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Endodontic Management of a Mandibular Second Premolar with Three Root Canals and Taurodontism: A Case Report

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A complete understanding of canal morphology is essential to achieve successful endodontic treatment. Although mandibular second premolars are reported to have usually only one root canal at the apex, in this case we reported a mandibular second premolar with three root canals and taurodont morphology. A patient was referred to the endodontic department at Mashhad Faculty of Dentistry with a chief complaint of pain in her mandibular right second premolar tooth. The diagnosis of pulpal necrosis and chronic apical periodontitis was established. The initial radiograph showed a taurodont premolar with two roots. However, with cone-beam computed tomography assistance, three root canals were confirmed. The root canal treatment process was successfully managed with a dental operating microscope. Using cone-beam computed tomography and a dental operating microscope greatly facilitated the determination of tooth morphology and successful following nonsurgical endodontic treatment.

Keywords: Endodontic Management; Mandibular Premolar; Taurodontism

Introduction

Anatomical variations have been reported in all teeth, specifically in mandibular premolars. Endodontic treatment failure may be attributed to a missed canal, which can be related to the inability to recognize canal's presence[1]. Therefore, a detailed knowledge of the root canal morphology is essential. Particular tooth types, for example, mandibular premolar teeth, have been reported to have anomalous anatomy, so their root canal management is announced to be the most difficult among others [2] .

Taurodontism is defined as a morphological change in tooth shape. It is caused by the failure in the invagination of Hertwig's epithelial root sheath, which leads to an apical displacement of the root furcation. It is characterized by an elongated pulp chamber, apically displaced pulp chamber floor, and shortening of root canals. Its prevalence has been reported to range between less than 0.1% to 48% [3].

Vertucci reported that among mandibular second premolars, 97.5% have only one root canal and 2.5% have two canals, three root canals have been seldom reported [1].

Different studies have been conducted on the anatomy of the root canal system; Rodig [4], Mahdavisefat [5], and shokouhinejad [6] reported mandibular second premolars with three canals. Khorasani *et al.*, reported mandibular first premolar with C-shape root canal configuration [7].

Zillich and Dowson announced that in the second premolars, 84.5 % had one canal, 11.7 % had two canals, and 0.4 % had three canals [8].

Al-Fouzan [9], Holtzman [10], Davaji [11], Niavarzi [12] and Penukonda [13] reported mandibular premolars with four canals and Demiryürek [14] reported a mandibular second premolar with five canals and taurodontism.

In a case report by Tzanetakis *et al.* [15], endodontic management of a mandibular second premolar with four root canals was done with a dental operating microscope.

Taurodontism in mandibular premolars has been reported for the first time by Tennant 1966, Mena 1971, Madeira *et al.* 1986, Llamas & Jimenez-Planas 1993, Tiku *et al.* 2003) [3]. Recently, Vujaskovic [16], Demiryürek [14], and Penukonda [13] have reported a case of taurodont mandibular premolar.

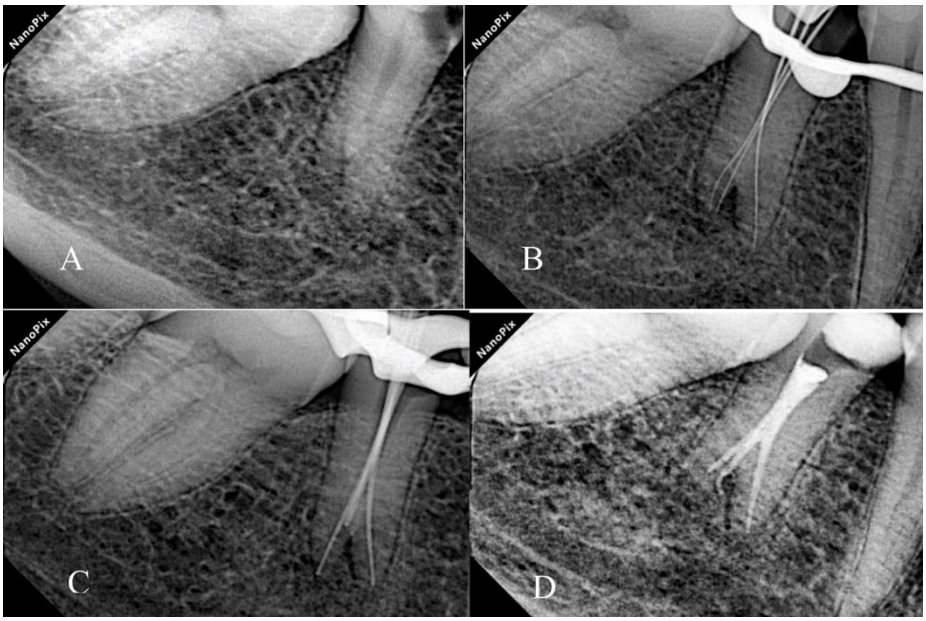

Figure 1. Mandibular second premolar; *A)* Preoperative radiograph; *B)* Working length confirmation radiograph; *C)* Master cone confirmation radiograph; *D)* Postoperative radiograph

