

Endodontic Management Of Maxillary Premolars With Complex Root Canal Anatomies

Research Article

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Abstract

In addition to debriding and obturating the root canals, knowledge and understanding of the anatomy of the teeth play a vital role in the success of endodontic treatment. Maxillary premolars present with varying root canal anatomies which are influenced by factors such as ethnicity, age and gender. When an aberrant anatomy goes unattended, endodontic treatment fails. Therefore, identifying variation in anatomy followed by systematic cleaning and shaping would result in positive treatment outcomes. Variation in root canal anatomy can be identified with the help of diagnostic aids like angled radiographs, CBCT imaging along with magnification that helps in location of additional canals.

This article discusses the successful endodontic management of three case reports of maxillary premolars with complex root canal anatomies.

Keywords: Maxillary Premolars; CBCT; Periapical Radiography; Aberrant Anatomy; Magnification.

Introduction

The success of root canal therapy depends on effectively managing all the existing canals which is possible only by having a thorough knowledge of the root canal anatomy followed by disinfecting and obturating them [1]. Variations in root canal anatomy are common and can occur as a result of various factors like age, ethnicity, gender and study designs [2-5]. Such variations in anatomy would make the access and visualization difficult to the root canal system which in turn would result in leaving behind the pulp tissue in root canal spaces, leading to failure of endodontic treatment [6, 7].

Variations in root canal anatomy are commonly identified with angled radiographs where the shape and the direction of the root is assessed along the evaluation of the root position relative to the tooth [7]. In cases where variations are predicted and when radiographs are inconclusive, CBCT imaging is opted where the num-

ber of canals along with their sites of bifurcation can be assessed at various sections of the acquired three dimensional data [8].

Maxillary premolars commonly present with Vertucci type I configuration of root canals. Many other variations have also been reported in literature [9-11]. Previously our team has a rich experience in working on various research projects across multiple disciplines [12-26] Now the growing trend in this area motivated us to pursue this project.

This case report discusses the successful endodontic management in maxillary premolars presenting with complex anatomies.

Case Report 1

Maxillary Premolar (14) With An Intercommunicating Channel

A 42 year old female patient reported with mobile crown and pain

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Received: May 03, 2021

Accepted: May 26, 2021

Published: May 30, 2021

Citation: Pradeep Solete, Sneha Pai. Endodontic Management Of Maxillary Premolars With Complex Root Canal Anatomies. *Int J Dentistry Oral Sci.* 2021;08(05):2597-2600.
doi: <http://dx.doi.org/10.19070/2377-8075-21000508>

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at 14. Patient gave a history of root canal treatment 6 months ago. Patient had intermittent pain that aggravated on chewing. Clinical examination showed a mobile crown in 14 which when removed had secondary caries on the tooth. There was mild tenderness to percussion. Radiograph revealed incompletely obturated root canals in 14 with periapical radiolucency. It was diagnosed as root canal treated 14 with symptomatic apical periodontitis.

Treatment Protocol

Patient was told about retreatment and consent was taken for the same. The gutta percha was retrieved using Xylene and retreatment files (Dentsply-Sirona, USA). The canals were negotiated to its full length using a size 10K file (Dentsply-Sirona, USA). An inter communicating canal was seen between buccal and the palatal canals. The root canals were cleaned and shaped using ProTaper Gold rotary files (Dentsply-Sirona, USA) following which calcium hydroxide intracanal medicament was placed. In the next appointment, the canals were cleaned after isolating the tooth and obturation was completed using cold lateral compaction with resin sealer (AH Plus, Dentsply-Sirona, USA). Radiograph was taken to assess the quality of obturation and then a final restoration was placed. (Figure 1).

Case Report 2

Maxillary Premolar (15) With Three Root Canals

A 30 year old male patient reported with pain in 15. He gave a history of root canal treatment 6 months ago. Clinical examination showed a permanent restoration in 15 with tenderness to percussion. Radiograph revealed a missed canal in the buccal root. The case was diagnosed as Incompletely obturated 15 with symptomatic irreversible pulpitis.

