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THE DIFFERENCE BETWEEN RADIOGRAPHS AND CONE BEAM COMPUTED TOMOGRAPHY IN THE DIAGNOSIS OF BONE DESTRUCTION: A CASE REPORT

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ABSTRACT

This clinical case report describes successful treatment of a 34-year-old female with an exacerbating swelling in the right maxillary premolar region which had previously undergone endodontic treatment. Clinical examinations contributed to the presence of excessive bone loss but radiographic imaging revealed no bone destruction. Correct diagnosis and treatment planning was achieved by the help of cone beam computed tomography images. After orthograde endodontic retreatment successful outcome was achieved and the patient remained asymptomatic even after a 4 year follow up period.

Keywords: Cone Beam Computed Tomography, Periapical Lesion, Radiolucency, Symptomatic Apical Periodontitis

INTRODUCTION

Diagnosis, treatment planning and follow ups in endodontic practice depend on imaging. Findings from conventional intraoral and panoramic radiographic imaging are routinely used for this purpose. But there are some shortcomings in the usage of these techniques, such as superimposition, two-dimensional view of the three-dimensional anatomy and depiction of limited aspects especially in periapical radiographs, which are the most popular imaging used in endodontic practice. Additionally, geometric distortion of the anatomical structures being imaged with conventional radiographic methods often occur [1]. These limitations have propelled the practitioner to use more precise methods like small- or limited-volume cone beam-computed tomography (CBCT) imaging which produces accurate three-dimensional images of teeth and the surrounding dento-alveolar structures.

In a review study, Nair et al [2] stated that CBCT technology has proved to be useful for localization and characterization of root canals, treatment planning of periapical surgery, and detection of root fractures in extracted teeth.

The accuracy of CBCT is due to its ability in detecting radiolucent lesions before they are visualized in conventional radiographs [3-8]. It is known that periapical lesions in cancellous bone cannot be detected in conventional radiographic images until the cortical bone is perforated [4]. However, CBCT can reveal bone defects of the cancellous bone and cortical bone separately [5]. The prevalence of apical periodontitis was found to be significantly higher when using CBCT, in comparison with periapical radiographic imaging for detection [5]. One study showed that 34% of the radiolucencies detected in CBCT images were missed when periapical radiographic imaging was used in maxillary premolars and molars [6].

Herein, we describe a case in which despite of the buccal cortical destruction and swelling seen in clinical examinations, conventional radiography did not show any periapical bone destruction.

Case report:

A 34-year-old female was referred to our endodontic office, with a chief complaint of swelling in the right maxillary premolar region. Antibiotics were prescribed for her by a general practitioner. After antibiotic consumption the swelling disappeared, but exacerbated again after a while.

The patient`s medical history was noncontributory. Initial root canal treatment was done one year ago. Clinical examinations revealed a crown restoration on an amalgam core in the endodontically

treated maxillary right second premolar. The tooth was tender to percussion and palpation, had grade 3 mobility and periodontal probing around the tooth showed a pocket in the buccal region with a 10 mm depth (figure 1).

Preoperative intra oral periapical and panoramic radiographic images showed limitted PDL widening but the alveolar bone structure seemed normal and no radiolucency was observed (figure 1). According to the clinical and radiographic findings, a diagnosis of symptomatic periapical periodontitis and infected initial root canal treatment was established and endodontic orthograde retreatment was suggested for the patient. Endodontic apical surgery was considered if retreatment was unsuccessful.

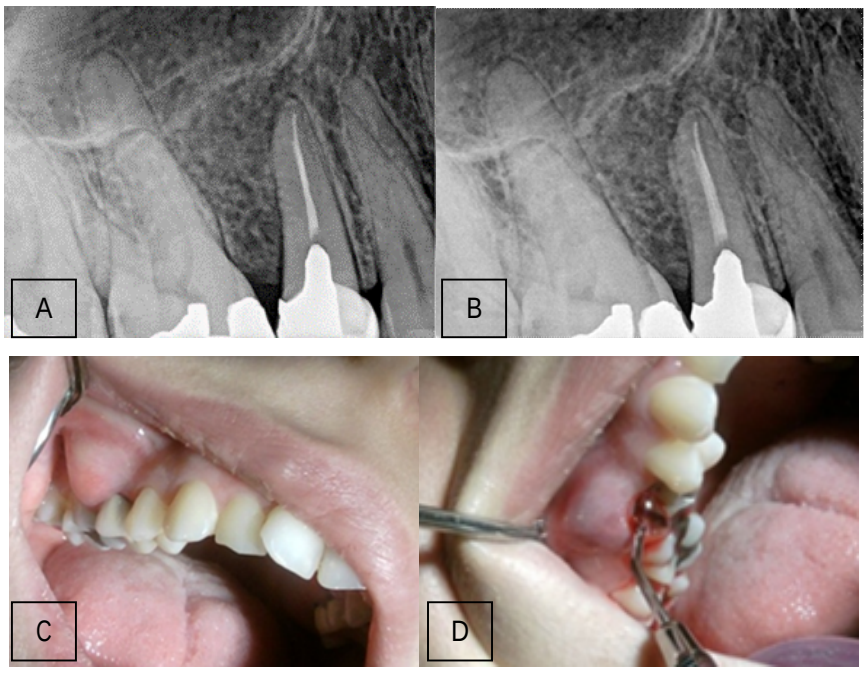

Figure 1: A. Preoperative periapical radiopraphic image. B.Mesially angulated periapical radiopraphic image. C. Preoperative clinical photography. D. Preoperative probing of the tooth.

