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Case Study

Endodontic Management of Calcified Canals

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Abstract

Calcified canals are characterized by the deposition of dentin along the canal walls. This paper aims to present the free-hand endodontic management of two clinical cases with this condition. Calcified canals represent one of the most difficult situations for endodontic treatment, due to the possible complications that may occur. Cone-beam computed tomography (CBCT), dental operative microscope and ultrasound are essential for a successful management of root canal obliteration. Careful preoperative evaluation and treatment planning, clinical experience, anatomic knowledge and technical means have a crucial role in the treatment outcome of these canals.

Keywords: Calcified Canals; Diagnosis; Endodontic Treatment; CBCT; Ultrasound

Introduction

Calcified canals represent one of the most difficult situations for endodontic treatment, due to the possible complications that may occur [1]. Partial or total obliteration of the endodontic system, by deposition of dentine in the root canal space, starts from the coronal and extends at various levels towards the apical [2]. The radiograph shows the absence of the radiolucency that characterizes the root canal. It can occur both in young people, usually as a late complication of a trauma, when it can reach even 40% of dental injuries [3], but also in elderly people, due to the deposition of secondary dentin [4].

When clinical signs and symptoms occur, or in the presence of periapical radiolucency, endodontic treatment is required [5]. Root canal treatment of teeth with calcified canals is often challenging, time consuming and not risk-free. This can only be accomplished successfully using the dental operating microscope, but this alone is not enough [6]. The various details of the dentin need to be differentiated to locate the canal opening [7].

Our article shows by the proposed extremely complex and difficult clinical cases, both an anterior tooth, maxillary canine, but also a posterior tooth, maxillary premolar, that endodontic treatment is possible for these teeth, even freehand, but only under the conditions of using current endodontic technical means combined with thorough knowledge of endodontic anatomy and clinical experience.

Clinical case 1

This 37-year-old male patient was referred to our clinic for endodontic treatment of tooth 23, left maxillary canine. The treatment was initiated by the referral dentist, who performed unsuccessful canal identification attempt and decided to send the patient to us and to a CBCT scan. Patient reported no discomfort in relation to this tooth. The patient does not remember a dental trauma in the past and there was no evidence of occlusal trauma. In addition to this, the other anterior maxillary teeth already had root canal treatment, and we could not assess if they were also calcified. We can only estimate that they were most likely not affected by pulp obliteration, considering that the root canal treatment performed by the same doctor did not raise any issues. Clinical examination revealed that the tooth 23 was asymptomatic, with no pain on percussion or sinus tract, and the tooth mobility and probing depths were within normal limits. A digital periapical radiograph (Figure 1a) showed no apical radiolucency in relation to this canine but revealed a calcified root canal almost to the apex. An overextended access cavity was also observed. CBCT scan confirmed (Figure 1b) the severely calcified root canal, up to the apical third of the root. Also, we detect no perforation, although the mesial dentine wall of the access cavity was extremely thin. The apex was curved towards buccal and distal and had a close relationship with the maxillary sinus.

After the tooth was anesthetized, the rubber dam was placed and the existing dressing removed. With the aid of a dental microscope, we carefully analysed the access cavity for any trace of perforation, but we did not highlight any of this. Then we evaluated the landmarks provided by the different shades of dentine and, helped by the information provided by CBCT, as well as the orientation in relation to the axis of the tooth, we carefully removed the dentine with the ultrasonic tips. We checked along the way if there is an entry point for endodontic files. We used for this purpose 0.06 mm C plus files (VDW®, Munich, Germany). At some point, we were able to locate the canal, but only the tip of this 0.06 mm file could be placed inside this orifice. From this moment, we patiently followed the sequence of 0.06-0.08-0.10 mm files, and, after 2-3 mm, we also inserted a rotating R Pilot (VDW, Germany), then we continued in the same way, until we established the working length with the electronic apex locator (Morita, Japan). We shaped the canal to a 0.25 mm 4% taper (Rotate, VDW Germany) (Figure 1c). During the shaping procedure we irrigated extensively with sodium hypochlorite 5.25%, using polypropylene needle to deliver irrigation solutions close to the apex, Eddy Flex cannula (VDW, Germany). We obturated the canal with Ahplus resin-based sealer (Dentsply) and warm vertical compaction of gutta-percha. A postoperative radiograph was taken, and it showed the root canal filling (Figure 1e). We filled the access with composite resin (Figure 1e) and advised the patient to return for follow-up.

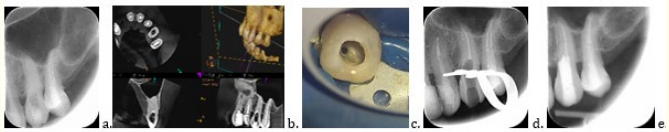

Figure 1: a. Preoperative radiograph b. preoperative CBCT c. clinical image d, e postoperative radiographs.

