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Endodontic Management of Maxillary First Molar with C-shaped Canal Configuration: Two Case Reports

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Abstract

The goal of root canal treatment is the thorough cleaning, shaping and obturation of the root canal system. A good knowledge of internal anatomy and its variation is an obsolute necessity for succesful endodontic treatment. This article, describes the endodontic management of two maxillary first molars having c-shaped root canal configuration.

Key words: Endodontic, C-shaped, Maxillary

Introduction

The main goal of endodontic treatment is cleaning and disinfection of the root canal system. (Martins et al., 2016) One of the important causes of the failure in endodontic treatment is the presence of untreated canals. (Song et al., 2011) Identification of variations in the anatomy of the root canal system is a prerequisite for successfully diagnosis and treatment of endodontics. (Martins et al., 2016; Neelakantan et al., 2010) One of the most important anatomical variations is the c -shaped root canal. (Jo et al., 2016) The anatomical complexities of the root canal cause a challenge during endodontic treatment. (Naseri et al., 2013) C-shape teeth treatment is one of the most challenging treatments. (Fernandes et al., 2014) It is due to its unique characteristics and the presence of web and fins connecting the individual root canals to each other, (Jo et al., 2016) which causes difficulty in proper shaping, cleaning and obturation of root canal system. (Kim et al., 2018) The c-shape root canal was first described by Cooke and Cox in 1979. (Cooke and Cox, 1979) This variation is more common in the mandibular second molars (Ladeira et al., 2014; Martins et al., 2016; Zheng et al., 2011) and its occurrence is very rare in the maxilla primary molars. (De Moor, 2002; Cleghorn et al., 2006) The morphological variation of the c-shape root canal is unusual and can lead to problems during treatment. This research has described the successful treatment of two unusual c-shape maxilla primary teeth.

Case 1

The case 1 was a 13 years boy referred to dental school of Zahedan University of Medical Sciences by his general dentist for treating the root canal of the maxilla left primary molar.He complained of continuous vague pain in his posterior maxilla. His medical history was unremarkable. Clinical examination showed a temporary restoration at the occlusal surface of the tooth # 14 and sensitivity to percussion in this tooth. A preoperative Radiograph revealed the tooth had the fused roots (Figure1-a). Based on clinical and radiographic examination a diagnosis of symptomatic apical periodontitis was made and nonsurgical endodontic treatment was recomended. After local anesthetic injection by 1.8 ml lidocaine 2% solution with epinephrine 1.80000 (persocaine, Daroupakhsh, Tehran, Iran) and isolation with rubber dam, the temporary restoration was removed.

5% sodium hypochlorite solution was placed in the Pulp chamber. The evaluation of pulp chamber floor with an endodontic explorer (HU-Friedy, Chicago, IL, USA) showed a fusion between the distobuccal and palatal canals, which created a large arc canal system in distopalatal area along with an individual mesiobuccal canal. The length of the canals was determined using an apex locator (Root ZX, Morita.tokyo, japan) and confirmed by radiography (Figure 1-b). The canals were prepared using a Pro Taper nickel titanium rotary instrument (Maillefer, Ballaigues, Switzerland-Dentsply) and Crowne Down Technique and they were disinfected with 5% sodium hypochlorite solution and ultrasonic agitation. Moreover, the isthmus between DB and P canals was shaped and cleaned using a manual file (maillefer, flexoFiles, Dentsply) and circumferential movements. Then, the canals were dried with sterile paper point and calcium

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hydroxide was placed inside the canals and the access cavity was sealed temporality using cavit. The patient was recalled after one week. In the next appointment, the patient was asymptomatic and EDTA solution 17% (Asia Chimi Teb, Tehran, Iran) was placed in the canals for 1 minute and then washed with 5% sodium hypochlorite before obturation to control the debris remaining in the isthmus between the distobuccal and palatal canals. Finally, the canals were dried by sterile paper point (Dentsply Maillefer) and master cone was taken (Figure 1-c) and obturation was done with Thermoplasticized injection technique and AH26 sealer (Dentsply, DeTrey, Konstanz, Germany). The access cavity was then restored with composite resin. The final radiographic examination confirmed the accuracy of endodontic treatment and showed the presence of two apical foramens (Figure 1-d). The photography image after the obturation also represented the large distopalatal canal along with an individual mesiobuccal canal (Figure 1-e).

Case 2

A 25-year-old woman referred to Endodontics Department at Zahedan Dentistry School. The patient referred due to pain in the upper right posterior region of the jaw, and a severe and prolonged sensitivity to cold since few days ago. The patient used NSAID to relieve pain, but the symptoms were only temporary improved. Clinical examination showed decays in the tooth # 3 mesial as well as sensitivity to percussion. No abnormal finding was found during periodontal examination. The vitality tests with *warm gutta-percha* and cold spray (Meta Biomed Co., Chungcheongbuk do, Korea) caused severe and prolonged pain and the response to electrical pulp test (Parke, Electronics Division, Farmingdale, NY, USA) was positive. preoperative periapical radiograph revealed a radiolucency involving the pulp .The radiograph also indicated that the tooth had a single, fused root. Moreover, PDL widening was also observed (Figure 2-a). Based on clinical and radiographic examinations, a final diagnosis of irreversible pulpitis with symptomatic apical periodontitis was made and non surgical endodontic treatment was recomended. After local anesthetic injection, using 1.8 ml of 2%lidocaine solution with epinephrine 1.80000 (persocaine, Daroupakhsh, Tehran, Iran) and isolation with rubber dam, decays were removed and the access cavity was prepared.