Treatment Protocol

In this case CBCT scan was taken to evaluate the exact position

of the missed canal. It was seen that the distobuccal canal was left unobturated. Access was re-established, and the canal was negotiated with a size 10K file (Dentsply-Sirona, USA). Cleaning and shaping of the canal was achieved using ProTaper Gold files (Dentsply-Sirona, USA) after which the canal was obturated using matched taper single cone technique with resin based sealer (AH Plus, Dentsply-Sirona, USA). Post operative radiograph was taken to evaluate the obturation after which permanent restoration was placed.

Case Report 3

Maxillary Premolar (15) With Complex Anatomy

A female patient aged 45 years reported with severe pain in 15. She gave a history of initiated root canal treatment 3 months ago. Patient had severe pain that aggravated on chewing and having cold beverages. Clinical examination showed temporary restoration placed in 15 with tenderness to percussion. Radiograph revealed curved canals with widening of the periodontal ligament space. The case was diagnosed as previously initiated root canal treatment with symptomatic apical periodontitis.

Treatment Protocol

Access to the tooth was re-established and the canals were negotiated using a size 10K file (Dentsply-Sirona, USA). Cleaning and shaping was completed using Hyflex EDM files and irrigant activation was achieved using endoactivator (Dentsply-Sirona, USA). Obturation was done using cold lateral compaction technique and resin based sealer (AH Plus, Dentsply-Sirona, USA). Periapical radiograph was taken to assess the obturation and a final restoration was given.

Discussion

Premolars are believed to be difficult to manage endodontically due to the variation in the number of roots, pulp cavity and

Figure 1. a. Preoperative radiograph. b. GP retrieval. c. Working length determination radiograph. d. Obturation radiograph.



Figure 2. a. Preoperative radiograph. b. Preoperative CBCT. c. Working length determination radiograph. d. Obturation radiograph.

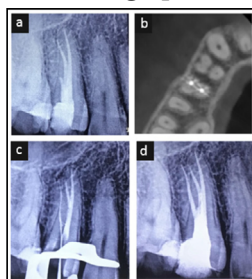
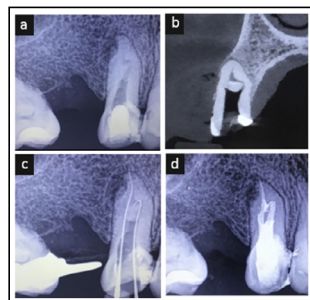


Figure 3. a. Preoperative radiograph. b. Preoperative CBCT. c. Working length determination radiograph. d. Obturation radiograph.



root canal configurations [27]. As per Vertucci's study, maxillary premolars are the only teeth that have demonstrated all the eight types of canal configurations [28]. Also the study by Gupta et al has reported similar findings [29].

There are several studies carried out to evaluate the canal configuration of maxillary premolars in Indian population. One of the studies reported Vertucci's type IV canal configuration (33.2%) to be the most commonly prevalent in maxillary first premolars followed by Vertucci's type I configuration (23.2%) [29]. Pecora et al have reported most of the maxillary second premolars to possess Vertucci's type II canal configuration (33.6%) followed by type IV configuration [27].

Intercanal communication or isthmus have been commonly observed in the middle third of the tooth [30]. This intercanal communication containing the pulp tissue serves as a reservoir for the bacteria and therefore debriding and cleaning of this area should be managed well for the success of endodontic therapy [31]. Sert and Bayirli and UJ Raj have reported the incidence of isthmus in maxillary premolars to be as high as 20.5% [5, 32].

The knowledge of root canal anatomy of teeth is of utmost interest as it helps in predicting the probable anatomy using diagnostic aids like radiographs. The size, shape and position of the root relative to the tooth should be assessed to determine any aberrant anatomy if present [7]. Additionally, CBCT imaging can also be used if radiographs remain inconclusive [8]. Clinically, modification of the access and tactile exploration with the file under magnification would help identification and management of any complex anatomies leading to predictable endodontic outcome. Our institution is passionate about high quality evidence based research and has excelled in various fields [33-43].