This case report presents endodontic management of a taurodont mandibular right second premolar with three separate root canals. Cone-beam computed tomography (CBCT) and dental operating microscope were used as a diagnostic tool to facilitate endodontic treatment.

Case Report

A 36-year-old female patient was referred to the endodontic department at Mashhad Faculty of Dentistry, with a chief complaint of pain about her mandibular right second premolar tooth for approximately 2 weeks and had no medical complications.

In the clinical examination, no swelling or sinus tract was found, and the tooth was not sensitive to percussion, thermal, and electrical pulp testing. thermal (Cold test, Luber cold spray, Tolu Taravat Tabiat Tebb Inc., Tabriz, Iran) and electrical pulp testing (Parkell Inc., Edgewood, New York, USA).

No periodontal pockets were found. Radiographic evaluation of the tooth presented an anomalous root canal morphology of two roots with taurodontism (Figure 1A). This type of root canal anatomy does not fit in Vertucci's classification. Therefore, Sert and Bayirli's root canal categorization classified it as type IX [17].

Based on periapical radiographic findings, with the aim of a better description, the patient was referred to obtain a CBCT image. According to the AAE Endodontic Case Difficulty Guideline [18], this case was classified as high difficulty. Following a complete description of treatment complications, the patient provided informed consent, and the CBCT of the mandible was performed using the Planmeca ProMax (Planmeca, Helsinki, Finland). The axial images of CBCT exhibited the third canal in the taurodont second premolar with furcation involvement (Figure 2B). The coronal image presented the three canals, branching 3-4 mm apically (Figure 2A). By the axial image of CBCT (Figure 2B), two root canals were located in the buccal root and one root canal in the lingual root. Hence, in this report, we mentioned the three root canals: buccal 1 (B1), buccal 2 (B2), and lingual.

Pulpal necrosis and chronic irreversible pulpitis was diagnosed, and nonsurgical endodontic therapy was suggested. After local anesthesia was administered (mandibular nerve block with lidocaine 2% and epinephrine 1:100,000, Darupakhsh, Tehran, Iran), the tooth isolation was done, and the caries were excavated. The access cavity was prepared with high-speed diamond round bur No. 2 (Jota AG, Rüthi, Switzerland) and water coolant. Coronal flaring was carried out with Gates Glidden drills. After modification of the access cavity, two separate root canal orifices (B2 and lingual) were detected under a dental operating microscope (Zumax OMS2380, Suzhou, China). They were negotiated with #8 K-file (Mani Inc, Utsunomiya, Japan). Following passive shaping of the coronal third of B2 and lingual root canals, the B1 orifice was found due to a sticking point with the #8 K file. The working length was determined with an apex locator (DemPex apex locator, UK) and it was established by a periapical radiograph (Figure 1B).

