Endodontic intervention in mandibular premolar with complex anatomy associated to cracked root diagnosis: Case report

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ABSTRACT

Introduction: Internal dental anatomy represents a great challenge in Endodontics. Diagnosing and delineating an accurate treatment plan is often a challenge. **Objective:** The objective of this case report was to describe a clinical case of endodontic intervention in mandibular premolar with complex anatomy, associated with cracked root after two and a half years. **Case report:** Female patient was referred for evaluation with painful symptoms. Clinical examination revealed tooth #44 provided support for a removable partial denture and was periodontally healthy. Active intraoral fistula was also present. Pulpal sensitivity tests were performed with negative response. Radiographic examination revealed complex dental anatomy, with two fused roots and periapical lesion. Diagnosis of pulp necrosis was established, and endodontic therapy instituted. **Results:** Clinical and radiographic control one year and four months later demonstrated repair of periapical region, as well as recovery of masticatory and aesthetic functions. However, two and a half years after endodontic intervention, the patient returned with painful symptoms. Examination revealed a periodontal pocket located 12mm mesiobucally, whereas radiographic examination evinced lateral apical periodontitis. Cone-beam computed tomographic scans were requested, but did not add to the diagnosis. Clinical signs established the diagnosis of cracked root with indication of extraction and referral for oral rehabilitation. **Conclusion:** The importance of diagnosis and follow-up as well as supremacy of clinical examination are highlighted for the implementation of the correct treatment plan.

Keywords: Root canal preparation. Endodontics. Tomography.

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Introduction

Internal dental anatomy still represents a major challenge in endodontic therapy, primarily for its variations, such as the presence of angles and accentuated radii of curvature, in addition to isthmus and branches, commonly found in mandibular premolars. For this reason, it requires knowledge to distinguish tooth morphology and facilitate therapy, since variations make standardized treatment difficult.[1,2] Diverse root canal systems may be related to sex and ethnicity, both in first and second premolars.[3]

Effective endodontic treatment is closely related to adequate chemical-mechanical preparation, in which the action of chemical substances must have close contact with the rich and complex root anatomy. Irrigating solutions help in dissolving inflamed and/or necrotic pulp tissue, as well as debris, in addition to providing decontamination of the root canal system.[4,5] In combination with mechanical debridement of endodontic instruments, a three-dimensional sealing of the root canal system is thus enabled. Root canals unidentified by imaging examinations may not be filled, and neither may be isthmus, ramifications and indentations, thereby hindering the best prognosis of therapy. Correctly performing the aforementioned steps is essential, since microorganisms can remain within anatomical irregularities.[3,5,6]

In this context, proper recordings are extremely important for endodontic treatment, and periapical radiography is the main resource used for this purpose.[7] Radiography is a crucial examination at all stages of intervention. It requires knowledge for correct interpretation, as despite its limitations it is a source of information for diagnosis, treatment and follow-up of the clinical case, particularly because it is a two-dimensional image.[8]

To overcome the limitations of periapical dental radiography, the emergence of cone-beam computed tomography (CBCT) provided greater effectiveness to imaging examination, as it allows images of the irradiated region to acquire a tridimensional form and be further reconstructed in any plane.[9] CBCT has been widely used in Dentistry due to its high quality and versatility, which has improved diagnosis in cases of cracks or fractures.[10] Nevertheless, it may present limitations, especially due to producing artifacts that end up hindering analysis. Its indication is rather plausible when intraoral radiograph used for diagnosis led to inconclusive results.[10,11] The importance of accurate diagnosis of fractures or cracked roots is related to effective prognosis and treatment plan which, in some cases, may lead to tooth extraction.[12]

Based on those assumptions, the objective of the present study was to report a clinical case of endodontic intervention in mandibular premolar with complex anatomy, associated with diagnosis of cracked root after two and a half years of follow-up. The importance of clinical and imaging examination for correct diagnosis and planning is highlighted.

