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Case Report

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Endodontic treatment of three mandibular incisors with two canals and two separate foramina: A case report

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Abstract

Mandatory perquisites of successful root canal therapy are comprehensive knowledge about anatomy and morphology of teeth, cleaning and shaping of all canal system and sealing it off. This paper reports retreatment of three mandibular anterior teeth having two separate canals and two foramina with a six-month follow up.

Keywords: Anatomical variations, Mandibular incisor, Retreatment, Root canal morphology, Mandibular incisor, Root canal anatomy.

INTRODUCTION

A comprehensive knowledge of root canal system anatomy, in line with adequate removal of pulpal remnants and bacteria, shaping the root canal system as well as sealing the prepared space are among the mandatoryprerequisites of a successful root canal treatment [1,2].

Mandibular anterior teeth are known to have one canal in 15-68% of cases. However, in many studies the prevalence of the additional canal(s) is the popular point of interest [3-10], neighboring multiple teeth with additional canals can be extraordinary.

This paper is a report regarding retreatment of three mandibular anterior teeth having two separate canals and two foramina with a six-month follow up.

CASE REPORTS

A 45-year-old female without any history of medical complication was referred to the post graduate section of Endodontic Department with the chief complain of “a pain in front section of the lower jaw that interferes with biting". The dental history revealed that the pain was originated from four connected crowns in the anterior mandible which had been made two years ago. Patient claimed teeth had undergone root canal treatment. Her radiographs showed Teeth #24, #25 and #26 had poor root canal treatment (Fig-1).

During the intra oral examination, the bridge was found to be loose. Pulpal sensitivity tests and periodontal examinations were done after the bridge removal on the tooth #27; teeth #22 and #23 were as controls (Table-1)

Local anesthesia was established by bilateral mental nerve block injections of 2% lidocaine with 1:80,000 epinephrine (Persocaine E, Daroupakhsh, Tehran, Iran). Carious lesions were removed and access cavities prepared using a high-speed diamond bur under copious water spray. Teeth were isolated using rubber

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Figure 1: Pretreatment radiograph

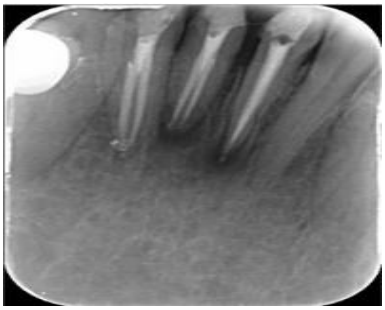

Figure 2: Post treatment radiograph

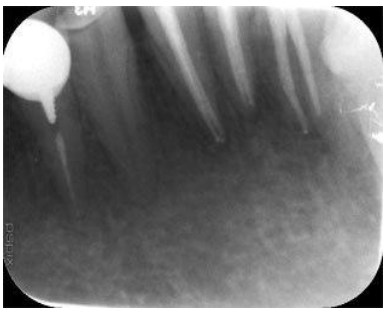

Figure 3: Six-month follow-up radiograph

Table 1: Pulpal sensitivity tests, diagnosis and treatment plan

	Cold Test	Hot Test	EPT	Palpation	Percussion	Diagnosis	Treatment
#24	_	_	_	+	+	SAP†	Retreatment
#25	_	_	_	+	+	SAP†	Retreatment
#26	_	_	_	_	_	AAP‡	Retreatment
#27	+s**	+s**	+5	_	_	Normal	Follow up
#22*	+s**	_	+6	_	_	Normal	No Treatment
#23*	+s**	_	+5	_	_	Normal	No Treatment

*: Control tooth, ** S: Short, †: Symptomatic apical periodontitis, ‡: Asymptomatic apical periodontitis.

dam, wooden wedge, floss and clamp. Gutta perchas were removed using choloroform (Golchai,Tehran, Iran) and K-files (Mani, Japan). Working lengths were determined by an electronic apex locator (Raypex5, VDW, Germany) and confirmed by periapical radiographs. In these radiographs presence of additional canals was suspected, so the access cavities were buccolingually enlarged. After successful ***negotiation***? of the lingual canals, another radiograph was taken in order to confirm the working length. Root canal preparation was carried out using ProTaper (Dentsply-Maillefer, Ballaigues, Switzerland) as rotary instruments and hand K-files (Mani, Japan) up to apical size #35. The canals were dressed by calcium hydroxide (Golchai,Tehran ,Iran) and temporarily restoredusing Self-curing glass ionomer (G.C. Dental Industrial Corp., Tokyo, Japan). The bridge was temporarily cemented using non-eugenol Tempbond (Kerr Europe AG, Switzerland) for one week. On The next session the pain was relieved.Canals were irrigated by 1.25% sodium hypochlorite and instrumented again by master apical file and finally obturated by gutta percha (Aryadent,Tehran,Iran) and AH26 sealer (Dentsply, Detray, Konstanz, Germany) using lateral condensation technique. Self-curing glass ionomer (G.C. Dental Industrial Corp., Tokyo, Japan) was chosen as the temporary filling material and the bridge was cemented temporarily in place by non-eugenol Tempbond (Kerr Europe AG, Switzerland). According to the results of the sensitivity tests, the tooth #27 was temporized with the pre-existing restoration without any endodontic intervention for further follow-up.

