

Three-rooted premolar treated with conventional endodontics: 24-month follow-up case report

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ABSTRACT

Introduction: The thorough knowledge of the internal anatomy of tooth is one of the determining factors for the success of endodontic treatment. Three-rooted second maxillary premolars represent a rare occurrence during endodontic treatment, making its description in the literature an important contribution. This paper describes the endodontic treatment of maxillary second premolar with three separated root canals. **Case report:** The patient exhibited a right maxillary second premolar affected by continuous pain that was exacerbated by cold testing. Periapical radiograph analysis suggested the presence of three separated roots,

which was confirmed during the careful access to the pulp chamber. The tooth was treated with manual instrumentation technique and filled through lateral condensation technique. One and two-years follow-up visits revealed absence of clinical and radiographic signals. **Conclusion:** The presence of three root canals in second maxillary premolars may compromise endodontic treatment success. Meanwhile, a conscious knowledge of anatomy and a careful diagnosis do not exclude the treatment of anatomic variations by a general dentist without the use of technological resources.

Keywords: Root canal therapy. anatomy. Anatomic Variation.

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Introduction

Optimal prognosis for endodontic treatment requires profuse knowledge of root canal system anatomy, including the awareness of possible morphological variations within each dental group. These anatomic conditions might challenge the endodontic therapy mainly during the root canal system negotiation, since it might require special attention and knowledge from the professionals.^{1,2,3,4} Even with all the cautiousness, 23% of endodontically treated teeth have failed due to missed root canals that were left untreated with remaining infection⁵. Furthermore, these extra root canals were reported to increase in 4.38 times the chance of apical periodontitis development that may be associated to a periapical radiolucency.⁵⁻⁸

Among these variations, maxillary premolars often have presented two roots, each one containing one canal, with their entrances located beneath buccal and palatal cusps during coronary access.^{9,10} This disposition generally respects external coronary anatomic format of the tooth; however, maxillary premolars may also present extra roots and additional canals. The prevalence of three root canals in the first upper premolars has varied from 0.5 to 6%,^{11,12,13} and similarly, maxillary premolars with three separated roots have been described with lower incidences varying from 0.3 to 2%.^{11,13-16} Moreover, *in vitro* investigations was analysed more than 600 teeth and this demonstrated a prevalence of only 1.1% of premolars with three canals.¹² This low prevalence numbers shows a very rare condition in the clinic routine. Its eventual appearance, however, must be detected correctly and the professional must be prepared to perform a precise diagnosis and treatment.

The lack of detection of these extra root canals may cause endodontic treatment failure due to the maintenance of the infection into the untouched canals, therefore the study of these possible anatomic variations represent a relevant aspect to disseminate technical experiences of handling these cases. Occasionally, these conditions, when properly detected, may also be effectively treated through conventional resources and techniques, and despite most of the studies have demonstrated the use of advanced technologies to handle anatomic variations,¹⁷⁻²⁰ no report has shown the use of manual endodontic instruments

and traditional filling technique to achieve clinical and radiographic success. Thus, this report aims to describe the presence of three-rooted maxillary second premolar treated through traditional endodontic techniques and followed-up for 24 months.

Case report

A 38-year-old female patient was referred to Endodontic Clinic claiming continuous pain in the posterior right maxillary area, exacerbated by cold drinking and not reacting to analgesics. Though the patient could not identify the tooth that was causing the pain, the clinical exam demonstrated extensive unsatisfactory restoration in the second maxillary right premolar that was over responsive with slow regression to cold test.

Radiographic exam demonstrated the presence of radiolucency below an extensive restoration on the second maxillary right premolar, suggesting the presence of caries with great proximity to pulp chamber (Fig 1A). In addition, a careful analysis of the radiographic image indicated the possible presence of anatomic variation in the root, suggesting a three-rooted conformation (Fig 1B). Both clinical and radiographic data lead to the diagnosis of symptomatic irreversible pulpitis. Endodontic treatment was proposed to the patient to relieve her symptoms.