Clinical case report

Female Afro-Caucasian patient was referred to a specialized dental office for endodontic assessment of her mandibular first premolar on the right side (#44). The main complaints were painful symptoms a few days before, and sensitivity to palpation. Medical history was not relevant. Clinical examination revealed the tooth provided support for a removable partial prosthesis and had a restoration in class I composite resin. It exhibited physiological dental mobility, probing depth of 2mm and absence of bleeding at all sites. She also presented discreet swelling in the internal wall of the vestibule and active intraoral fistula. All thermal and electric pulp sensitivity tests were performed, with negative responses. Radiographic examination revealed complex anatomy with narrow root canals, two apparently fused roots, and an image suggestive of rare diffuse lateral osteitis, mesial to the middle third of the root (Fig 1). Pulp necrosis and periapical diagnosis of chronic periapical abscess of tooth #44 was established. Endodontic therapy was then instituted as treatment modality.

In the first session, endodontic access was performed in a conventional manner with high-speed KG 1558 bur (Medical Burs, Cotia, Brazil). Buccal and lingual canals were prepared with a combination of manual 25mm #10 and #15 K-files (Dentsply Maillefer, Ballaigues, Switzerland) (initial holding) and continuous rotary instruments, ProTaper Universal system (Dentsply Maillefer, Ballaigues, Switzerland), according to manufacturer's recommendations. The working length was determined at 1mm short actual tooth length. Cervical and middle thirds

were initially pre-enlarged with ProTaper Universal Sx and S1 instruments. Subsequently, odontometry was performed with K-file #15 and Endex apex locator (Osada, Tokyo, Japan), while apex patency was performed with K-file #10. The substance used throughout chemical-mechanical preparation was 5.25% sodium hypochlorite (Macela Dourada, Vitória da Conquista, BA, Brazil). After chemical-mechanical preparation, ultrasonic activation was performed with Enac tip ST21 (Osada, Tokyo, Japan) associated with 17% EDTA T (Fórmula & Ação, São Paulo, SP, Brazil) up to the ProTaper F3 instrument. Final irrigation was performed with 5.25% sodium hypochlorite and rot canals were dried with absorbent paper tips of the ProTaper Universal system. Root canals were filled with calcium hydroxide PA (Lenza farmacêutica, Belo Horizonte, MG, Brazil) combined with propylene glycol (Lenza farmacêutica, Belo Horizonte, MG, Brazil), as intracanal medication. Temporary sealing was performed with coltosol (Vigodent, Rio de Janeiro, RJ, Brazil) and Ionoseal glass ionomer cement (Voco, Cuxhaven, Germany).

In the second session, 30 days later, the patient was asymptomatic, with healing fistula. Root canal filling was performed by means of the thermoplastic vertical hydraulic compression technique of the accessory point (Fig 2), with F3 cones of the Protaper system combined with AH Plus sealer (Dentsply, De TreyGmbh, Germany), in addition to crown sealing with coltosol (Vigodent, Rio de Janeiro, RJ, Brazil)

Figure 1. Study radiograph.

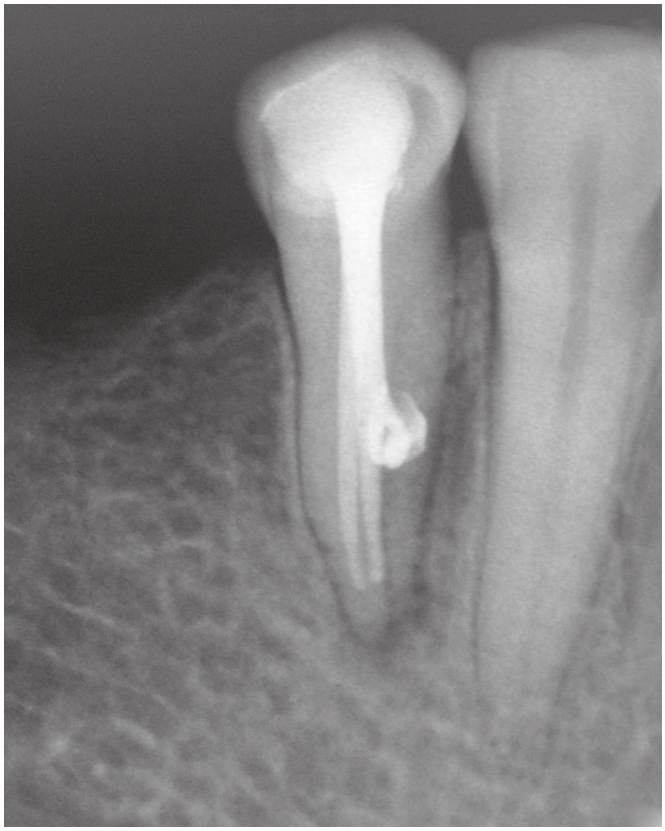

Figure 2. Root canal system filling radiograph.

and Ionoseal glass ionomer cement (Voco, Cuxhaven, Germany). The case was then referred for restorative treatment.

