int Endod J.* 2003; 36:912-9.
 13. Zafersoy-Akarslan Z, Erten H, Uzun O, Semiz M. Reproducibility and agreement of clinical diagnosis of occlusal caries using unaided visual examination and operating microscope. *J Can Dent Assoc* 2009; 75:455.
 14. M. C. England Jr., G. R. Hartwell, and J. R. Lance, "Detection and treatment of multiple canals in mandibular premolars," *Journal of Endodontics*, vol. 17 no 4 pp. 174-178, 1991
 15. 18. Javidi M, Zarei M, Vatanpour M. Endodontic treatment of a radicular maxillary premolar: a case report. *J Oral Sci.* 2008; 50(1):99-102.
 16. Slowey RR. Radiography aids in the detection of extra root canals. *Oral Surg Oral Med Oral Pathol.* 1974; 37(5):762-72.
 17. Slowey R. Root canal anatomy. Road map to successful endodontics. *Dental Clinics of North America.* 1979; 23(4):555-73.
 18. Carr GB. Microscopes in endodontics. *J Calif Dent Assoc.* 1992; 20:55-61
 19. Vertucci FJ, Haddix JE. Tooth morphology and access cavity preparation. In: Hargreaves KM, Cohen S, editors. *Cohen's Pathways of the Pulp.* 10th ed. St. Louis: Mosby; 2011. pp. 136-222.
 20. Maibaum WW. Endodontic treatment of a "ridiculous" maxillary premolar: A case report. *Gen Dent.* 1989; 37:340-1.
 21. Pineda F, Kuttler Y. Mesiodistal and buccolingual roentgenographic investigation of 7,275 root canals. *Oral Surg Oral Med Oral Pathol.* 1972; 33: 101-10.
 22. Kerekes K, Tronstad L. Morphometric observations on root canals of human premolars. *J Endod.* 1977; 3:74-9.
 23. Vertucci FJ. Root canal anatomy of the human permanent teeth. *Oral Surg Oral Med Oral Pathol.* 1984; 58:589-99.