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Case Report

Diagnosis and treatment of maxillary first premolarwith three roots: seven case reports

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Abstract: Failure in understanding the diversity of root canal anatomy is a common finding. A three-rooted maxillary first premolar is an interesting variety of tooth anatomy. This article discusses about diagnosis and treatment of first maxillary premolar with three-roots. The canals were cleaned and shaped following obturation by lateral condensation of gutta percha using AH26 as sealer.
Keywords: diagnosis and treatment, maxillary premolar, three roots

INTRODUCTION

The main goal of root canal treatment is the cleaning and shaping of the entire pulp space and its obturation using an inert filling material. It is essential for the clinician to be familiar with root canal anatomy prior to endodontic treatment. False assessment of canal morphology causes defective debridement and obturation of the canal system which ultimately leads to failure of the endodontic treatment [1]

The internal anatomy of the maxillary first premolar is complicated due to variations in number and morphology of its roots and canals. Conventional radiography hassom elimitations in visualizing pulp and the apical region[2].

Several studies have focused on the morphology of maxillary first premolar root canal systems and have reported interesting racial diversities [3, 4]. Reports have indicated a prevalence of 30-60% for single- rooted 41.7-70% for two-rooted and 5-6% for three-rooted maxillary first premolars [5, 6].

Other studies have also stated 5-6% prevalence for three-rooted maxillary first premolars [7]. In a study by Vertucci and Gegauff, of the total 400 maxillary first premolars assessed, 5% were found to have three canals of which 0.5% had three canals in one root, 0.5% had two canals in one root and the third was in another and 4% were reported to have one canal in each root [7].

Three-rooted maxillary premolars are occasionally referred to as Ridiculous, small molars, or mini-molars due to their similarity to adjacent molars [8, 9]. In a study on the radiographs of maxillary premolars, Sieraski *et al.;* [10] found that if the mid-root is wider than the crown mesiodistally, it is more likely to be three-rooted. Considering the above, four patients with three-rooted maxillary first premolars were diagnosed and treated.

CASE REPORT 1

A 16year-old male with a non-contributory medical history appealed the clinic of Endodontic Department of Zahedan dental university. He had a history of Spontaneous pain. Clinically there was a deep carious lesion at mesial and distal surfaces in tooth #24.The tooth were sensitive to cold and electrical pulp test showed irreversible pulpitis. Pre-operative periapical radiography confirmed the presence of a carious lesion on mesial and distal surfaces of maxillary first premolar (Figure 1). The periapical region looks like to be radiographically normal. After the administration of the local anesthetic using 2% lidocaine with 1:80,000 epinephrine (Darupakhsh, Tehran, Iran) under rubber dam isolation, tooth #24 was accessed. Access cavity was modified at bucco-proximal angle from the entrance of the buccal canals to the cavo-surface angle resulting in a cavity with a T-shaped outline. Mesiobuccal, disto buccal and palatal canals were explored with #15 k file (Mani, Japan). The working length was established with apex locator (Root ZX, Morita, Japan) and confirmed radio graphically for

each root (Figure2). Coronal flaring was carried out with sizes 3 to 1 of Gates Glidden drills in a crown-down fashion (Dentsply Maillefer, Switzerland). The remaining root canal system was prepared using K-files with copious irrigation with 2.5% sodium hypochlorite solution. Master apical files were selected for all canals which are displayed in figure 3. The canals were dried with paper points and obturated by lateral condensation technique using gutta percha (Meta, Southkorea) and AH 26 (DENTSPLY, Germany) as root canal sealer (Figure 4).

Fig-1*:* Carious lesions in the mesial and distal surfaces of maxillary first premolar (case 1)

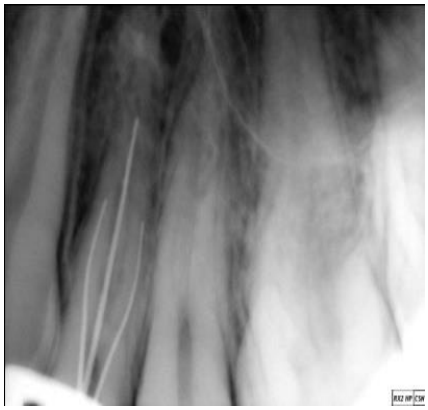

Fig-2*:* Working length determination (case 1)

Fig-3: Master apical files (case 1)

