Mandibular First And Second Premolars With Three Canals

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Citation

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Abstract

To achieve successful endodontic treatment, the clinician has to identify the different canal configurations and treat them properly. Finding two mandibular premolars with three canals in the same patient is quite rare. However the clinician should be aware of the multiple and complex variations that can take place during root formation. The various methods to identify premolars with aberrant canals using radiographs, operating microscope and careful examination of the pulpal floor are discussed in this case. The possible link of complex canal system with racial variations is also analyzed.

INTRODUCTION

The main objectives of root canal treatment are thorough shaping and cleaning of all pulp spaces and its complete obturation with an inert filling material. The presence of untreated canal may be a reason for failure of endodontic therapy ([1]). To achieve satisfactory root canal therapy, a proper and in-depth knowledge of complex and abnormal root canal morphology is more than essential. Pineda and Kutler, Green, Zillich and Dowson, Vertucci and Pécora et al. have studied the canal anatomy and configuration of mandibular premolars ([2,3,4,5,6]). Pécora et al. observed that 22.3% of the mandibular first premolars possessed two canals and two separate foramina while 5.12% had two canals and one foramen. Comparatively 5.3% of the mandibular second premolars examined had two canals with two foramina and 4.4% had two canals with one foramen. Only 0.46% of the first and second premolars examined showed a three-canal and three-foramen configuration ([6]). Zillich and Dowson reported that a second or third canal existed in at least 23% of first premolars ([4]).

It is also important to be familiar with any variations in tooth anatomy and characteristic features in various racial groups since such knowledge can aid in location and negotiation of canals as well as their subsequent treatment ([7]). There seems to be a racial predisposition for the presence of two or more canals in the mandibular or maxillary premolars ([8,9,10]). The majority of reports on endodontic treatment with three or more canals concern patients of Caucasian and Negroid origins ([10,11,12,13]). Walker in his study of the mandibular first premolars in the Southern Chinese population of Hong Kong seemed to indicate a high prevalence of teeth with more than one canal ([14]). It is suggested that there is a need for further studies of root canal systems of teeth of non-Caucasian origin to establish the frequency of root and canal variations that may exist in the dentitions of different racial groups. The purpose of this article is to report the case of a Southern Chinese patient from Guangzhou who has three canals and three separate foramina in both the mandibular first and second premolars and their subsequent treatment.

REPORT

A 34 year-old Cantonese man with no contributory medical history was referred from a private practitioner to Guanghua College of Stomatology, Sun Yat-Sen University in Guangzhou (Canton), South China. The patient's chief complaints were pain and swelling in the lower right region. Intra-oral examination revealed grossly carious lesions with teeth # 28, # 29, # 30, # 31 and # 32 that had been dressed with zinc oxide cement. A localized swelling with purulent discharge on palpation was also present in # 31 & # 32 regions (fig.1 A). Tooth # 29 was tender on percussion tests but showed no reaction to electrical and thermal stimuli while teeth # 28, # 30, # 31 and # 32 were slightly responsive to percussion, electric pulp testing and warm gutta-percha. Radiographic evaluation showed periapical radiolucies with # 29, # 30, # 31 and # 32, with thickening of the periodontal ligament more prominent in # 29 and # 30 (fig.1 B). More than one root canal was suspected in both premolars and an extra medially and distally angulated periapical radiograph was taken to help in a better interpretation of the canal system. With a tracer gutta-percha point the source of the draining sinus turned out to be the

second premolar. A diagnosis of suppurative apical periodontitis was associated with # 29. Tooth # 28 was diagnosed as an irreversible pulpitis whereas # 30, # 31 and # 32 were chronic apical periodontitis. Endodontic treatment was planned for # 28, # 29, # 30, # 31 and # 32 starting with # 29 so as to provide drainage for the swelling.

