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Intraoral radiographic diagnosis and management of an aberrant mandibular premolar: a case report

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ABSTRACT

Mandibular premolars are known for their aberrant root canal variations. This is because, they are highly unpredictable and often present with a wide variety of morphological variations. Slowey et al. reported that these root canal aberrations in mandibular premolars present an endodontic challenge to the dental practitioners.Hence, these teeth may require skillful and careful root canal preparation and canal filling techniques. One of the major reasons for failure of root canal treatment can be attributed to the unobserved canals by the operator during the procedure. This article reports and discusses the successful endodontic management of a mandibular second premolar, with an atypical canal pattern that has been missed by the dentist inadvertently in the initial appointment.

Keywords: Anatomical variations; atypical pattern; mandibular premolars; root canal morphology; root canal treatment; type V canal.

Introduction

The prognosis and success of endodontic therapy depends on complete debridement of the entire pulpal space followed by a three-dimensional root canal filling to create a fluid tight seal. To achieve this, a thorough knowledge of the root canal anatomy of each individual tooth is very essential. However, the root canal morphology of teeth is extremely complex and often differs in variations [1,2].The risk of missing a canal detail during root canal therapy is high because of this extreme complexity of the pulp canal morphology.

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It has been reported that the incidence of missed canals or roots in teeth necessitating endodontic treatment is about 42% [3]. Zillich and Dowson reported 11.7% and 0.4% occurrence of two canals and three canals in mandibular premolars respectively [4]. Cleghorn et al. in a literature review, reported that the incidence of an additional root (0.4%), an additional canal (9.9%), and an additional apical exit (8.2%) in the mandibular second bicuspids is lower than that of the mandibular first bicuspids (2.0%, 24.2%, and 21.1%, respectively) [5].Overall, an accessory root was present only in about 0.0–4.4% (average 0.61%) of teeth as reported in a systematic review by Kottoor et al [6].In Indian population, this presentation of second premolars with two root canals was reported to be 13.5– 20% [7].Hence, the endodontic management of mandibular second premolars with variable canal configuration can be diagnostically and technically challenging. In light of these observations, this article highlights a case report of successful endodontic management of a

mandibular second premolar with variable canal pattern.

Case Report

A 45 year old male patient visited a private clinic with the chief complaint of pain in lower right back tooth region. The patient's medical history was non-contributory and the nature of pain was spontaneous, non-radiating, lingering aggravated on eating food and relieved by medication. The patient also had a habit of mouth breathing. On clinical examination, the right mandibular second premolar was sensitive to percussion. Deep caries with pulpal involvement was also noted. The case was provisionally diagnosed as symptomatic irreversible pulpitis and root canal treatment was suggested. In the first appointment, the tooth was anaesthetized using local anaesthetic solution, 2% Lignocaine HCl in 1:200,000 epinephrine (Xylocaine; AstraZeneca Pharma Ind Ltd, Bangalore, India.) by an inferior nerve block of the right side. The dentist initiated the root canal treatment in relation to45. In the first appointment, conventional access cavity preparation was done. Considering this as a routine case, the dentist explored the pulp space with a 15 size K file (Mani Inc, Tochigi Ken, Japan) anticipating the presence of only a single canal in the mandibular second premolar. Then, an intraoral periapical radiograph in relation to 45 was taken with the file in place as shown in Fig. 1. On careful interpretation of the radiograph, the dentist recognized that the internal morphology of the mandibular second premolar showed a variable canal pattern. The condition was explained to the patient and the dentist sealed the access cavity with Cavit G (3M ESPE, Seefeld, Germany) following gentle irrigation with 0.9% normal saline and occlusal reduction. As the patient was willing to save his tooth, the dentist referred the case to an endodontist.

In the second appointment, following administration of local anaesthesia, the access was re-entered in 45. An attempt for rubber dam isolation was done, but the patient was not comfortable with the same (due to airway obstruction), following which, rubber dam was removed and cotton roll isolation along with high volume saliva ejectors were employed. On careful interpretation of the radiograph, the mandibular premolar exhibited Vertucci's Type V canal pattern (i.e. single canal exits the pulp chamber and divides into two separate and distinct canals with separate apical foramina short of the apex). Hence, the access cavity was modified by additional removal of coronal dentin for improved straight line access. Following exploration of the pulp chamber with DG 16 explorer, the coronal third of the canal was explored with a precurved No. 10 size ISO K file. The file was initially placed more buccally into the orifice and eventually directed lingually. Once tactile perception of the presence of two canals was confirmed, a radiograph was taken with the placement of the files in the respective canals (Fig. 2). Following working length determination, the root canals were instrumented with a crown down technique with copious irrigation using 2.5% sodium hypochlorite solution. Following cleaning and shaping, the root canal system was obturated with cold lateral compaction of gutta percha cones using a traditional zinc oxide eugenol sealer. A post-obturation radiograph was obtained and the coronal access cavity was restored with resin composite (Filtek P60, 3M ESPE, St. Paul, Minnesota, US) following an intra-orifice seal with Glass Ionomer cement (Ketac Molar Easymix, 3M ESPE, Seefeld, Germany). The patient was advised postoperative review following a week. On review, the patient was asymptomatic and hence a post endodontic restoration in the form of a crown was planned thereafter.

