



The Impact of Cone-Beam Computed Tomography and Operating Microscope on Endodontic Treatment of a Complex Clinical Case

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Abstract

This case describes the endodontic evaluation, decision making and treatment plan, as well as the endodontic retreatment and follow-up of two maxillary molars in a young 32-year-old female patient. The associated pathology and iatrogenic aspects associated with these teeth were multiple and threatened the success of their conservative treatment. Cone-beam computed tomography, operating microscope and bioceramics were essential in the management of this complex clinical case, which required an advanced diagnostic and treatment techniques, materials and skill. This clinical case emphasizes the importance of an accurate preoperative diagnosis and an individualized treatment plan for long-term success.

Keywords: Operating Microscope; Cone-Beam Computed Tomography; Perforation; Root Fracture; Bioceramic; Endodontic Treatment

Introduction

Periapical pathosis after endodontic treatment may occur either as a primary or secondary lesion. Prevalence of apical periodontitis as a posttreatment disease can exceed 30% of all root-filled teeth, which translates into an important health risk. The quality of the coronal seal is one of the factors which is significantly associated with failure of endodontic treatment [1]. Secondary caries, perforations, vertical root fractures are potential portals of entry for microorganisms and contamination of endodontic system. This infection originating from the root canal space causes apical periodontitis.

Success rate for the orthograde retreatment cases varies with the evaluation criteria. After 1 to 12 years of follow-up was 65.70% and 77.10% for a lenient success rate [2]. It can reach even 85% healed cases [3], or 91% healed cases [4].

These optimistic percentages are encouraging for conservative treatment and it should be the first choice when considering the treatment plan. CBCT, dental microscope, bioceramic materials are invaluable resources in endodontic retreatments.

Apical periodontitis is not always visible on a periapical radiograph, either due to its small size, or to the adjacent structures [5]. CBCT provides three-dimensional views which facilitates

diagnosis and treatment planning, because it has a significant effect in determining the etiology of endodontic pathoses [6].

Pain, apical pathology (secondary or persistent) are the situations when an endodontic retreatment is required. In addition, there are the cases when a new restoration is planned and the endodontic treatment is not satisfactory. It is important to establish the cause for which a retreatment is indicated, in order to be able to remove it and the retreatment to be successful.

Clinical Case Description

A 32-year-old female patient was referred to our office for endodontic evaluation and treatment of teeth 16 and 17. She presented with discomfort on the right posterior region of the maxillary. Medical history was unremarkable. The patient had the first and second maxillary molars root canal treated some years ago. Clinical examination revealed a sinus tract on the attached gingivae in relation with tooth 17, which had a crown coverage. The tooth 16 was positive to vertical percussion, the tooth 17 slightly tender to percussion. Periodontal probing depths were normal for 17. Tooth 16 presented a deep palatal pocket.

The patient had a periapical radiograph (figure 1a), which revealed: 17 root canal treated, two large posts, incomplete root canal filling, furcal radiolucency, secondary caries 16, incomplete root canal filling, large composite restoration, with fracture lines. The crown and one of the posts of tooth 17 were removed quite easily and also some fragments of the coronal restoration of tooth 16. Afterwards we decided to trace the sinus tract with a gutta-percha cone and then took another radiograph (figure 1b). It showed the origin of the draining sinus tract, which was the furcal radiolucency of tooth 17.

Tooth 16 had a palatal vertical root fracture, identified with the dental operating microscope. As we suspected a large perforation of mesio-buccal root of tooth 17 due to the invasive post, we decided to scan the patient with small field of view CBCT. This was also needed for a suitable treatment plan for both teeth.

CBCT scan was acquired with Veraviewepocs 3D P (R100) equipment (J. Morita MFG Corp., Kyoto, Japan). The scan parameters were 90 kV, 5 mA, 9.4 s exposure time, 125 µm spatial resolution and 40×40 mm field of view (FoV).

CBCT scan showed (figure 1c):

16, had a missed mesio-buccal root canal and we decided to extract the palatal root only and to retreat the other canals. 17, large inter-radicular bone loss and an extensive strip perforation of the distal wall of the mesio-buccal root; no second mesio-buccal canal; no peripaical lesion in relation with the palatal root. This was important because this root had a ceramic post, which was impossible to remove and, for this reasons, we decided to keep this post for the future restoration of the tooth.

We explain the treatment plan to the patient and she gave the consent for it, also she understood the limitations due to the poor prognosis for both teeth, but still, she was keen to retain the teeth and decided to try to have them treated, as the alternative was not agreeable.

The palatal root of tooth 16 was extracted and after the healing, the tooth was temporary restored for the endodontic treatment.

Root canal treatment was carried out under local anaesthetic and rubber dam isolation in single visit, one for each tooth.

We retreated the tooth 17, the disto-buccal and the mesio-buccal canals. The perforation was easily visualized with a dental microscope, as it was coronally located. There was some bleeding from the perforation site (figure 1d). The canals were gently irrigated with sodium hypochlorite 2.5% and prepared with Rotate files (VDW, Germany) and then obturated with NeoSealer Flo (Avalon Biomed). We placed a bioceramic material (Well-Root PT premixed) to seal the perforation (figure 1e) and the crown was then restored with composite and a temporary crown until the clarification of the evolution. The sinus tract had resolved after 7 days.