Anaesthesia was achieved by means of inferior alveolar nerve block with 1.8mL of 2% lignocaine with 1:80000 adrenaline. After placing a rubber dam, the gutta-percha was removed from tooth # 29 without the use of any solvent, using Hedstrom files and copious irrigation with 5.25 % sodium hypochlorite. Initial exploration of the pulpal floor with a size 10 k-file (Maillefer, Ballaigues, Switzerland) revealed two canals. From the aspect of the pulpal floor a third canal was suspected. Further exploration with a bended size 10 k-file did not help in locating the entrance of that canal. With the help of an operating microscope (OPMI Pico Dental Microscope, Zeiss, Oberkochen, Germany) and after careful examination of the pulpal floor, a mesiolingual canal was found and explored (fig.1 C). The trunk of the canal seemed to trifurcate at mid-root level giving rise to three separate canals. Gates Glidden drills sizes 5, 4, 3 were used for the initial opening of the orifices of the canals. The root canal lengths were estimated with an apex locator-Justy II (Yoshida Dentcraft, Tokyo, Japan) to mesiolingual canal 17 mm, mesiobuccal canal 18.5mm and distal canal 17.5mm. Working length radiographs were taken to confirm these estimates. The canals were cleaned and shaped by the graduating taper crown down technique with Profile rotary instruments (Dentsply/Tulsa Dental, Tulsa, Oklahoma, USA). The canals were packed with calcium hydroxide and the access cavities were sealed with zinc oxide cement. Exploration of # 28 showed relatively the same canal configuration with the trifurcation at mid-root level and was treated in the same manner as # 29. Teeth # 30, # 31 and # 32 showed normal canal configurations and root canal treatment was carried out normally. After two weeks, the swelling had subsided and the patient had no complaint of pain. The dressing and calcium hydroxide were removed and the canals were thoroughly cleaned by alternate irrigations of 17% EDTA and 5.25% sodium hypochlorite. The patency of each canal was checked by using a size 15 k-file. After drying with paper points, the canals were fit No 35, 0.04 taper gutta-percha to full working length. Each of the canals was obturated with warm vertical condensation technique Touch 'n Heat™ heat source (SybronEndo/Analytic Tech., Irvine, California). “Back-packing” of the remainder of the radicular space was done by injecting plasticized gutta-percha using Obtura II (Obtura/Spartan, Fenton, Missouri, USA) (fig.1 D).

Figure 1

Figure 1a: A Intra oral examination.

Figure 2

Figure 1b: Pre-operative radiograph showing multi canal system with # 28 and extensive destruction of periradicular bone associated with long-standing pathosis of # 29.

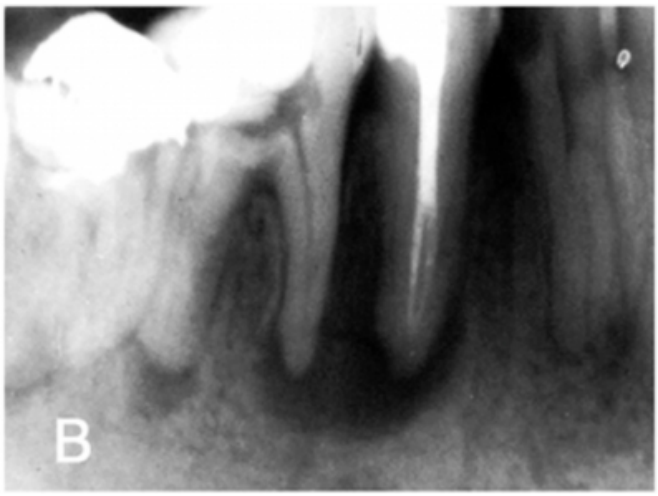


Figure 3

Figure 1c: Magnified view of the pulp chamber showing the mesiolingual (ML), mesiobuccal (MB) and distal (D) root canal orifices.