Clinical Significance

This article emphasizes the importance of knowledge regarding root canal anatomy along with tactile sensation and magnification in identifying and successfully managing maxillary premolars with complex anatomies. It also stresses the benefit of using diagnosing aids in identifying the root canal anatomy. All these along with thorough cleaning and shaping of the root canals with a three dimensional obturation blocking all the exit pathways would lead to successful endodontic outcome.

References

[1]. Cleghorn BM, Christie WH, Dong CC. The root and root canal morphol-

- ogy of the human mandibular first premolar: a literature review. *J Endod.* 2007 May;33(5):509-16. Pubmed PMID: 17437863.
- [2]. Gulabivala K, Aung TH, Alavi A, Ng YL. Root and canal morphology of Burmese mandibular molars. *Int Endod J.* 2001 Jul;34(5):359-70. Pubmed PMID: 11482719.
- [3]. Awawdeh LA, Al-Qudah AA. Root form and canal morphology of mandibular premolars in a Jordanian population. *Int Endod J.* 2008 Mar;41(3):240-8. Pubmed PMID: 18081806.
- [4]. Neaverth EJ, Kotler LM, Kaltenbach RF. Clinical investigation (in vivo) of endodontically treated maxillary first molars. *J Endod.* 1987 Oct;13(10):506-12. Pubmed PMID: 3482228.
- [5]. Sert S, Bayirli GS. Evaluation of the root canal configurations of the mandibular and maxillary permanent teeth by gender in the Turkish population. *J Endod.* 2004 Jun;30(6):391-8. Pubmed PMID: 15167464.
- [6]. Slowey RR. Root canal anatomy. Road map to successful endodontics. *Dent Clin North Am.* 1979 Oct;23(4):555-73. Pubmed PMID: 294389.
- [7]. Mittal S, Kumar T, Mittal S, Sharma J. Mandibular premolars with aberrant canal morphology: An endodontic challenge. *J Conserv Dent.* 2014 Sep;17(5):491-4. Pubmed PMID: 25298656.
- [8]. Patel S, Brown J, Pimentel T, Kelly RD, Abella F, Durack C. Cone beam computed tomography in Endodontics - a review of the literature. *Int Endod J.* 2019 Aug;52(8):1138-1152. Pubmed PMID: 30868610.
- [9]. Mahore D, Alam S, Mishra SK, Muxallary A. ENDODONTIC MANAGEMENT OF THREE ROOTED MAXILLARY FIRST PREMOLAR AND PRESENCE OF AN ASSOCIATED THREE ROOTED SECOND PREMOLAR. *UNIVERSITY JOURNAL OF DENTAL SCIENCES.* 2020 Jul 14;6(1):64-6.
- [10]. Low D. Unusual maxillary second premolar morphology: a case report. *Quintessence Int.* 2001 Sep;32(8):626-8. Pubmed PMID: 11526890.
- [11]. Shenoy A, Bolla N, Vemuri S, Kurian J. Endodontic retreatment--unusual anatomy of a maxillary second and mandibular first premolar: report of two cases. *Indian J Dent Res.* 2013 Jan-Feb;24(1):123-7. Pubmed PMID: 23852245.
- [12]. Govindaraju L, Gurunathan D. Effectiveness of Chewable Tooth Brush in Children-A Prospective Clinical Study. *J Clin Diagn Res.* 2017 Mar;11(3):ZC31-ZC34. Pubmed PMID: 28511505.
- [13]. Christabel A, Anantanarayanan P, Subash P, Soh CL, Ramanathan M, Muthusekhar MR, et al. Comparison of pterygomaxillary dysjunction with tuberosity separation in isolated Le Fort I osteotomies: a prospective, multi-centre, triple-blind, randomized controlled trial. *Int J Oral Maxillofac Surg.* 2016 Feb;45(2):180-5. Pubmed PMID: 26338075.
- [14]. Soh CL, Narayanan V. Quality of life assessment in patients with dentofacial deformity undergoing orthognathic surgery--a systematic review. *Int J Oral Maxillofac Surg.* 2013 Aug;42(8):974-80. Pubmed PMID: 23702370.
- [15]. Mehta M, Deeksha, Tewari D, Gupta G, Awasthi R, Singh H, et al. Oligonucleotide therapy: An emerging focus area for drug delivery in chronic inflammatory respiratory diseases. *Chem Biol Interact.* 2019 Aug 1;308:206-215. Pubmed PMID: 31136735.
- [16]. Ezhilarasan D, Apoorva VS, Ashok Vardhan N. Syzygium cumini extract induced reactive oxygen species-mediated apoptosis in human oral squamous carcinoma cells. *J Oral Pathol Med.* 2019 Feb;48(2):115-121. Pubmed PMID: 30451321.
- [17]. Campeau PM, Desrochers D, Lu JT, Burrage LC, Kim C, Hori M, et al. The genetic basis of DOORS syndrome: an exome-sequencing study. *Lancet Neurol.* 2014 Jan;13(1):44-58. Pubmed PMID: 24291220.
- [18]. Kumar S, Sneha S. Knowledge and awareness regarding antibiotic prophylaxis for infective endocarditis among undergraduate dental students. *Asian Journal of Pharmaceutical and Clinical Research.* 2016;154.
- [19]. Christabel SL, Gurunathan D. Prevalence of type of frenal attachment and morphology of frenum in children, Chennai, Tamil Nadu. *World J Dent.* 2015 Oct;6(4):203-7.