The pulp chamber floor was examined by endodontic explorer (HU-Friedy, Chicago, Ill., USA). In addition, the chamber floor showed the presence of a single c-shaped orifice in the centre of the root that was observed under the microscope (OPMI pico DentaMicroscope, Carl Zeiss, Oberkochen, Germany). 3% sodium hypochlorite solusion was placed in the pulp-chamber. Working lenght was determined by apex locator (Root ZX; Morita, Tokyo, Japan) and confirmed by radiography (Figure 2-b). The c-shaped canal were prepared using Protaper *Nickel Titanium Rotary* (Dentsply-Maillefer, Ballaigues, Switzerland) and the Crowe Down Technique. 5% sodium hypochlotite solution and normal salin were used for irrigating the canals between files and the canal was finally rinsed with 17% EDTA solution. After completing biomechanical preparation, the canal was dried using sterile paper point (Dentsply Maillefer). Master cone was taken (Figure 2-c) and obturation was performed using the Thermoplasticized injection technique and AH26 sealer technique (Dentsply, DeTrey, Konstanz, Germany) and the access cavity was restored using amalgam (Figure 2-d). The photography image after the obturation also represented the c-shape canal (Figure 2-e)

Discussion

The naming of the c-shape canal system backs to the c-shape cross-sectional morphology of the root and root canal, and pulp-chamber has an individual ribbon-shaped orifice with an arc of 180 degrees. (Naseri et al., 2013) This variation is the result of a lack of root division, resulting in a relationship between root canals that can continues up to 1.3 apical canals. (Fan et al., 2004; Jafarzadeh and Wu, 2007) The main anatomical characteristic of the c-shape canal is the presence of a web or fin that connects individual root canals. The roots containing c-shape canal often have a conical or square shape. (Jafarzadeh and Wu, 2007) This variation was reported more often in mandible second molars (Ladeira et al., 2014; Martins et al., 2016; Zheng et al., 2011) and it was first reported in the maxilla primary molars by Newton and McDonalds in 1984. (Newton and McDonald, 1984)

De Moor et al. (2002) reported the prevalence of c-shape canals 0.091% in maxilla primary molar based on radiographic evaluation and the most common type was the fusion between palatal roots and distobuccal, which was similar to the first case in this paper. In their review study, Cleghorn et al. (2006) reported the prevalence of c-shape root canals in the maxilla primary molar 0.12%. Although deep isthmuses are clinically unnoticed, they can be harbor for microorganisms and may be associated with unsuccessful treatment. (Martins et al., 2016) Therefore, after the instrumentation through nickel-titanium rotary files, k-files and H-files can enter to the canal passively and filing can be directed towards isthmus areas in order to obtain a better debridement. (Yin et al., 2010) Several classifications of the c-shape canal have been proposed for a better understanding of this type of root canal anatomy. (Martins et al., 2016 ;Fan et al., 2004; Melton et al., 1991) The primary classification was proposed by Melton et al. in 1991 based on optical microscopy and stereomicroscopy. Based on the Melton classification, the first patient is placed in the second category of this classification. It has the semicolon-shaped orifice in wich dentine seperates a main C-shaped canal from om mesiobuccal distinct canal. The second patient is placed in the first category of this classification and has a continuous c-shape canal running from pulp-chamber to the apex without any separation. (Melton et al., 1991)

Various studies have shown that the c-shape root canal can be identified based on an intraoral x-ray image before treatment, and several studies also showed that the c-shape root canal is not easily identified by this method. (Melton et al., 1991) Radiography for determining the working length in C-shape canal detection is more useful than preoperative radiography and final radiography. (Lambrianidis et al., 2001) However, the identification of this configuration could be facilitated if preoperative radiography, the radiography for determining the working length and the final radiography interprete simultaneously. (Jerome, 1994) At the first case, an initial radiographic evaluation showed the fusion of the roots, and in the second case, a conical root was observed, with a lucent space in the centre of root. Due to irregular canal morphology, irrigation plays an important role in disinfecting the canal. (Weine et al., 1998) To better disinfect the root canal system, it is better to use ultrasonic irrigation. (Cheung and Cheung, 2008) In addition to using ultrasonic instruments, chemical agents also play a significant role in disinfection of the c-shape root canal system. (Yin et al., 2010) Three-dimensional filling of root canal system can be problematic due to the complexities of the c-shape root canal system. In both cases, the Thermoplasticized injection technique was used. The goal of the Thermoplasticized technique is to transfer the sealer and gutta-percha to root canal system under hydraulic force. (Ruddle, 1992) Given what was stated above, the diagnosis, cleansing and disinfection of the root canal and its complete filling in the c-shape root canal system can be challenging. However, with the precise knowledge of the anatomy of this variation, along with the proper use of skill, this problem can be resolved.

Result

Due to the scarcity of c-shape canal configuration in the maxilla primary molar and the challenging nature of treatment of this variation, the precise knowledge of its internal anatomy and the proper application of cleansing and shaping and obturation of root canal system techniques can be helpful in increasing the success of treatment and preventing errors during clinical practice.

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