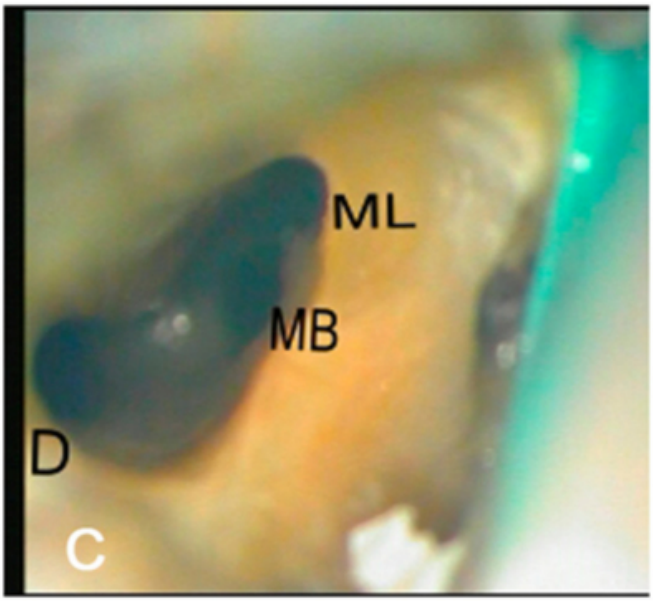
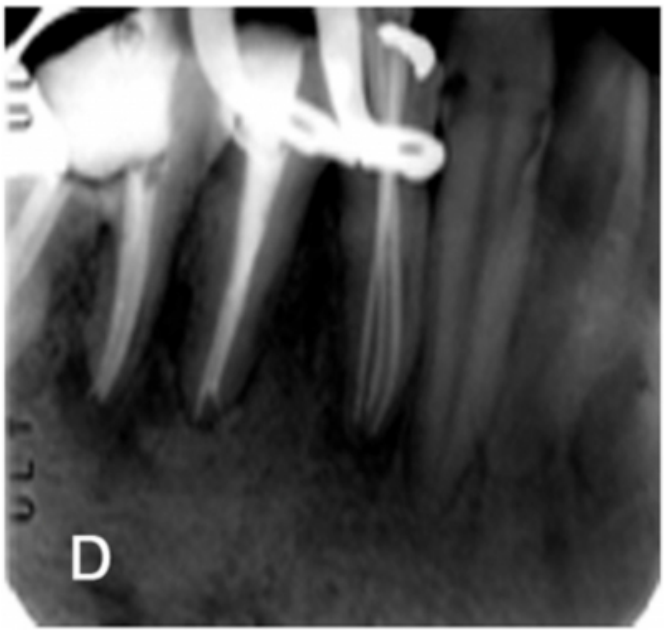


Figure 4

Figure 1d: Radiograph showing complete obturation of # 29 and evaluation of position of master gutta-percha cones before compaction in # 28.



The teeth were crowned afterwards and the patient was recalled after 1 month, 6 months, 12 months and 2 years period. The two-year postoperative radiographs showed good healing of the surrounding tissues (fig.2 A-D).

Figure 5

Figure 2ab: A Post-obturation radiograph with # 28 with some extrusion of sealer and 2-year recall radiographs (fig 2 B) showing complete peri-radicular bone repair.