The treatment was initiated through application of topical anesthesia (Benzotop 200mg/g, Rio de Janeiro, Brazil), followed by local anesthesia with 2% lidocaine + 1:100.000 epinephrine (ALPHACAINE 100, DFL, Rio de Janeiro, Brazil). Following anesthesia, tooth was isolated with rubber dam and all the unsatisfactory restoration and carious tissue was removed using round carbide bur (KG SorensenT, Barueri, Brazil). Pulp chamber access and cavity shape were established with diamond burs (KG Sorensen T, Barueri, Brazil), and high-speed handpiece (Fig 1C).

Root canals were copiously irrigated with 1% sodium hypochlorite (Milton solution, Asfer, São Caetano do Sul, São Paulo, Brazil) to neutralize all the toxic content. Subsequently, the three root canals were located: mesio-buccal, disto-buccal and palatal canals and were explored with manual endodontic files (Dentsply/Maillefer, Petrópolis, Rio de Janeiro, Brazil). The exploration files were kept in position for radiographic working length determination (Fig. 1D)

that was associated with the use of electronic apex locator (Propex II, Dentsply/Maillefer, Petrópolis, Rio de Janeiro, Brazil), in order to confirm the root canal dimension.

Once working length was established, the three root canals were instrumented through crown-down technique, using manual endodontic files in decreasing order, finalizing with a k-file #30 as the last used endodontic file, in all the root canals. During all the mechanical preparation, root canals were copiously irrigated with 1% sodium hypochlorite (Milton solution, Asfer, São Caetano do Sul, São Paulo, Brazil) to remove all the inflamed pulp tissue and possible infection. After the chemical mechanical preparation, root canals were covered with calcium hydroxide (Biodinâmica, Ibiporã, Paraná, Brazil) intracanal medication and the tooth was restored with temporary endodontic material (Coltosol - Coltene, Rio de Janeiro, Brazil).

After 7 days, the tooth was anesthetized and isolated in order to allow intracanal medication removal, through copious irrigation with 1% sodium hypochlorite and manual k-file. Next, final irrigation with 17% EDTA (Biodinâmica, Ibiporã, Paraná, Brazil) was performed during 3 minutes under agitation, in the meantime of gutta-percha point radiograph proof. Root canal filling was accomplished through lateral condensation technique using zinc oxide cement (EndoFill, Dentsply/Maillefer, Petrópolis, Rio de Janeiro, Brazil) (Fig. 1E). The excess of filling material in the coronary portion was cleaned, the tooth was restored with composite resin (Opallis, FMG, Joinville, Santa Catarina, Brazil), and a final radiograph showed complete filling of the three root canals (Fig 1F and 1G). The patient was followed-up after 24 months and she did not demonstrate signal/symptoms or the presence of periapical radiolucency.