- [20]. Kumar S, Rahman RE. Knowledge, awareness, and practices regarding biomedical waste management among undergraduate dental students. *Asian Journal of Pharmaceutical and Clinical Research*. 2017;10(8):341.
- [21]. Sridharan G, Ramani P, Patankar S. Serum metabolomics in oral leukoplakia and oral squamous cell carcinoma. *J Cancer Res Ther*. 2017 Jul-Sep;13(3):556-561. Pubmed PMID: 28862226.
- [22]. Ramesh A, Varghese SS, Doraiswamy JN, Malaiappan S. Herbs as an antioxidant arsenal for periodontal diseases. *J Intercult Ethnopharmacol*. 2016 Jan 27;5(1):92-6. Pubmed PMID: 27069730.
- [23]. Thamaraiselvan M, Elavarasu S, Thangakumaran S, Gadagi JS, Arthie T. Comparative clinical evaluation of coronally advanced flap with or without platelet rich fibrin membrane in the treatment of isolated gingival recession. *J Indian Soc Periodontol*. 2015 Jan-Feb;19(1):66-71. Pubmed PMID: 25810596.
- [24]. Thangaraj SV, Shyamsundar V, Krishnamurthy A, Ramani P, Ganesan K, Muthuswami M, et al. Molecular Portrait of Oral Tongue Squamous Cell Carcinoma Shown by Integrative Meta-Analysis of Expression Profiles with Validations. *PLoS One*. 2016 Jun 9;11(6):e0156582. Pubmed PMID: 27280700.
- [25]. Ponnulakshmi R, Shyamaladevi B, Vijayalakshmi P, Selvaraj J. In silico and in vivo analysis to identify the antidiabetic activity of beta sitosterol in adipose tissue of high fat diet and sucrose induced type-2 diabetic experimental rats. *Toxicol Mech Methods*. 2019 May;29(4):276-290. Pubmed PMID: 30461321.
- [26]. Ramakrishnan M, Bhurki M. Fluoride, Fluoridated Toothpaste Efficacy And Its Safety In Children-Review. *International Journal of Pharmaceutical Research*. 2018 Oct 1;10(04):109-14.
- [27]. Pécora JD, Saquy PC, Sousa Neto MD, Woelfel JB. Root form and canal anatomy of maxillary first premolars. *Braz Dent J*. 1992;2(2):87-94. Pubmed PMID: 1290917.
- [28]. Vertucci FJ, Gegauff A. Root canal morphology of the maxillary first premolar. *J Am Dent Assoc*. 1979 Aug;99(2):194-8. Pubmed PMID: 287737.
- [29]. Gupta S, Sinha DJ, Gowhar O, Tyagi SP, Singh NN, Gupta S. Root and canal morphology of maxillary first premolar teeth in north Indian population using clearing technique: An in vitro study. *J Conserv Dent*. 2015 May-Jun;18(3):232-6. Pubmed PMID: 26069411.
- [30]. Hargreaves KM, Cohen S, Berman LH. Cohen's pathways of the pulp. Mosby Elsevier; 2011.
- [31]. Weine FS. The enigma of the lateral canal. *Dent Clin North Am*. 1984 Oct;28(4):833-52. Pubmed PMID: 6594281.
- [32]. Jayasimha Raj U, Mylswamy S. Root canal morphology of maxillary second premolars in an Indian population. *J Conserv Dent*. 2010 Jul;13(3):148-51. Pubmed PMID: 21116391.