One-month follow up

Pain relieved and the bridge was removed in order to test the tooth #27 which showed to be vital and had no sign(s) of irreversible pulpitis. Patient was referred to prosthodontic department for further treatments (Fig-2).

Six-month follow up

Unfortunately, patient did not pursue the prosthetic treatment and was still using the previous bridge. The tooth #27 had signs of irreversible pulpitis and underwent root canal therapy using the previously mentioned protocol.The tooth #27 had two canals at the working length determination but the septum between canals was removed during the preparation of canals. The periapical lesions of the teeth #24 and #25 showed radiographic signs of healing (Fig -3).

DISCUSSION

Thorough knowledge of root canal anatomy is an integral part of endodontic treatment that directly deals with success in all phases of procedure [1,11]. Inability to detect and cleaning of all canals and incorrect canal obturation are among the most important factors in treatment failure [2,12,13]. However, complete cleaning and shaping cannot be achieved because of root canal system complexity. It is difficult to measure the importance of these uncleansed areas in treatment success [13].

There are many studies on the prevalence of additional canals revealing diverse results. Some of these contributing factors resulting in such dispersion include sex(9), ethnic background [14,15], age [16], methodology of study (e.g. CBCT [4,17-19], clearing and injection [5,8, 10, 20], MicroCT [21,22], peripheral quantitative computed tomography (pQCT) [23], conventional radiography [24-26] and clinical inspection.

It is important to note that few methods are clinically accessible such as radiography, magnifying or pulp chamber staining. Besides angled radiographs, other imaging techniques such as CBCT and MicroCT as new technologies have gained popularity [21,22]. although eliminating superimpositions [27,28], more precision [29], more rapid detection of periapical pathosis [30], missed canal detection [4,31] and root fractures detection (horizontal/Vertical) [32] are some benefits of CBCT, the routine use of this technology is accompanied with several limitations such as poor quality in comparison to the conventional periapical radiographs [27], artifacts near amalgam or some of the prosthetic restorations or sometimes gutta percha [33], device size, method and position of imaging ,inaccessibility and cost.

There are many studies and case reports using magnifiers (loop or dental operating microscope (DOM)) [34-37]. The major limitation in using loop is that the focal distance is fixed and clinician may need to choose an uncomfortable position [38]. Using higher magnification by DOM can result in missing the operation field by minor patient movements during the procedure [38].

Some of other methods that can help in locating the orifices are using ultrasonics, furcation staining (e.g., Methylen Blue dye), champaign bubble test [12], using of 17% aqueous EDTA, 95% ethanol and the

Stropko irrigator to clean and dry the pulp chamber floor prior to visually inspecting the canal system [39].

Careful visualization of pre-, intra-, and post-treatment radiographs as well as taking horizontally angled images are the most common, accessible and popular method in detecting any anatomical variation [24,26]. The results of a study using standard straight radiographs from the buccal aspect of mandibular incisors and premolars, considering the narrowing or canal disappearance phenomena, showed missing of second canal in one third of the specimens [26].

Regarding dimensionsof mandibular anterior crowns that make them the most difficult to access, particular care must be taken to avoid access cavity errors. Therefore, too much caution may result in smaller-than-usual access cavity preparations, which in turn might result in missing additional canals. Lingual shoulder (i.e. the dentinal shelf that starts from the cingulum and terminates 2mm below the orifice) is another impeding factor in locating the additional canals.

Mesio-distal/facio-lingual index is also a guide in predicting and additional canal. The less this index, the more the chance of having second canals in mandibular anteriors [40].

Leoni et al show that 50% of mandibular centrals and 62% mandibular laterals are classified as Vertucci's type I and 28% as type III [22]. In another study using the same method, 92% of mandibular incisors are categorized as Vertucci's type I or III [41].

Prevalence of second canal is reported to be 15-68% in mandibular anteriors [3-10,20,36,41]. According to two studies done in Iranian population [4,8], the prevalence of one canal in lower centrals was reported the to be 64.52% and 72.7%. Also the prevalence of single-canalled lateral incisors was reported to be 70.6% and61.71%. and the prevalence of Vertucci's type IV canal configuration for mandibular central and lateral incisors were stated to be 7.7% and 15.4%, respectively [4]. Prevalence of Vertucci's type IV and more are noteworthy because they have at least two separate foramina, leading to two separate avenues to the periapical region. Leoni's study showed that 40% of mandibular central and 26% of lateral incisors have lateral canals [22]. Therefore, treating only one canal in these tooth types may not be sufficient in gaining successful results and the importance of negotiating additional anatomical complexities cannot be overemphasized.

CONCLUSION

Comprehensive knowledge of anatomy and its related variations, bearing study results in the clinician's mind, and application of new technologies have significant impacts on favorable treatment outcomes.

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