Clinical and radiographic controls 1 year and 4 months (Fig 3) later radiographically revealed restoration and repair of the periapical region, recovery of masticatory and aesthetic functions, which confirmed that the treatment plan proposed for the clinical case was achieved. However, after two and a half years of endodontic intervention, a new control appointment was scheduled due to complaint of painful symptoms in the region. Clinical examination revealed a 12-mm periodontal pocket of 12 mm in the mesiolingual region, in addition to mild sensitivity to vertical percussion. Radiographic examination revealed recurrence of the radiolucent area, compatible with rare diffuse lateral osteitis, similarly to that diagnosed in the beginning of the proposed therapy (Fig 4). CBCT scans were obtained with the objective of investigating the potential for cracked root and/or root fracture that explained why periapical pathology had reappeared. However, the images did not contribute to diagnosis (Fig 5).

Diagnosis was then based on clinical findings. Treatment modality of choice was extraction of mandibular first premolar on the right side. After the surgical procedure, the cracked root was evinced, located in the cervical third precisely in the mesiolingual region, extending to root fusion in the apical third (Fig 6). The patient was advised and informed of the entire process and referred for rehabilitation treatment.

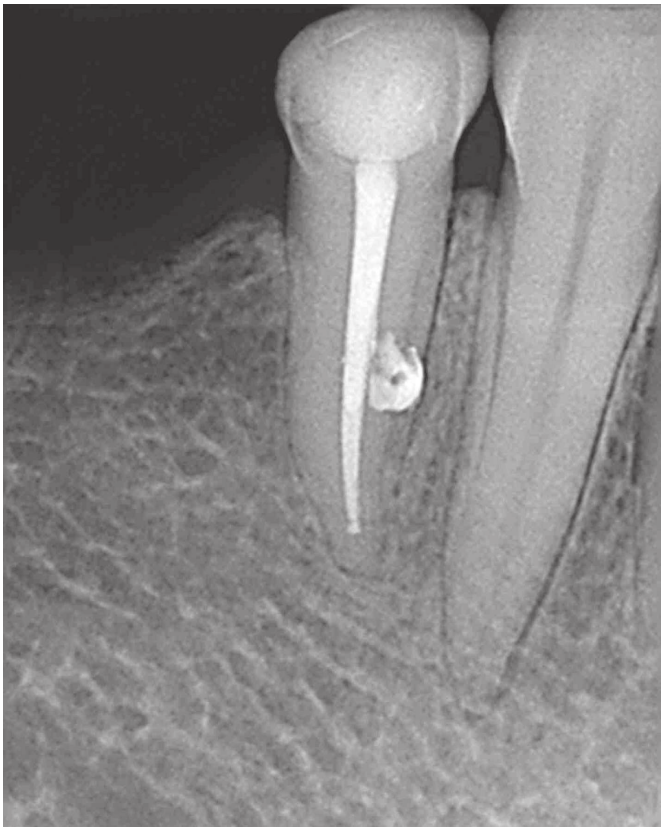

Figure 3. Follow-up one year and four months later.