- [33]. Vijayashree Priyadharsini J. In silico validation of the non-antibiotic drugs acetaminophen and ibuprofen as antibacterial agents against red complex pathogens. *J Periodontol*. 2019 Dec;90(12):1441-1448. Pubmed PMID: 31257588.
- [34]. J PC, Marimuthu T, C K, Devadoss P, Kumar SM. Prevalence and measurement of anterior loop of the mandibular canal using CBCT: A cross sectional study. *Clin Implant Dent Relat Res*. 2018 Aug;20(4):531-534. Pubmed PMID: 29624863.
- [35]. Ramesh A, Varghese S, Jayakumar ND, Malaiappan S. Comparative estimation of sulfiredoxin levels between chronic periodontitis and healthy patients - A case-control study. *J Periodontol*. 2018 Oct;89(10):1241-1248. Pubmed PMID: 30044495.
- [36]. Ramadurai N, Gurunathan D, Samuel AV, Subramanian E, Rodrigues SJL. Effectiveness of 2% Articaine as an anesthetic agent in children: randomized controlled trial. *Clin Oral Investig*. 2019 Sep;23(9):3543-3550. Pubmed PMID: 30552590.
- [37]. Sridharan G, Ramani P, Patankar S, Vijayaraghavan R. Evaluation of salivary metabolomics in oral leukoplakia and oral squamous cell carcinoma. *J Oral Pathol Med*. 2019 Apr;48(4):299-306. Pubmed PMID: 30714209.
- [38]. Ezhilarasan D, Apoorva VS, Ashok Vardhan N. Syzygium cumini extract induced reactive oxygen species-mediated apoptosis in human oral squamous carcinoma cells. *J Oral Pathol Med*. 2019 Feb;48(2):115-121. Pubmed PMID: 30451321.
- [39]. Mathew MG, Samuel SR, Soni AJ, Roopa KB. Evaluation of adhesion of *Streptococcus mutans*, plaque accumulation on zirconia and stainless steel crowns, and surrounding gingival inflammation in primary molars: randomized controlled trial. *Clin Oral Investig*. 2020 Sep;24(9):3275-3280. Pubmed PMID: 31955271.
- [40]. Samuel SR. Can 5-year-olds sensibly self-report the impact of developmental enamel defects on their quality of life? *Int J Paediatr Dent*. 2021 Mar;31(2):285-286. Pubmed PMID: 32416620.
- [41]. R H, Ramani P, Ramanathan A, R JM, S G, Ramasubramanian A, et al. CYP2 C9 polymorphism among patients with oral squamous cell carcinoma and its role in altering the metabolism of benzo[a]pyrene. *Oral Surg Oral Med Oral Pathol Oral Radiol*. 2020 Sep;130(3):306-312. Pubmed PMID: 32773350.
- [42]. Chandrasekar R, Chandrasekhar S, Sundari KKS, Ravi P. Development and validation of a formula for objective assessment of cervical vertebral bone age. *Prog Orthod*. 2020 Oct 12;21(1):38. Pubmed PMID: 33043408.
- [43]. Vijayashree Priyadharsini J, Smiline Girija AS, Paramasivam A. In silico analysis of virulence genes in an emerging dental pathogen *A. baumannii* and related species. *Arch Oral Biol*. 2018 Oct;94:93-98. Pubmed PMID: 30015217.