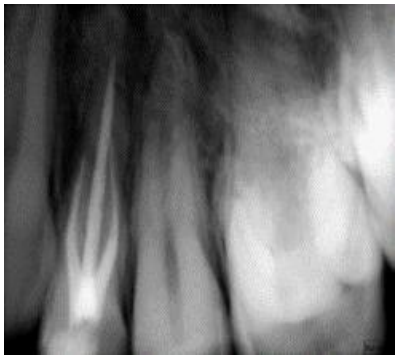

Fig-3*:* Obturated root canals (case 1)

CASE REPORT 2

A female patient aged 30 with a non-contributory medical history was referred to the Endodontic Department of Zahedan dental school with a history of spontaneous pain. Clinically there was a deep carious lesion at the distal surface in tooth #24. Tooth #25 also had a carious lesion at the mesial surface. Vitalitytestsshowedthattooth#24 had irreversible pulpitis. No periapical radiolucency was detected (Figure 5).Access cavity was modified at bucco-proximal angle from the entrance of the buccal canals to the cavo-surface angle resulting in a cavity with a T-shaped outline. After removing the coronal part, the buccal canals were explored with size #10 k file, the palatal with a size #15 k-file and finally three canals were confirmed radiogaphically. The working length was estimated using an apex locator and then confirmed by using radiography (Figure 6). Coronal flaring was carried out with Gates Glidden, sizes50, 70 and 90. The remaining root canal system was prepared with K-files and irrigated using 2.5% sodium hypochlorite solution. The canals were dried with paper points and obturated by using gutta-percha (Meta, South Korea) and AH26 sealer (DENTSPLY, Germany) with lateral condensation technique (Figure8). Amalgam filling was carried out and the patient was referred for treatment of tooth #25.

Fig-5: Preoperative radiograph of case 2

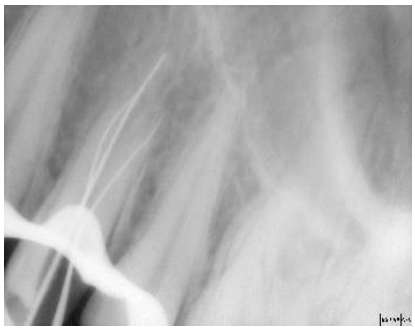

Fig-6: Radiographic confirmation of working length (case 2)

Fig-7: Master apical cones (case 2)

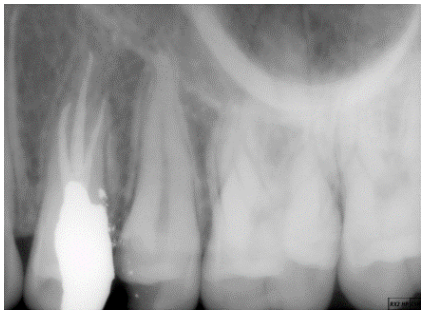

Fig-8: Obturated root canals (case 2)

CASE REPORT 3

A 35 year-old male patient with a dental history of spontaneous pain and negative medical history was referred to Endodontic Department of Zahedan medical university. Amalgam filling was observed at the distal surface of tooth #24.The tooth was sensitive to cold and Electrical pulp testing indicated irreversible pulpitis. No periapical radiolucency was observed radiographically (Figure 9). Following rubber dam isolation access cavity was prepared. After removing the coronal part, the buccal canals were Explored with size #10 k file and the palatal with a size #15 k file. The working length was estimated using an apex locator and then confirmed by using radiography (Figure10). Coronal flaring was carried out byGatesGliddenwithsizesof50, 70 and 90.The remaining root canal system was prepared with K-files and copious irrigation using 2.5% sodium hypochlorite solution was applied. The canals were dried with paper points and obturated by lateral condensation technique using gutta percha(Meta, South Korea) and AH 26 (DENTSPLY, Germany) root canal sealer(Figure 12). Amalgam restoration was carried out.