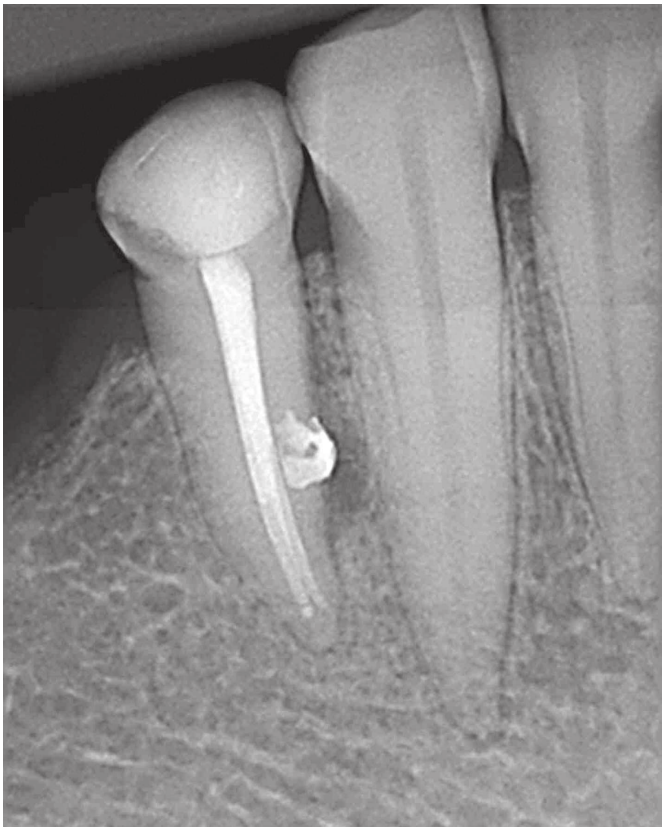

Figure 4. Follow-up two years and six months later.

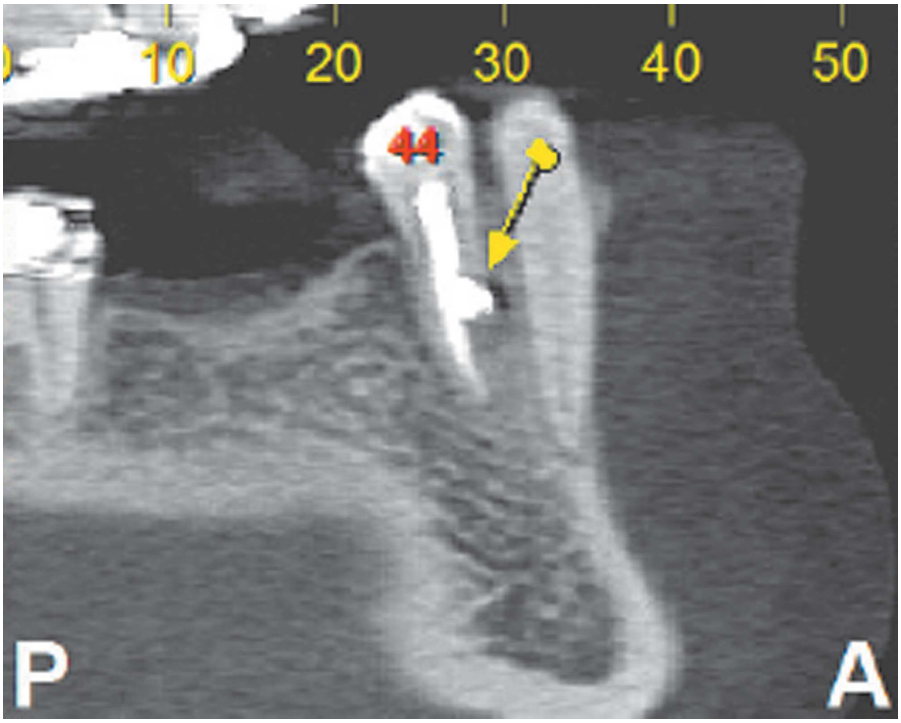

Figure 5. Tomographic assessment.

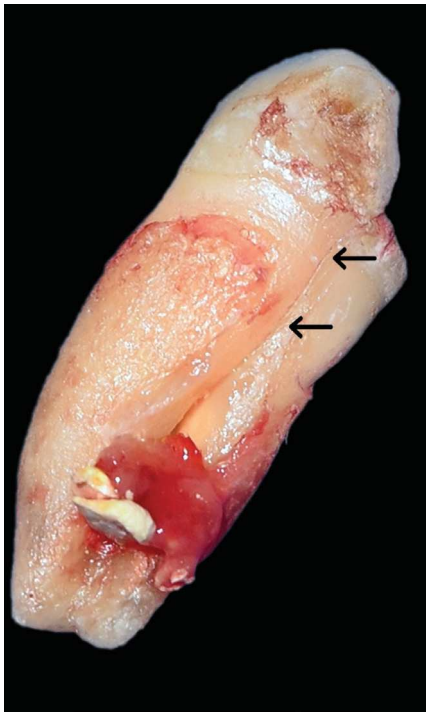

Figure 6. Cracked root.

