Case Report

Management of Calcified Canal with the Aid of Cone Beam Computer Tomography

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Received 21 Feb. 2015
Received in revised form 24 Mar. 2015
Accepted 31 Mar. 2015

Keywords: Calcific metamorphosis, Cone beam computer tomography (CBCT), Internal bleaching.

ABSTRACT

Trauma to teeth can lead to deposition of hard tissue within the root canal space. This is referred to as calcific metamorphosis (CM). It is clinically manifested as loss of translucency and yellowish appearance of the tooth. Clinicians are frequently in a dilemma as to whether to treat these teeth non-surgically or surgically. The use of conventional radiographs often do not give a clear picture of the actual root canal anatomy because of its inherent limitations. Thus in cases of CM, cone beam computer tomography (CBCT) can aid in evaluating the extent and nature of calcification, depth of calcification and can guide the clinician to access the patent portion of the canal. Moreover, on the bases of the information received from the CBCT scan, clinician can decide whether to go for a non-surgical or surgical treatment.

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**Introduction**

Calcific metamorphosis (CM), also referred to as pulp canal obliteration, is a pulpal response to trauma that is characterized by deposition of hard tissue within the pulp space\(^1\). Hard tissue deposition within the root canal space followed by yellowish discoloration of the crown of the tooth is a characteristic clinical feature of pulp canal obliteration\(^2\). The loss the pulp space in a radiograph is a representative feature of CM\(^1\). However, the absence of a root canal in a radiograph does not mean total obliteration of pulp space. In most of these cases, very fine pulp canal space with pulp tissue can be present and these spaces may harbour millions of microorganisms\(^3\).

Since more than 75\% of teeth with CM are asymptomatic and since the incidence of endodontic mishaps such as gouging, perforation, instrument fracture are likely to be higher in such cases, endodontic therapy is usually indicated in teeth with obliterated pulp canal only when it is associated with clinical and/or radiographic features of periapical disease\(^4\). Teeth with calcified pulp space which requires root canal therapy often faces a dilemma on whether to be treated via a non-surgical method/surgical method/both. Surgical treatment is mostly indicated when the root canal cannot be located by the usual orthograde approach\(^5\).

Since the conventional radiographs are the representation of a three-dimensional structure by a two-dimensional (2D) image, it does not provide an accurate depiction of the internal anatomy of the root canal\(^6\). On the other hand; cone-beam computed tomography (CBCT) is an accurate diagnostic tool in endodontics as it eliminates the superimposition of anatomic structures. Therefore it can reveal the internal morphology of the root canal better\(^7\). Thus CBCT can be a valuable tool in the diagnosis, treatment and prognosis of teeth with calcific metamorphosis\(^8\).

Hence the purpose of this article is to show case the value of CBCT in the successful management of a tooth with calcific metamorphosis.

**Case Description**

A 25 year old female patient reported to the Department of Conservative dentistry and Endodontics with a chief complaint of occasional mild pain and discoloration with respect to upper anterior tooth. Patient gave a history of trauma to the front teeth 8 years ago. On clinical examination, tooth no. #21 was discoloured and was slightly tender on percussion [Fig. 1a]. On examination of the intra-oral periapical radiograph (IOPAR), the pulp chamber of #21 appeared to be completely calcified. There was well-defined periapical radiolucency with respect to the same tooth [Fig. 1b]. It was understood from further history taking that the patient had visited a dentist before, who had suggested her to undergo peri-radicular surgery, as negotiation of the calcified canal was impossible and not worth the risk. The patient then came to our clinic enquiring for an alternative treatment to surgical procedure.

Pulp sensibility test demonstrated that only #21 was not responding. IOPAR taken in different angulations also demonstrated complete obliteration of the pulp space. Patient was then advised for a Cone Beam Computer Tomography (CBCT) for the upper maxillary region (small FOV; 40x50 mm) [PLANMECA PRO-MAX 3D MID, ROMEXIES 3.25 software] to have a better understanding of the root canal and peri-radicular region. The image revealed a well-defined periapical lesion with a break in the buccal cortical plate [Fig. 2a]. The examination of the different slices of the CBCT images in various planes (Sagittal...
and coronal planes) revealed a narrow radiolucent line in the centre of the teeth [Fig. 2a, b]. This suggested a narrow, but patent pulp canal. This gave confidence to proceed with conventional root canal therapy rather than adopting a surgical approach.

Coronal access cavity was prepared, and the canal was located under endodontic microscope (Seiler IQ, St. Louis, Missouri) and use of ultrasonic (Satelec P5, Acteon, North America) [Fig. 3a]. The orifice was enlarged using Gate Glidden drill (Mani Inc, Japan) and the canal was then sequentially enlarged using K-files to Size #35 (Dentsply Maillefer, Balligues) with the use of a chelating agent (RC Prep, Premier dental products company, PA, USA). The root canal was concomitantly irrigated with the alternate use of 1% sodium hypochlorite and 17% EDTA. The pulp space was then packed with Ca(OH)2 (Calcicur, Voco, Germany) intra-canal medicament to thoroughly disinfect the radicular space and aid in healing of the peri-radicular tissues. After the placement of intra-canal medicament for 2 weeks, the patient was asymptomatic. The canals were then dried and obturated with cold lateral compaction with gutta-percha along with AH-plus sealer (Densply, Germany).