Fig-9: Preoperative radiograph of case 3

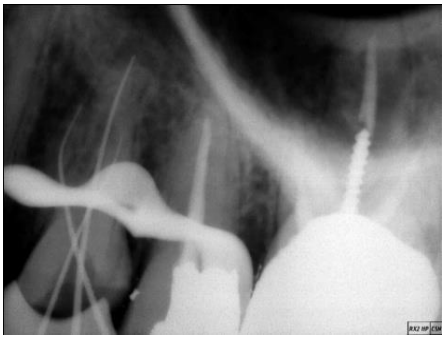

Fig-10: Radiographic confirmation of working length (case 3)

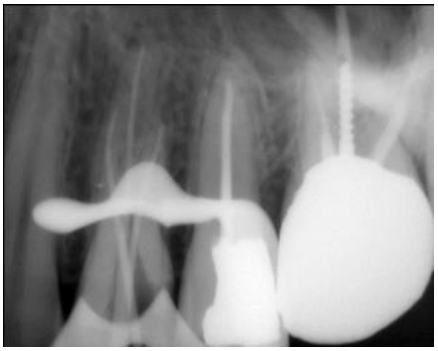

Fig-11: Master apical cones (case 3)

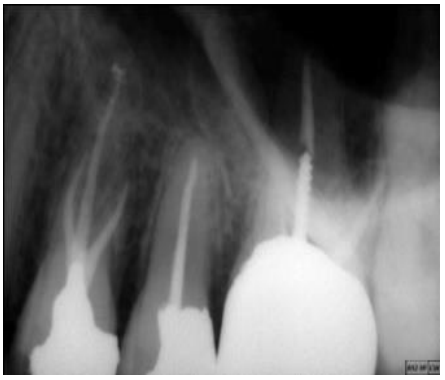

Fig-12: Obturated root canals (case 3)

CASE REPORT 4

A 15-year-old male patient with a non-contributory medical history referred to the department

of endodontic, Zahedan dental university. The patient exposed a chief complaint of spontaneous pain on tooth#14. A preoperative periapical radiograph confirmed the presence of a carious lesion on the distal surface of maxillary right first premolar (Figure 13). The tooth was sensitive to cold and electric pulp testing indicated irreversible pulpitis. The periapical region appeared radiographically normal. After the administration of the local anesthetic using 2% lidocaine with 1:80,000 epinephrines (Darupakhsh, Tehran, Iran) under rubber dam isolation tooth #14 was accessed. Mesiobuccal and disto buccal canals were explored with size of10 K file (DENTSPLY, Maillefer,, Switzerland)and the palatal with size of#15 K file (DENTSPLY, Maillefer, Switzerland). The working length was established with apex locator (Root ZX, Morita, Japan) and confirmed radio graphically for each root (Figure 14). Gates Glidden drills (Dentsply, Maillefer, Switzerland) with a brushing motion were used in a crown-down fashion to enlarge the orifices. The canals were cleaned and shaped with nickel titanium Protaper files (DENTSPLY, Maillefer, Switzerland) and ultimately irrigated using2.5% sodium hypochlorite.

After drying the canals with paper points, master cones were selected and obturation was carried out using lateral condensation technique with gutta-percha (Figure 15).AH26 sealer (DENTSPLY, Maillefer, Switzerland) was used as the root canal sealer(Figure 16). The treatment was completed in a single appointment.

Fig-13: Preoperative radiograph of case 4

Fig-14: Radiographic confirmation of working length (case 4)

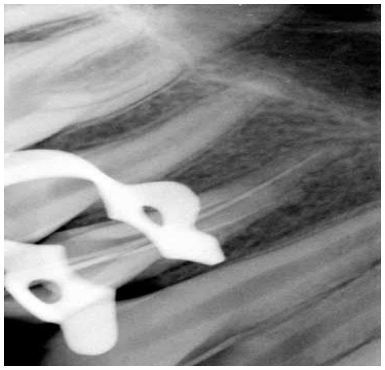

Fig-15: Master apical files (case 4)

Fig-16: Obturated root canals (case 4)

CASE REPORT 5

A 21 years old male patient with a non-contributory medical history referred to a department of endodontic, Zahedan dental university, he reported stimulated pain while eating cold foods and nightly spontaneous pain on tooth #14 and performed pulpotomy on his too thin the past. The remain caries on distal and occlusale surface observed clinically and apical radiolucency near palatal root indicated in preoperated radiography (figure17)

After the administration of the local anesthetic using 2% lidocaine with 1:80,000 epinephrine (Darupakhsh, Tehran, Iran) under rubber dam isolation, Access cavity was modified at bucco-proximal angle. Mesiobuccal, disto buccal and palatal canals were explored with #15 k file (Mani, Japan). The working length was established with apex locator (Root ZX,

Morita, Japan) and confirmed radio graphically for each root (Figure18). Coronal flaring was carried out with sizes 3 to 1 of Gates Glidden drills in a crown-down technique (DENTSPLY Maillefer, Switzerland). The remaining root canal system was prepared using K-files with copious irrigation with 2.5% sodium hypochlorite solution. Master apical cones were selected for all canals which are displayed in figure 19. The canals were dried with paper points and obturated by lateral compaction technique using gutta percha (Meta, Southkorea) and AH 26 (DENTSPLY, Germany) as root canal sealer (Figure 20). The tooth #15 also needed root canal therapy and we performed that. It was a three canal premolar. The patient referred for restoration.