Discussion

Despite all advances in Endodontics, diagnosis and planning of an accurate treatment are a challenge. Mandibular premolars are considered complex teeth in endodontic interventions due to their anatomical variations.[13] Complementary examination, such as periapical radiograph, aim to improve this reality, but due to its limitations in terms of geometry and overlap of images, its use has been complemented by CBCT, which offers more precise tridimensional images.[9,14]

In order to enhance chemical-mechanical preparation, especially in cases of anatomical complexity, NiTi rotary instruments were incorporated into the dental market and have become popular for root canal shaping, mainly due to the advantages provided, namely: elasticity, efficiency[15,16] and cutting capacity.17 In addition to significantly less dentin volume removal, they usually produce more centralized canals, decreasing the potential for deviations[18] and optimizing clinical time, when compared to manual stainless steel instruments.[19] In the present case report, ProTaper Universal NiTi rotary instruments were used.

Chemical-mechanical preparation is an important step in endodontic therapy. When combined with an effective tridimensional sealing of the root canal system, it aims to reach anatomical irregularities, curvatures, isthmus and ramifications. As a result, better intervention prognosis is achieved. Furthermore, the use of thermoplastic techniques offers adequate sealing due to excellent fitting to dentin walls,[5] along with sealers that can reach sites inaccessible to endodontic instruments. This significantly reduces the existing microbial load.[5,20] Based on the aforementioned concepts and all the anatomical peculiarities of the present case, the proposed therapy was clinically and radiographically successful for a period of one year and four months, as evidenced by regression of signs and symptoms.

Long-term clinical success can be influenced by several factors. In the case reported herein, after two and a half years of endodontic intervention, a new control appointment was scheduled due to complaint of painful symptoms. Clinical and radiographic reassessment demonstrated recurrence of the periapical lesion, exactly in the same place, and determined a diagnosis suggestive of cracked root. In addition to susceptibility of fractures in premolars due to their anatomy, clinical signs fulfill several prerequisites that may be associated with cracked root. Painful symptoms, periodontal pocket and fistula are present in most cases. Inspection with an exploratory probe aiming to feel the line of fracture contributes to diagnosis. Such conditions are sometimes linked to other factors, such as cracks, thus making treatment prognosis difficult.[12,21-23] In the present case report, it was not possible to perform this procedure.

Visual examination and records with information gathered from the patient are the starting point for suspected fractures. Presence of chronic infections at site triggers the emergence of periodontal pocket and mobility, and so do the history of pain to the act of biting. Removal of gingival tissue for analysis may favor the recognition of cracks.[21,22,24] Data of these present case reveal probing evinced a 12-mm periodontal pocket located in the mesiolingual region, in addition to sensitivity to vertical percussion. The aforementioned combination of symptoms, together with success in endodontic treatment, made feasible to assume the potential for cracked root, in agreement with previous reports finding isolated periodontal pocket, slight sensitivity to vertical percussion and chewing pain.[24,25]

Based on the aforementioned assumptions, CBCT provides a more accurate diagnosis when compared to periapical radiography, but still presents limitations mainly for endodontic treatment, with a sensitivity of 92% and specificity of 85%.[26,27,28] Regardless of voxel resolution (0.2, 0.3, 0.4mm) relatively similar results are achieved in terms of accuracy. The only difference is the amount of radiation received by the patient.[27,28] In the case described herein, after clinical assessment performed during control lasting for two and a half years of endodontic therapy, CBCT was performed with a view to elucidating the cause of recurrence of periapical lesion, including cracked root and/or root fracture. Nevertheless, the examination did not detect any changes, except for periapical lesion with precise dimensions. Endodontic therapy conditions and the presence of restorative material in the affected tooth probably provided ease for formation of artifacts. The latter represent one of the major limitations of CBCT.[11,26]

The most common causes for the development of cracked root are cumulative loss of dental structure due to caries, restorative procedures, as well as protocols inherent to endodontic therapy, or even iatrogenic factors.[23] An important aspect to be reported was the fact that the affected tooth provided support for a removable partial denture clip, in addition to presenting restorative treatment without cusp coverage, facts that could have contributed to cracked root formation in the present case. In restorative procedures performed in wider cavities, it has been suggested there is a need to cover cusps to protect and strengthen the residual dental structure, and thus prevent the appearance of root fractures in endodontically treated teeth.[30]

Conclusion

Reaching accurate cracked root diagnoses remains a major challenge in Endodontics. Inspection and sensibility to details of clinical and complementary examination can ensure correct diagnosis. The present case report allowed us to demonstrate the importance of clinical examination in order to determine an effective treatment plan.

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