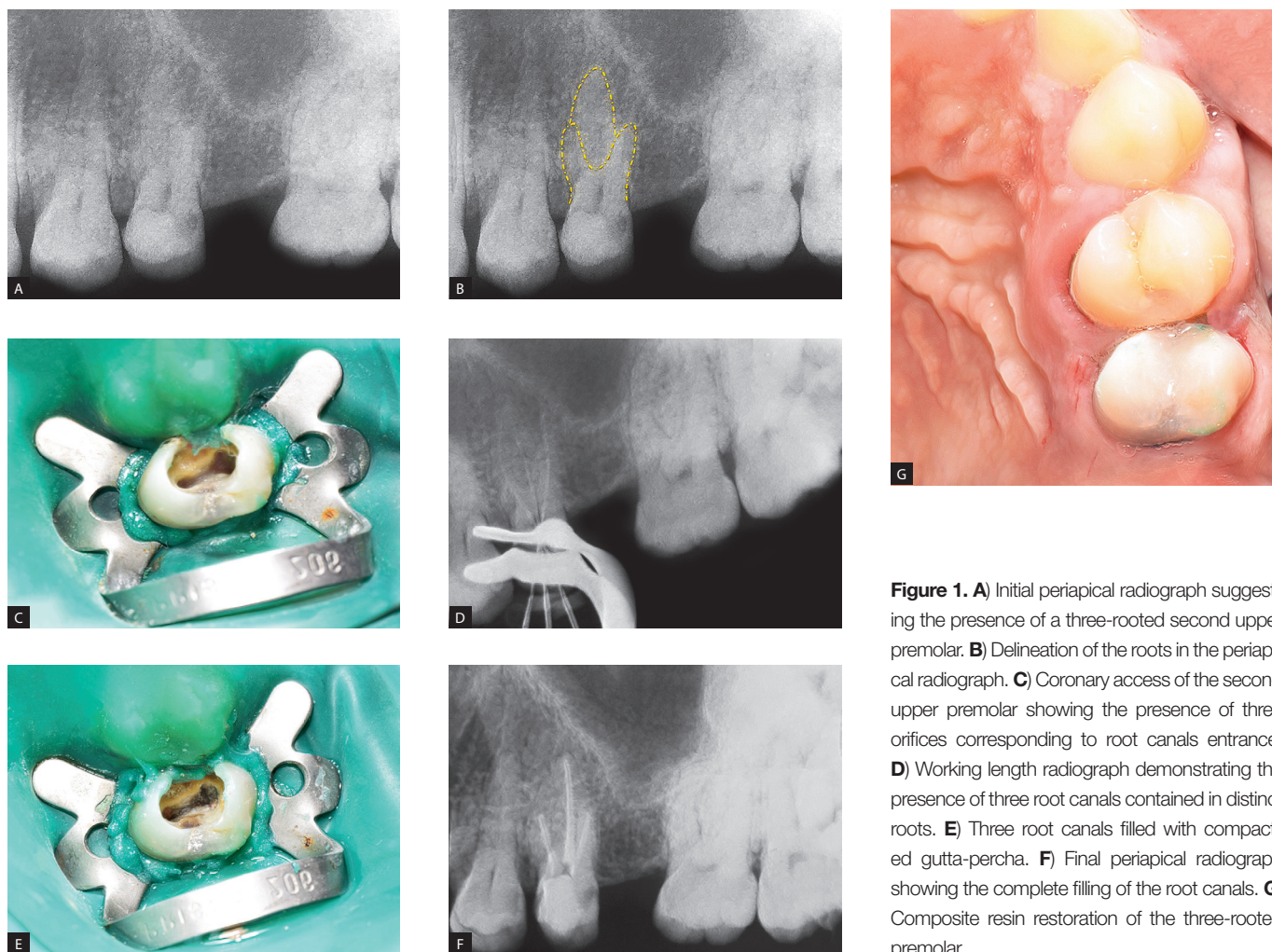


Figure 1. **A)** Initial periapical radiograph suggesting the presence of a three-rooted second upper premolar. **B)** Delineation of the roots in the periapical radiograph. **C)** Coronary access of the second upper premolar showing the presence of three orifices corresponding to root canals entrance. **D)** Working length radiograph demonstrating the presence of three root canals contained in distinct roots. **E)** Three root canals filled with compacted gutta-percha. **F)** Final periapical radiograph showing the complete filling of the root canals. **G)** Composite resin restoration of the three-rooted premolar.