After obtaining an informed consent, the tooth was anesthetized with 1.8 ml 2% lidocaine containing 1/80000 epinephrine (Darupakhsh Co., Tehran, Iran). An endodontic access cavity was prepared. After rubber dam isolation, initial root fillings were removed with chloroform and Hedstrom files (Mani, Matsutani Seisakusho Co., Tochigi-ken, Japan). The working length was determined by an ipex apexlocator (NSK, Tochigi, Japan). Cleaning and shaping was performed using ProTaper Ni-Ti instruments (Dentsply Maillefer, Ballaigues, Switzerland) and EDTA gel (MD-ChelCream, Meta Biomed Co., Ltd., Cheongju City, Chungbuk,

Korea) with crown down technique. Canals were dressed with calcium hydroxide dressing (Golchay, Tehran, Iran) and coronally sealed with a temporary filling material (Zonalin, Kemdent, UK).

For better understanding of the root canal system's complex anatomy, and the presence of accessory canals, vertical root fracture and due to inconsistency of the clinical manifestations and radiographic images of the involved tooth, limited CBCT images were requested.

One week later, in the second appointment, CBCT images showed that the tooth had an additional unprepared root canal and the buccal cortex and half of the cancellous bone was completely destroyed (figure 2). The second canal was cleaned and shaped and calcium hydroxide dressing was placed again.

In the third appointment, 13 day later, the canal dressing was changed with mixture of calcium hydroxide and 2% chlorhexidine solution (Calasept, Nordiska Dental, Angelholm, Sweden). In this appointment there was no swelling and the pocket depth in the buccal region reduced to 5 mm.

In the forth appointment the canals were dried with absorbing paper points (Meta Biomed Co., Ltd., Cheongju City, Chungbuk, Korea) and obturation was performed using cold lateral compaction of gutta percha (Meta Biomed Co. Ltd., Cheongju City, Chungbuk, Korea) and AH26 sealer (De Trey, Dentsply, Switzerland) (figure 3).The patient was advised to a full coverage crown restoration.

One month after the first appointment, in the follow up visit, the pocket depth was normal and the swelling and pain of tooth was completely relieved. The patient was asymptomatic during a four year follow up time (figure 4).

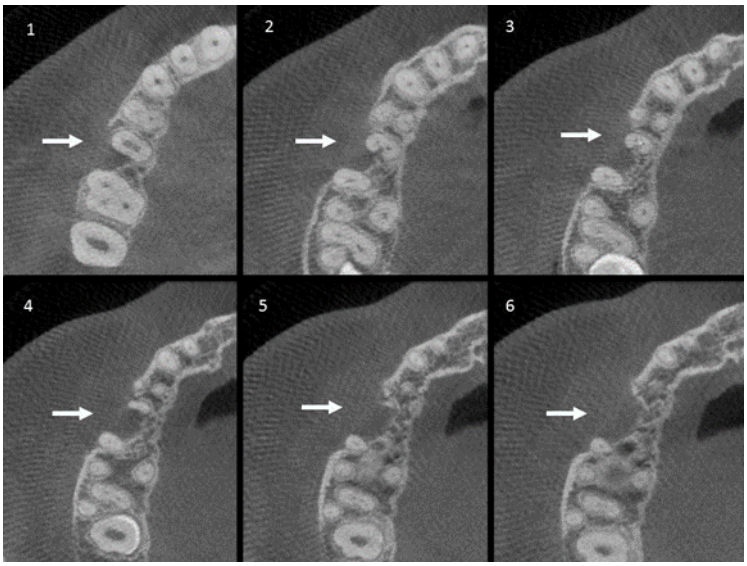

Figure 2: Axial CBCT images from coronal to apical show destruction of the cortex and cancellous bone.