Discussion

In the present case, Vertucci's Type V canal pattern was observed in the mandibular second premolar. Vertucci (1984) classified the root canal configuration of human permanent teeth into eight types: type 1 (1), Only one canal extends from the pulp chamber to the apex; type II (2-1), two distinct canals leave the pulp chamber and join short of the apex to form one canal; type III (12-1), one canal leaves the pulp chamber, divides into two within the root, and then merges to exit as a single canal; type IV (2), two separate and distinct canals extend from the pulp chamber to the apex; type V (1-2), single canal leaves the pulp chamber and divides short of the apex into two separate and distinct canals with separate apical foramina; type VI (2-12), two distinct canals leave the pulp chamber, merge within the body of the root, and re-divide short of the apex to exit as two separate canals; type VII (1-2-1-2), single canal leaves the pulp chamber, divides and then rejoins within the body of the root, and finally re-divides into two separate canals short of the apex; and type VIII (3), three distinct canals extend from the pulp chamber to the apex [1].One of the primary requisites in endodontic treatment is the successful, precise identification of the internal root canal morphology. To obtain predictable results, high-quality pre-operative radiographs should be obtained at different horizontal angulations and carefully evaluated to detect the presence of an accessory root canal [8].The morphological shape and form of the root, its

position, and its relative outline should be carefully determined from the radiograph. In the present case, the dentist initiated the root canal therapy based on only clinical examination without any preoperative radiographic analysis presuming that the mandibular second premolar commonly comprises only one canal. This signifies the importance of preoperative intra oral periapical radiographs which are always considered the backbone to diagnosis and is an eye-opener for all dentists who perform root canal therapy without a pre-operative radiograph. Once the iatrogenic error was realised by the dentist, the patient was referred to an endodontist which implies the significance of speciality referral in such complicated cases. Thereafter, a careful radiographic interpretation along with cautious exploration of the pulpal floor with DG 16 explorer, use of a precurved smaller size file (No. 10 size ISO K file) in addition to good tactile perception helped the endodontist to successfully locate and negotiate the two canals efficiently. As a radiograph is a two-dimensional representation of a three-dimensional object, it is a challenging task at times, to clearly delineate the configuration of the root canal. In such cases, advanced imaging techniques like spiral computed tomography (SCT), micro-computed tomography (micro CT) and cone beam computed tomography (CBCT) are very useful [9]. Using these techniques, images can be obtained in almost any sectional plane in the entire three dimensions. However, a careful tactile exploration of the root canal manually with smaller sized files is indispensable even in the presence of such advanced technologies. In the present scenario, despite the complexity of the root canal morphology, it was clearly determined on a simple conventional intraoral radiograph, eradicating the need for expensive three dimensional investigative techniques.

In this case study, failure to recognize the presence of an additional canal and its successful cleaning and root canal filling, might have led to acute flare-ups during treatment and its subsequent failure following endodontic treatment which can be attributed to the close proximity of the mandibular second premolar to the mental foramen [10].While locating the root or the canals in such aberrant cases, it should always be considered that the more apically the canal divides, it becomes increasingly tough to effectively access, clean, shape and successfully obturate. Hence, smaller size K files are initially used as they can deviate either buccally or lingually according to the division of the main canal. In addition, an adequate tactile sense is also essential and the files have to be precurved appropriately before negotiating such canals. It is also important to note that, during obturation, the patency of the canal should be maintained through the apically condensed gutta percha with a larger size file or with a root canal spreader of suitable taper while each canal is being filled.

Rubber dam isolation was not done in the present case, which might be considered as a major limitation, but adequate care was maintained to prevent contamination of the operating field using cotton rolls and high volume saliva evacuators. Though, rubber dams increase the quality and safety of dental treatments, open mouth position plays the largest role in decreased upper airway patency, and open mouth position with a rubber dam may further disrupt breathing pattern, as stated by Iwatani et al [11]. Since the patient revealed a habit of mouth breathing, in addition to the fact, that there was a discomfort caused due to airway obstruction, rubber dam application was terminated in the current case.