Discussion

Upper premolars genuine anatomy includes the prevalence of one or two root canals. However, they might have three root canals, mostly when it comes to Afro-descendants of male gender (83.3%). This is a likely reality in Salvador, which is considered the city with larger Afro-descendants population in Brazil.²¹⁻²³ Despite the infrequency of this condition, a high incidence of neglected canals into upper premolars group (46.5%) has been demonstrated in endodontically treated teeth analyzed by cone beam tomography.⁵ Taking this into consideration, the meticulous analysis of the tooth anatomy in the initial x-ray and the attention to some tooth external characteristics (e.g. tooth crown) are essential to guarantee the identification of extra canals, therefore ensuring the treatment of all root canal system.²⁴

Considering a 2-dimensional view of a 3-dimensional structure provided by the x-ray, intentional shifts of the x-ray beam from the ortho-radial position may help to identify root anatomy variations.²⁵ Although different x-ray beam angulations may help to identify root anatomy variations, in the current study, an ortho radial x-ray incidence image was sufficient to suggest a different upper premolar root anatomy, pointing to the possibility of extra root canals. Thus, some characteristics were crucial to suspect that a third root in the upper premolar could exist. Some of the characteristics that engendered the suspicion were the wide outline of the root and a sudden variation in radiographic density of the root canal space. This last radiographic observation has been reported as “fast break”, which might resemble a root canal bifurcation.⁵ Nevertheless, despite the importance of x-ray for the diagnosis of endodontic cases, when uncertain conclusions concerning anatomic variations persist, cone beam computed tomography (CBCT) is considered a precise instrument to confirm, by a 3-dimensional standpoint, the suspicious of an extra canal, since it points to the root exact location.²⁶⁻²⁹ When compared to conven-

tional periapical images, CBCT has demonstrated more accuracy in early diagnoses of extra canals, root fractures and root resorptions.^{22,27-29} It is well established that the main methods used by endodontists to detect extra root canals are the radiography and the CBCT. The latter was essential to detect a rare condition of C-shaped root configuration and 3 canals within a mandibular second premolar.²⁸ Thus, a study was carried to compare the accuracy of radiography and CBCT in locating extra root canals. It was observed that, among the endodontists, the CBCT presented superior accuracy (40%) when compared to the periapical x-ray.³⁰

Tallying the relevance of image interpretation resources, the advance in illumination and magnification devices also seems to improve the operative field, since it enables the endodontist to see, in better conditions, the root canal entrances and, consequently, reduces the chance of leaving a root canal.³¹ In the present case, the endodontic therapy was performed in a public dentistry school that does not provide any of the above mentioned technological means, due to its poor financial resource. Despite these circumstances, it was possible to detect an extra root canal in the upper premolar. The detection was accomplished thanks to the previous knowledge of dental anatomy by the professional and through the medium of a careful analysis of the initial x-ray image. Once the presence of a root anatomic variation was suspected, the first challenge was the access to the pulp chamber and, consequently, the location of the third root canal. The upper premolars pulp chamber format, traditionally oval-shaped, in this case, presented a “T” design, provided by the presence of the extra root canal.³² This new arrangement of premolars pulp chamber is similar to the one presented by maxillary molars — for this reason, they are known as “mini-molars”.³³ It was possible to observe, in the present case, the “T” shape formed by the distribution of the root canals in the pulp chamber. The three canals were located

with no additional technological resources (e.g. operative microscopy, CBCT, LED light) besides the x-ray, round burs and manual K files. Nevertheless, due to the unclear limit of the root end in the periapical radiograph, working length was also confirmed by an apical locator, since literature has demonstrated that apical locators has been more accurate in determining root canals length.^{34,35} Furthermore, despite the variety of advanced materials,^{8,36} the current case performed a successful endodontic treatment using conventional endodontic instruments and techniques. This fact may contribute to stimulate general dentists and endodontists — that work with limited resources in circumstances such as the ones pro-

vided by public institutions located in undeveloped countries — to treat dental complex anatomy cases by means of previous training and improvement of anatomy knowledge.

Conclusions

The present study demonstrated that even with limited resources it is possible to perform a successful endodontic treatment in cases of three-rooted maxillary premolar. To achieve this goal, it is mandatory that professionals update their knowledge of dental anatomy variation continuously, in order to properly handle these difficulties, especially in work adverse situations.

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