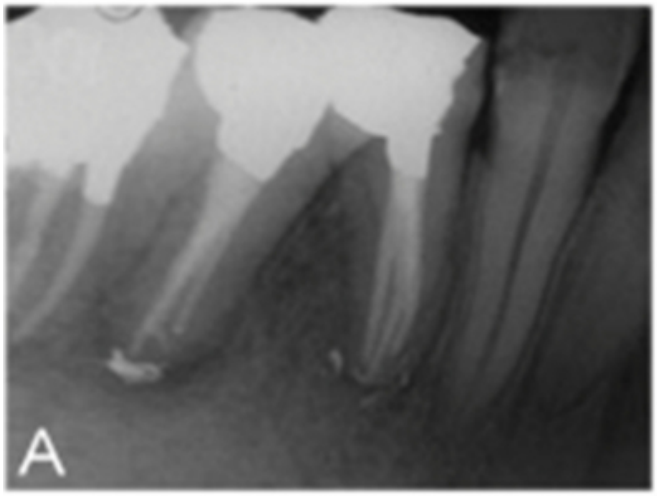


Figure 6

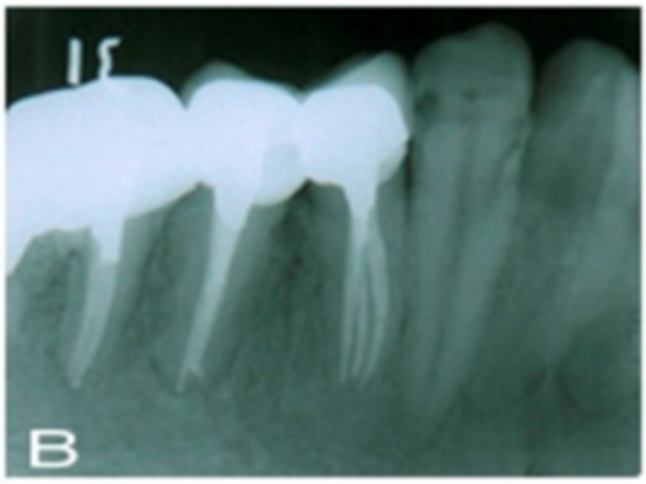


Figure 7

Figure 2cd: Post-operative radiograph of # 29 and 2-year recall radiographs (fig 2 D) indicating healing apical bone structure; patient is clinically symptom free.

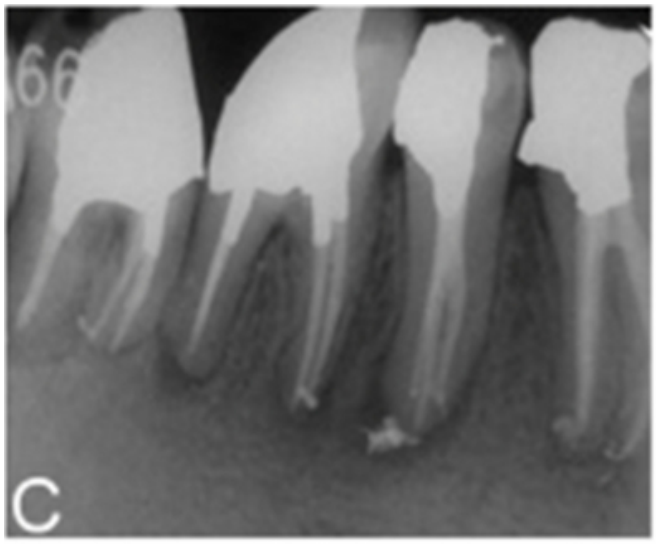
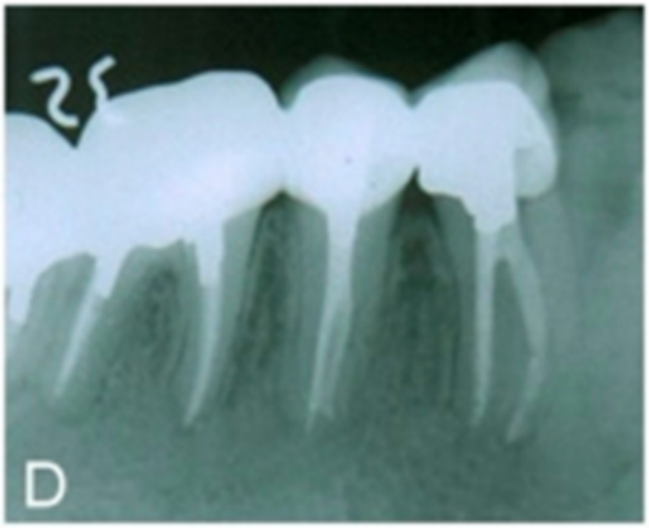


Figure 8



DISCUSSION

Any time the outline of the root canal is unclear, unusual, or strays from the conventional contours, one should be suspicious of an extra canal. Slowey discussed the fact that these ‘extra' root canals accounted for many of the endodontic failures and that most of these ‘extra' canals could be found if the clinician was alert to the clues that suggested their presence ([15]). Traditionally by examining the pulp chamber's floor certain indications could lead to the location of the canal orifices. Krasner and Rankow proposed certain laws to help clinicians identify the canal orifices based on the relation of the cemento-enamel junction ([16]).