Fig-17: Preoperative radiograph of case 5

Fig-18: Radiographic confirmation of working length (case 5)

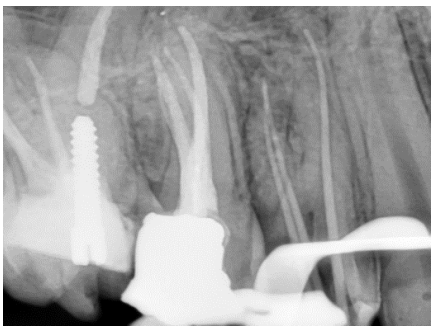

Fig- 19:Master apical files (case 5)

Fig-20: Obturated root canals (case 5)

CASE REPORT 6

A 24 years old male with a dental history of spontaneous pain and negative medical history was referred to the endodontic department of Zahedan dental school. The carious lesion on distal surface of tooth #24 was observed (figure 21). The cold test and electric pulp test indicated irreversible pulpitis and in percussion and palpation peri apex was normal.

Access cavity was modified at bucco-proximal angle from the entrance of the buccal canals to the cavo-surface angle resulting in a cavity with a T-shaped outline. After removing the coronal part, the buccal canals were explored with size #10 k file, the palatal with a size of #15 k file and finally the three canals were confirmed radiogaphically. The working lengths were estimated using an apex locator and then confirmed by radiography (Figure 22). Coronal flaring was carried out with Gates Glidden, sizes 50, 70 and 90. The remaining root canal system was prepared with K-files and irrigated using 2.5% sodium hypochlorite solution. The canals were dried with paper points and obturated using gutta-percha (Meta, South Korea) and AH26 sealer (DENTSPLY, Germany) with lateral condensation technique (Figure24)and patient referred for restoration.

Fig- 21: Preoperative radiograph of case 6

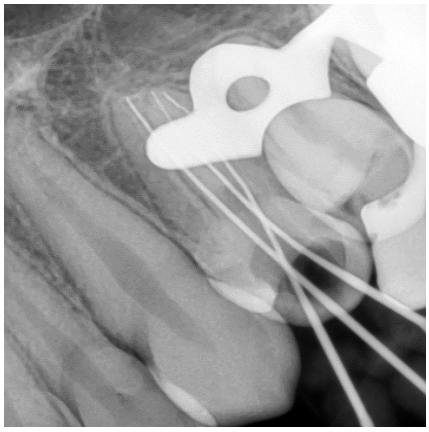

Fig-22: Radiographic confirmation of working length (case 6)

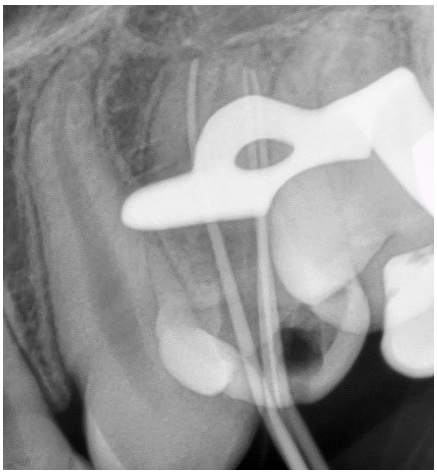

Fig-23: Master apical cones (case 6)

Fig-24: Obturated root canals (case 6)

CASE REPORT 7

A 33aged female with a non-contributory medical history was referred to the Endodontic Department of Zahedan dental school with a history of spontaneous pain. Clinically there was a deep carious lesion at the distal surface on tooth #14. A preoperative periapical radiograph confirmed the presence of a carious lesion on the distal surface of maxillary right first premolar and periapical radiolucency was not observed (figure 25).