Conclusion

Anatomical variations, especially the presence of accessory roots and canals, should always be considered during root canal therapy. A complete essential knowledge of root canal morphology and its variations, multiple angled pre-operative radiographs and their careful interpretations, a careful clinical inspection of the pulpal floor, proper modification of the access cavity and a good tactile perception are essential pre-requisites for successful location and negotiation of such accessory canals. Speciality referral is also to be considered, if there is difficulty or failure in recognition of additional canals during endodontic treatment.

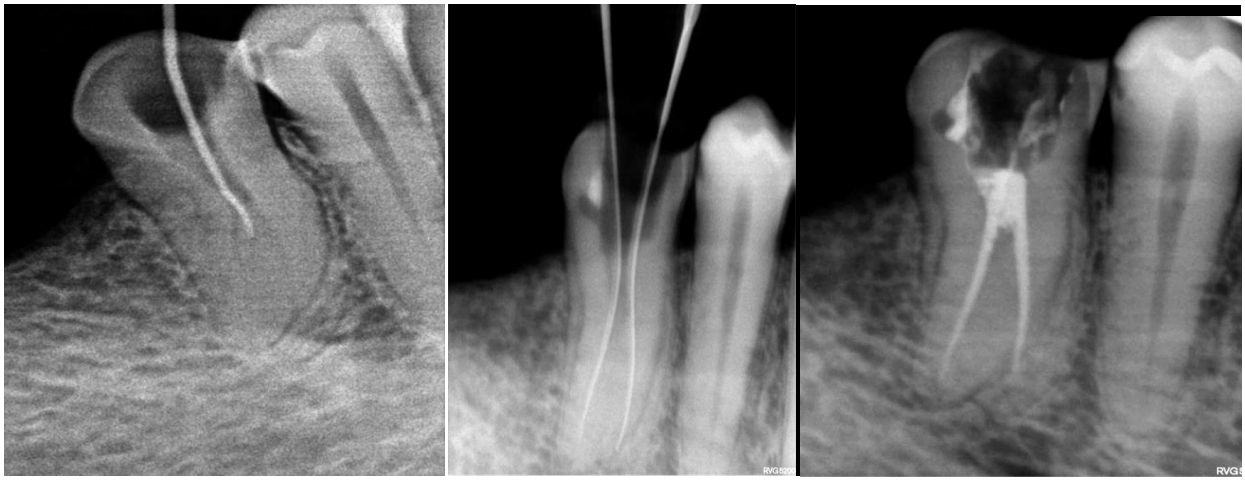

Fig 1: Radiograph of the mandibular second premolar with the initial file placement by the dentist following access opening during first appointment
Fig 2: Location and successful negotiation of Type V canal pattern in the mandibular second premolar during second appointment
Fig 3: Final obturation of the mandibular second premolar

References

1. Slowey RR. Root canal anatomy: Road map to successful endodontics. Dent Clin North Am.1979; 23:555–73.
2. Vertucci FJ. Root canal anatomy of the human permanent teeth. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1984; 58(5): 589-99.
3. Hoen MM, Pink FE. Contemporary endodontic retreatments: An analysis based on clinical treatment findings. J Endod. 2002;28: 834–6.
4. Zillich R, Dowson J. Root canal morphology of mandibular first and second premolars. Oral Surg Oral Med Oral Pathol. 1973; 36: 738–44.
5. Cleghorn BM, Christie WH, Dong CC. The root and root canal morphology of the human mandibular second premolar: a literature review.JEndod. 2007; 33(9):1031-7.
6. Kottoor J, Albuquerque D, Velmurugan N, Kuruvilla J. Root Anatomy and Root Canal Configuration of Human Permanent Mandibular Premolars: A Systematic Review. Anat Res Int 2013: 254250: Epub.
7. Parekh V, Shah N, Joshi H. Root canal morphology and variations of mandibular premolars by clearing technique: an invitro study. J Contemp Pract 2011; 12(4): 318-321.
8. Green D. Double canals in single roots Oral Surgery Oral Medicine and Oral Pathology 1973;35 (5): 689–696.
9. Neelakantan P, Subbarao C, Subbarao CV. Comparative evaluation of modified canal staining and clearing technique, cone-beam computed tomography, peripheral quantitative computed tomography, spiral computed tomography, and plain and contrast medium-enhanced digital radiography in studying root canal morphology. J Endod. 2010; 36(9): 1547–51.
10. Reddy JS, Chandra RVP, Santoshi L, Reddy VG. Endodontic management of two-rooted mandibular premolars using spiral computed tomography :a report of two cases. J Contemp Dent Pract. 2012; 13(6):908– 913.
11. Iwatani K, Matsuo K, Kawase S, Wakimoto N, Taguchi A, Ogasawara T. Effects of open mouth and rubber dam on upper airway patency and breathing. Clinical Oral Investigations.2013; 17(5):1295-1299.

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