Tooth 16 was also retreated, both mesio-buccal and disto-buccal root canals in a similar manner and also temporary restored (figure 1f).

Until completion of the treatment patient reported the remission of any discomfort and she was able to use these teeth.

She was able to return for a subsequent review appointment 7 months later, when we scanned the teeth with CBCT. Patient reported the teeth were completely asymptomatic and no abnormal signs could be detected.

On the CBCT images there was evidence of significant inter-radicular bone healing (figure 1g). The patient returned to the referral dentist for the final restoration.

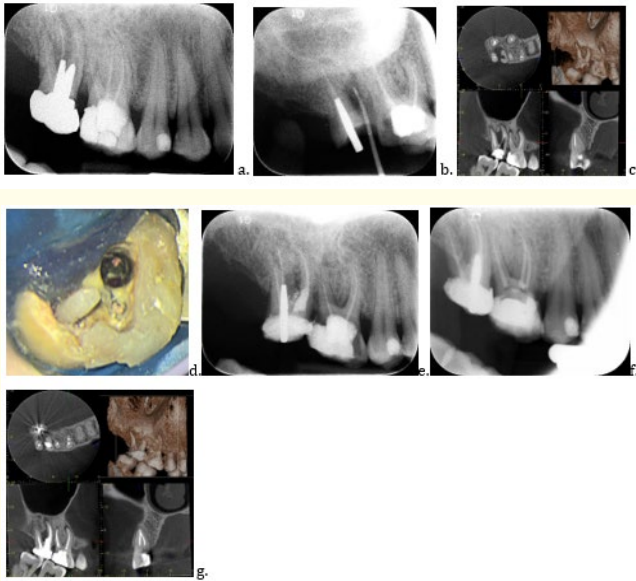


Figure 1: a. Preoperative radiograph b. Sinus tract origin radiograph c. Preoperative CBCT d. Intraoperative image showing site perforation e. Postoperative radiograph 17 f. Postoperative radiograph 16 g. 7 months follow-up CBCT.

Discussions

Survival studies for root filled teeth rather than success has highlighted the importance of the definitive restoration on long-term outcomes [7].

Our clinical case showed that tooth 16, endodontically treated and restored with a large coronal direct restoration without cuspal protection, suffered a vertical root fracture. In this three-rooted molar case it was possible to retain the other two roots, but more often the treatment for root fractures leads to extraction. It is mandatory to evaluate the remaining tooth structure after the completion of the endodontic treatment and to decide for an indirect restoration to avoid potential root fractures [8].

Maxillary molars exhibit a varied endodontic anatomy. To learn useful information preoperatively about the case we scanned

the patient. It was useful for both teeth, 16 and 17, so we were perfectly right to recommend the scan. On one hand, we find out that tooth 16 has a second untreated mesio-buccal canal and also where we can locate its orifice. If a molar does not have a second mesio-buccal canal, as was the case with tooth 17, then we are not to drill for a potential one, but we know from the beginning this information and we are able to stay minimally invasive. In our case, the mesio-buccal root of tooth 17 was already extremely compromised because of the large cast post.

On the other hand the scan helped us to decide for a selective retreatment for the tooth 17, as we did not retreat the palatal root, which was a container for a very hard material post. The absence of the periapical lesion on the CBCT image helped us to make this decision. Selective root canal retreatment has a favourable outcome in a majority of cases. Unretreated roots rarely developed radiographic signs of a new periapical lesion at follow-up [9].

As for the post placement, root filled molars with limited tissue loss can be restored without posts, particularly when total coverage is planned, as post insertion increases fracture loads [10].

If we decide for a post, then it is to be inserted in the most generous root, the palatal in this case; the mesio-buccal root is an oval root, highly susceptible to strip perforation because of thin dentinal walls and one can easily produce a strip perforation. This is an iatrogenic injury and may compromise the outcome of endodontic treatment [11].

Prognosis of perforation repair depends on factors such as time, site and size of perforation and mostly depends on elimination and prevention of infection of the perforation site [12].

Strip perforation presents great difficulty in sealing, because of its large affected area and irregular shape of the perforation site [13]. In our case, the time and size were quite unfavorable, but with a proper disinfection and with the advent of new bioceramic materials we considered to try a conservative treatment.

Bioceramic materials, both as sealer, but as putty materials as well, are extremely useful in the endodontic practice. They are biocompatible and limit periodontal inflammation. These materials have shown many favorable properties including a good sealing, biocompatibility, antibacterial effect, radiopacity, and ability to set

in the presence of blood; they induce osteogenesis and are suitable materials for the treatment of root perforations [14,15].

We performed the retreatments in single visit, as there was no exsudate and we were able to prepare and clean the root canal space in one appointment. There is evidence that showed no statistically significant difference in terms of healing in 24-month follow-up of retreatments completed in single visit or two visits in teeth with periapical lesions [16,17].

We decided for a CBCT follow-up, for its accuracy after a short period of time and respecting the AAE (American Association of Endodontists) recommendations regarding the use of CBCT in endodontic practice [18,19].

Conclusions

Our clinical case shows that an accurate diagnosis, a complex treatment plan and current technical equipment are of overwhelming importance to solve even the most difficult and hopeless situations and to retain the tooth as long as possible.

This case presented a successful treatment of strip perforation using bioceramic materials, as well as a conservative treatment for a tooth with vertical root fracture.

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