Clinical case 2

An 84-year-old female patient was referred to our clinic for endodontic treatment of tooth 14, maxillary right first premolar. According to the patient, this tooth caused no pain, but she wanted to have it restored, as its crown was severely broken. The referral dentist could locate only the buccal canal, but not to its apex. The same clinician advised the patient to take a CBCT scan. Clinically, the tooth was not tender to percussion or palpation and the periodontal probing was normal. The radiograph revealed no periapical lesion, despite the extensive coronal caries. Also, no root canal was visible at any level of the root. The CBCT showed (Figure 2b) the two individual roots, the buccal curved towards the palatal and it had a very thin root canal. The palatal had a root canal only in the last 4 mm from the apex. We followed the same clinical protocol as in case 1, with the mention that for this premolar, to identify the opening of the palatal canal, we took as a reference point of orientation the buccal canal and the divergent direction towards the apex of the palatal root, as observed on the CBCT (Figure 2 c, d).

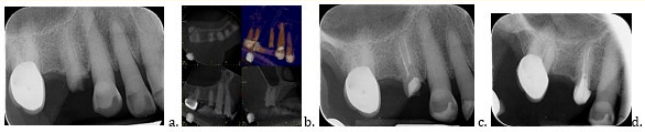

Figure 2: a. Preoperative radiograph b. preoperative CBCT c, d. postoperative radiographs.

Discussion

The deposition of dentin in the endodontic space starting from the coronal part of the tooth towards the apex leads to the calcification of the root canal. This can have various causes, the main ones being trauma, caries, dental procedures, leading to tertiary dentin deposition or age, and it leads to deposition of secondary dentin, but it can also be idiopathic [8]. The two cases presented show that this condition can occur at any age and can affect both anterior and posterior teeth. Depending on the extent of this process, the clinical management differs in difficulty. The approach of these cases involves a rigorous and detailed preoperative analysis of the radiograph and requires, in most cases, a cone-beam computed tomography (CBCT) scan to identify the level where the root canal becomes visible. CBCT is crucial in these cases. The 3D rendering provides valuable information for root canal identification [9-11].

Depending on this information, the treatment plan follows. Magnification and lighting are necessary, provided by the dental operating microscope. Assisted by this, the access is carried out in depth with long neck burs and then with ultrasonic tips, carefully following the anatomical landmarks specific to the endodontic space. The clinician analyses the appearance of the exposed dentin after access, both visually and in terms of texture. The dentin of the root walls is yellow, lighter in colour, while the dentin near the lumen of the canal is darker in colour, grey, and this is where one must look for the orifice of the canal (figure 1 c). The mechanical action produces dentinal debris that will eventually be deposited in the opening of the root canal. This white spot will then be probed with thin C+, C pilot or D-finders files, which are stiffer. It is essential to create a glide-path with these manual files and only then move on to rotary instrumentation [8].

Approaching posterior teeth with calcified canals is even more challenging. In clinical case 2, we used the favourable situation that the orifice of the buccal canal was accessible. Then we applied the law of symmetry 1 stated by Krasner (canal orifices are equidistant from a line drawn mesially to distally through the pulp chamber floor) [12] and the direction of the canal observed on the CBCT scan to find the palatal canal.

The treatment of teeth with this condition can also be achieved by static or dynamic guided endodontics [13,14]. These techniques are minimally invasive, but more expensive and cannot be used in every situation [15].

The empirical attempt to approach these cases of canal calcification can have serious consequences. Frequently, the access cavity is excessively large, weakening the dental structures and sometimes perforations occur, too, and there is a subsequent high risk of root fracture [16,17]. Even after achieving access, errors may still occur during endodontic treatment, especially if a calcified root canal is also associated with a curvature [18]. Ledges, perforations, instrument fractures, can decrease the prognosis of the root canal treatment, due to its insufficient cleaning and consequently a poor quality obturation [19].

Fortunately, calcification and curves are visualized on preoperative radiography and more so on CBCT scan; therefore it is essential to accurately assess the case difficulty beforehand and prevent the occurrence of these errors, which have a negative impact on the prognosis of endodontic treatment [20].

Conclusions

A successful endodontic treatment of calcified canals is highly related to the preoperative assessment of the case, but also the experience of the clinician, knowledge of endodontic anatomy and the technical equipment. Calcified canals are most frequently treated free hand. The proposed cases show that this technique, properly applied, can be successful. CBCT, dental operating microscope, ultrasound are essential in the management of these canals.

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