Fig-25: Preoperative radiograph of case 7

The tooth was sensitive to cold and electric pulp testing indicated irreversible pulpitis. After the administration of the local anesthetic using 2% lidocaine with 1:80,000 epinephrines (Darupakhsh, Tehran, Iran) under rubber dam isolation tooth #14 was accessed. Mesiobuccal and disto buccal canals were explored with size of a10 K file (DENTSPLY, Maillefer,, Switzerland) and the palatal with size of #15 K file (DENTSPLY, Maillefer, Switzerland). The working length was established with apex locator (Root ZX, Morita, Japan) and confirmed radio graphically for each root(Figure 26). Gates Glidden drills (DENTSPLY, Maillefer, Switzerland) with a brushing motion were used in a crown-down fashion to enlarge the orifices. The canals were cleaned and shaped with nickel titanium protaper files (DENTSPLY, Maillefer, Switzerland) and ultimately irrigated using 2.5% sodium hypochlorite.

After drying the canals with paper points, master cones were selected (figure 27)and obturation was carried out using lateral compaction technique with gutta-percha (AH26 sealer (DENTSPLY, Maillefer, ,Switzerland) was used as the root canal sealer (Figure 28). The treatment was completed in a single appointment and patient referred for restoration.

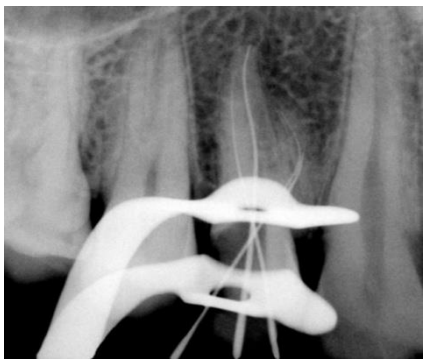

Fig-26: Radiographic confirmation of working length (case 7)

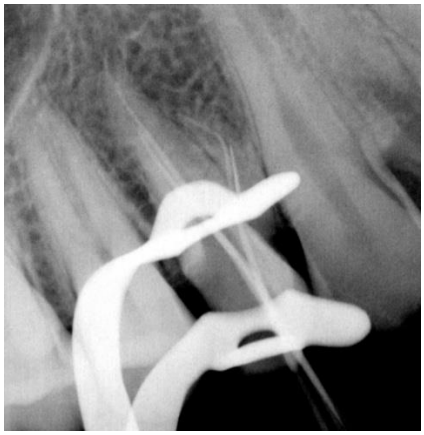

Fig- 27: Master apical cones (case 7)

Fig-28: Obturated root canals (case 7)

DISCUSSION

Historically dentists have treated maxillary first premolars with the assumption that only two canals are present. This approach should change since 0.5% to 9.2% of these teeth are found to have three canals [1, 5, 7, 11, 12]. Despite the low prevalence of three-rooted maxillary premolars it cannot be ignored.

It has been widely accepted that the success of endodontic treatment is entirely dependent on the complete cleaning, shaping and ultimately obturation of the canals [13].

According to Hoem and Pink, 42% of the teeth requiring endodontic retreatment had at least one canal with incomplete cleaning, shaping and obturation [14]. High quality preoperative radiographs and careful clinical examinations are essential to detect additional root canals [15]. Conventional radiographs are limiting due to their two dimensional nature and therefore cone beam computed tomography (CBCT) with three dimensional images has been suggested for detecting root canal variations and additional canals [16, 17]. Nevertheless conventional radiographs can also provide useful information provided that the parallel technique is used [18]. If a third canal is suspected during diagnosis, access cavity should be extended mesiodistally in the coronal region. This ultimately gives a T-shaped access cavity providing direct access to each of the three canals [19]. If the access cavity is insufficient with regards to extension, depth or position ideal results may not be achieved. Conversely, if a third canal is not suspected, a thorough examination of the pulp chamber floor and an accurate analysis of canal positions will suffice. In multi-rooted teeth canal orifices are often connected by slightly marked sulci.

In three-rooted maxillary premolars these canals are observed when the buccal canals are located in the bifurcation. Therefore the pulp should be completely removed and irrigation should be carried out using sodium hypochlorite and ultrasonic to achieve better visualizations [20].

CONCLUSION

Although the presence of three canals in maxillary premolars is rare, dentists should be thoroughly aware of the various root anatomies with special attention to the internal anatomy. Lack of knowledge on the internal anatomy and its variations will undoubtedly lead to errors in locating the canals and insufficient instrumentation and obturation of the root canal system.

Prior to treatment dentists should routinely obtain two to three radiographs in different angulations in order to determine the variations of root anatomy. Shaping of the narrow buccal canals in a three-rooted maxillary premolar poses an important challenge to the clinician.

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