The first and second law of symmetry (with the exception of the maxillary molars) stated that the orifices of the canal lay equidistant from a line drawn mesiodistally through the pulp chamber floor and that they all lay perpendicularly to that same line. The law of color change stated that the color of the chamber floor was always darker than the walls. Law of orifice location 1 & 2 described the location of the orifices at the junction of the walls and floor and were always located at the angles of these junctions. Law of orifice location 3 stated that the orifices lay at the terminus of root developmental fusion lines. The authors found that these laws agreed with 95% of the teeth examined. These laws can be quite useful to clinicians as they allow us to predict where the canal orifices can be located, especially in the cases of calcified orifices.

It is of critical importance that careful evaluation of each radiograph taken prior to and during endodontic therapy be done. Given that the intra oral periapical radiographs show a three-dimensional object in two dimensions which gives us a poor image of the canals, it becomes accountable that some of the endodontic failures were associated with teeth even though radiographically the canal systems appear to be obturated. Any curvature of the roots in a bucco-lingual aspect will not be seen in a normal radiograph. It is possible to overcome at least some of the limitations of conventional radiology by using at least two radiographs obtained from different, usually horizontal directions ([17]). Martinez-Lozano et al evaluated the effect of x-ray tube inclination on diagnostic reliability to determine the number of canals ([18]). They found that by varying the horizontal angle by 20 and 40 degrees, the number of root canals observed in the case of first mandibular premolars coincided with the actual number of canals present and in the case of second mandibular premolars only the 40 degree horizontal angle correctly identified the number of canals. In this case using normal radiographs all the canals cannot be seen very clearly.

The use of magnification and enhanced illumination are essential in the treatment of these special cases. Naked eye exploration of the canal floor may be very difficult and frustrating. The dental operating microscope provides the clinician an enhanced vision of the pulp chamber radicular space and the pulpal floor. With a better illumination as well as magnification, the presence of grooves in the pulpal floor which serve as a map for canal location and color difference between the dentin of the pulpal floor and that around the canal orifices can be more easily distinguished ([19]). The dental operating microscope was very useful in locating the

entrance of the mesiolingual canal in the present case.

Obturation was carried out first by using the vertically condensed warm gutta-percha technique up to the trifurcation zone in the mid root region and then by back filling with thermoplastisized gutta-percha. This method seems to be more appropriate for our case as the adaptation to the walls is said to be superior compared to cold lateral compaction ([20]). Care should be taken that, when using the Touch'n Heat system for warm gutta-percha compaction, the practitioner has the technical skills required. This technique provides very good results in curved canals. Since in this case trifurcation of the canal takes place at the mid root level, the use of a plugger to keep the other canal patent while obturation is being done, is quite helpful ([21]). Backpacking using plasticized gutta-percha ensures a good flow and adequate filling against the canal walls.

Walker mentioned that not enough is known about the teeth of non-Caucasoid origin as most of the studies carried out have had permanent teeth of North American or European origins ([14]). This should be kept in mind when practitioners come across patients of Mongoloid and Negroid origin. The endodontist should be more careful while treating patients of these origins as their canal systems may be more complex than expected.

The two year recall radiographs showed healing of the periradicular lesions. It is probable that if all the canals had not been properly instrumented, cleaned and obturated, then such success would not have been achieved.

CONCLUSION

The practitioner should be more careful while treating patients of Mongoloid origin as there may well be a racial predisposition towards erratic canal systems. The use of multi-angled diagnostic radiographs and operating microscope may be very useful in the diagnosis and treatment of such cases.

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