Patient was recalled after a week, gutta-percha was removed 2 mm into the orifice and a resin modified glass ionomer cement (Fuji II, GC, Tokyo, Japan) barrier was placed. After this thermocatalytic bleaching was initiated with the use of 30% Hydrogen Peroxide (Merk specialities, Mumbai, India) as the bleaching agent. After 30 minutes of in-office bleaching procedure, a mixture of sodium perborate (Loba Chieme, Art 5964, Mumbai, India) and 3% hydrogen peroxide mixture was place in the pulp chamber and sealed with poly-carboxylate cement (Dentsply, DeTrey, Konstanz, Germany). The patient was then recalled after 6 days and the above mentioned bleaching procedure was repeated. After a total of three bleaching appointments the shade of the tooth had lighted, and was comparable to the adjacent teeth [Fig. 3b]. The pulp space was then cleaned with saline and the access cavity was temporized. The patient was then recalled after 10 days and access cavity was resolved with composite (Filtek Z 350 XT, 3M ESPE, MN.) [Fig. 3c].

**Discussion**

The various treatment approaches in teeth with calcific metamorphosis (CM) are as follows: (a) wait and watch (b) non-surgical approach (c) surgical approach (d) non-surgical followed by surgical approach. Since more than three-fourth of the teeth with pulp canal obliteration are asymptomatic, no therapeutic intervention is usually indicated, except for periodic radiographic monitoring. Nonetheless, teeth that are symptomatic (tender on percussion) and/or have associated periapical lesion requires active therapeutic intervention. Conventional non-surgical endodontic therapy is the treatment of choice as it is can eliminate the foci of infection from the root canal space. However, if the canal cannot be located, a surgical intervention is required as it offers direct access to the periradicular area. In cases where there is persistence of infection even after non-surgical treatment a surgical approach is necessitated. Thus the choice of treatment is mainly dependant on the periapical status and canal patency of the affected teeth.

In the present case, since the patient had clinical symptoms and periapical lesion was evident in the IOPAR, endodontic therapy was mandatory. The sensitivity of conventional IOPAR is said to be too low to capture the presence of very narrow canals if at all present in teeth with CM. Thus an obliterated root canal as seen an IOPAR...
might prompt the clinician to opt for a surgical approach in a tooth were the canal is actually patent. Thus the patient is subjected to unnecessary surgery and associated complications. Moreover, the nidus of infection within the root canal is left untouched. On the contrary, the dependency on conventional IOPAR in the treatment planning in a tooth where the pulp space is actually completely calcified will result in unnecessary removal of the coronal tooth structure.

However, with CBCT scan the clinician can scroll through the entire volume and simultaneously view axial, coronal, and sagittal 2-D sections that range from 0.125–2.0 mm thick. The axial and proximal areas which are generally not seen with conventional periapical radiography can be revealed by CBCT.CBCT scanning provides an excellent imaging method to detect differences in external and internal dental anatomy. The ability to visualise the area of interest in thin sections eliminates the superimposition of surrounding structures, like dentin and surrounding bone to better understand the root canal morphology. In a calcified tooth CBCT aids in evaluating the extent and nature of calcification, depth of calcification and can guide the clinician to access the patent portion of the canal. Furthermore, depending on critical information revealed by CBCT clinician can decide whether to go for a surgical or non-surgical treatment. Despite the advantages offered by CBCT when compared with conventional radiographs, it should be used carefully, to gain most useful information for diagnosis and the radiation exposure to patient should be at the least possible level.

Apart from the factors like periapical status and canal patency of the affected teeth which determine the choice of treatment in a tooth with CM, the patients’ aesthetic requirement also plays a key role in the choice of the treatment. The different options to address the aesthetic concerns of patients associated with CM are; (a) external bleaching (b) endodontic treatment followed by internal bleaching (c) internal and external bleaching without root canal treatment (d) full/partial coverage restorations. External bleaching is slow and less predictable due to the nature of discoloration. Though internal bleaching without root canal therapy have been mentioned as a likely treatment option, it has not gained much support due to the possibility of secondary intraradicular infection. The difficulty in obtaining the accurate shade and removal of intact tooth structure are the drawbacks of extra-coronal restoration (full coverage crowns/veneers) in masking the discoloration. Intra-coronal bleaching after root canal therapy not only provides seal thus prevent secondary root canal infection, but also removes tertiary dentin from the pulp chamber thus contributing to the faster action of the bleaching agent. Thus in the current case, after root canal obturation and placing a barrier, intra-coral bleaching was performed successfully to aesthetically rehabilitate the tooth.

Conclusion

Whenever the anatomy of the tooth is not fully apparent on standard periapical radiographs, judicious use of CBCT can prevent the occurrence of iatrogenic mishaps and also reduces removal of healthy tooth structure and thus aids in increasing the longevity of tooth.

References


**Figure 1.** (a) Discoloured upper left central incisor (#21), (b) Intra-oral peri-apical radiograph (IOPAR) showing #21 with obliterated pulp space

**Figure 2.** Cone beam Computer Tomography images (a) Sagittal view showing thin radiolucent line at the centre of #21 and a loss of buccal cortical bone at the periapical region (b) Coronal view showing a narrow, but patent canal with respect to #21
Figure 3. (a) Negotiation of the calcified canal, (b) Post-operative image after completion of non-vital bleaching procedure, (c) IOPAR taken immediately after composite resin access cavity restoration