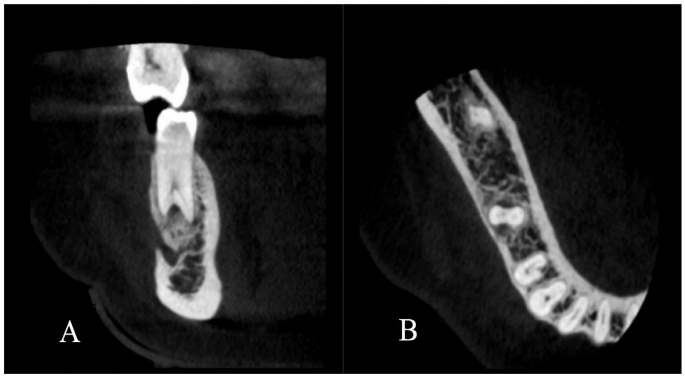

Figure 2. CBCT views; *A*) Coronal view; *B*) axial view

The shaping and cleansing of the canals were done up to N0.30 master apical file (Flexofile, Dentsply, Switzerland) and followed by SP1 silver rotary files up to 25/4 % (SP1, Shenzhen, China) with profuse irrigation with 2.5% sodium hypochlorite and normal saline, alternately. Because of the complexity of the root canal system, the complete treatment was scheduled for the second session, and all canals were dressed with calcium hydroxide paste (Morvabon, Tehran, Iran). The tooth was sealed with Cavit (Cavisol, Tehran, Iran). In the second session, calcium hydroxide was rinsed with 2.5% sodium hypochlorite. The ultimate irrigation was done with 17% EDTA (Morvabon, Tehran, Iran), 2.5% sodium hypochlorite, and a final rinse with normal saline. The canal irrigation was done with an ultrasonic activator (Ultra-X ultrasonic activator; Eighteeth, Changzhou, China). Then, the root canals were dried with sterile paper points (META, Chugbuk, South Korea). The canal obturation technique consisted of lateral compaction with gutta-percha (master gutta-percha cone No.30, META Biomed, Chugbuk, South Korea) and AH-26 sealer (Dentsply DeTrey, Konstanz, Germany) in the apical region and vertical obturation of the main root trunk, using the Fast fill obturation system (Eighteeth, Changzhou, China). A postoperative radiograph was taken (Figure 1D), and the patient was referred for permanent restoration. It was restored with a composite restorative material. At the 5-month follow-up session, it was clinically and radiographically asymptomatic (Figures 3A, 3B).

Discussion

Taurodontism is usually reported in molar teeth, and it's incidence in premolars is very low. A study by Madeira found seven first taurodont premolars and four second taurodont premolars but none among 1,010 upper premolars [19]. Because of alterations in the pulp chamber and canal morphology, root canal treatment becomes a challenge [3].

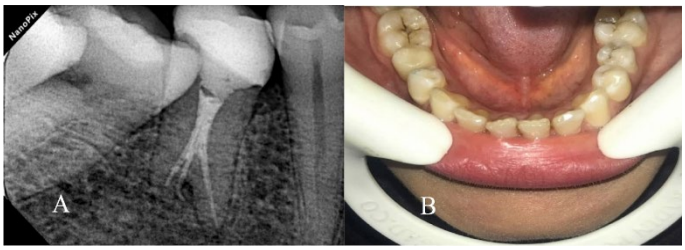

Figure 3. Mandibular second premolar; *A*) 6-month follow-up radiograph; *B*) 6-month follow-up photograph

Mandibular premolars have been reported to have anomalous anatomy in the literature, and the incidence of aberrant morphology in mandibular first premolars is higher than in mandibular second premolars [20]. Awareness of such complex root canal anatomy would help in the success of root canal treatment. Failure to detect canal orifices would lead to unsuccessful endodontic treatment of mandibular second premolar teeth with multiple canals [21].

One of the negative aspects of periapical radiographs is the superimposition of root canals. Previous studies revealed that CBCT may be helpful in the diagnosis and management of teeth with multiple root canals and complex morphology [22-24].

Although CBCT details root canal morphology, dentists should consider a higher radiation dose [25]. The CBCT images, in this case, the report revealed two distinct taurodont roots (one buccal and one lingual) and three separate root canals (located mesiobuccally, distobuccally, and lingually).

Root canal treatment of tauorodont tooth has its difficulties: long root trunk, complex morphology, obstructions, and various root canals. Meticulous investigation of canal orifices with magnification, ultrasonic irrigation, and the use of warm obturation seem to be crucial [3]. Another issue that should not be neglected is the clinician's competency and ability to treat such teeth. Teeth with complex root canal anatomy ought to be referred to endodontists.

A dental operating microscope and CBCT is essential for such cases. The Washington study of endodontics failure revealed the failure rate for the mandibular first and second premolars 11.45% and 4.54%, respectively [17]. These results can be related to the root canal complexity of these teeth. Moreover, it has been suggested that ultrasonic activation in cleansing such aberrant anatomies may be helpful [26].

In this case report, a third root canal in a taurodont tooth was diagnosed by CBCT since the periapical radiograph couldn't reveal its presence.

Conclusion

In this case report, periapical radiographs could not reveal the exact root canal anatomy. Therefore, the CBCT was administrated. Successful endodontic treatment, in this case, is related to the magnification achieved by a dental operating microscope, a thorough debridement, ultrasonic irrigation, and complete obturation.

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Conflict of interest
None.

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Author contributions
Melika Mohammadi: conducting the research, Writing the original draft, revising the manuscript, Review and editing. Mina Zarei: Review and editing, Supervising.

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