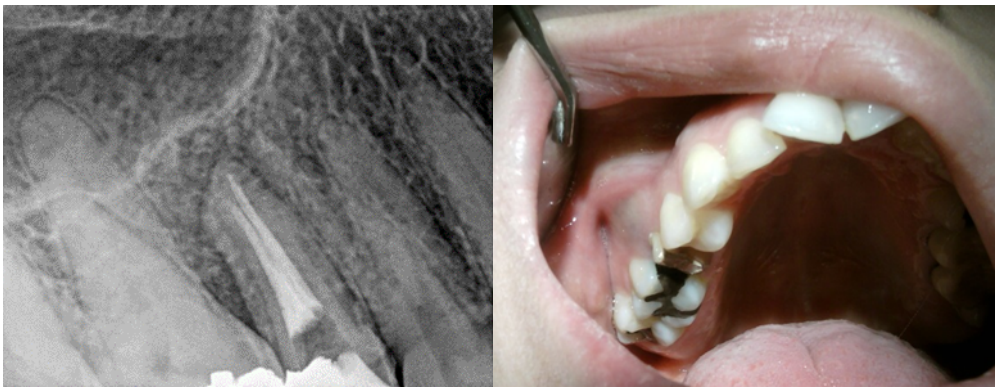

Figure 3: Postoperative radiographic and clinical images.

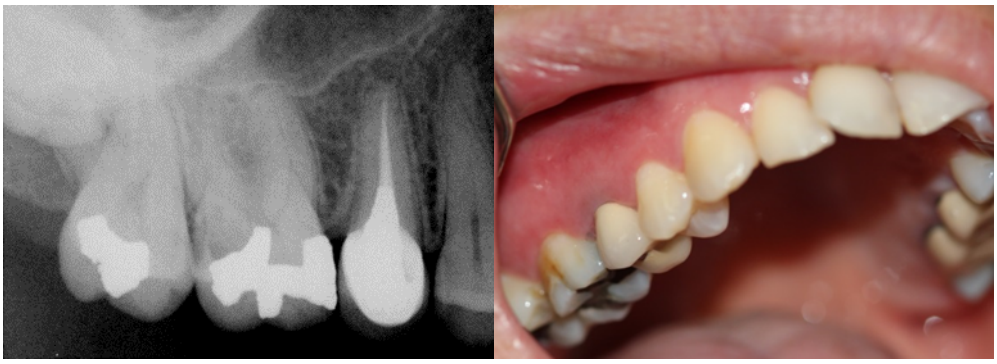

Figure: Four year follow up radiograph and photograph.

DISCUSSION

Making the correct pulpal and periapical diagnosis is helpful for treatment planning and prognosis determination [9]. The combination of clinical examinations and diagnostic imaging is the foundation for endodontic preoperative diagnosis and treatment planning. Radiographs play an important role in the success or failure of endodontic treatment. The quality and quantity of information obtained from radiographic imaging affects the diagnosis,

treatment planning and prognosis determination of teeth requiring endodontic treatments [9]. However, due to inherent drawbacks such as superimposition and distortion, it is sometimes difficult to detect periapical lesions with two-dimensional imaging. Due to structured noise of superimposed cortices, two-dimensional radiographs can only detect periapical lesions when bone loss reaches 30%–50%, [10]. Periapical radiographic imaging can only detect periapical radiolucencies when perforation or erosion of the overlying cortical plate has occurred [11-13]. Therefore, only 50–55% of small and medium sized lesions can be diagnosed as periapical disease by these images [14]. In the present case report, although according to the clinical manifestations observed the overlying cortical bone had been perforated, no radiolucency was seen in the periapical images taken. This may be due to superimposition of the palatal cortical bone in two dimensional radiographic images. Further research should be conducted to evaluate the minimum thickness for the cortical bone of one side that may obscure the radiolucency that should be seen consequent to the perforation of the cortical bone of the other side in two dimensional radiographs with superimposition.

Reports indicate that CBCT images provide clinically relevant information not found in periapical images [6, 15]. In endodontics, the use of CBCT involves diagnosis of pathosis, treatment planning, diagnosis of trauma to dentoalveolar structures and evaluation of previously root-treated teeth, especially for missed canals [16, 17]. In the evaluation of CBCT images of the present case the extent of bone loss can be seen. It should be noted that various clinical studies have stated that radiological findings from CBCT images represent the true status of the periapical tissues and can be used as a “golden standard” to detect periapical bone loss [4, 6, 18]. Patel et al [5] reported that CBCT identified periapical lesions in 100% of the cases. Therefore, this imaging technique has the required sensitivity [4], validity and reliability in detecting periapical lesions [5]. It should be noted that limited CBCT scanners which have a smaller field of view (3–4 cm3), cause lower radiation doses [5] similar to that of a digital panoramic image [19].

In the present report because of the questionable prognosis and excessive bone loss, we used calcium hydroxide and 2% chlorhexidine inter-appointment dressing in the root canals till signs of repair and success were seen. The reason for application of 2% chlorhexidine was its broad range antibacterial properties with efficacy on Gram-positive and Gram-

negative bacteria and fungi [20] and its substantivity [21].

CONCLUSION

The application of CBCT can be beneficial in complicated endodontic cases. It is very effective for reliable diagnosis of apical lesions and that it enabled successful diagnosis and treatment.

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The authors deny any conflict of interest.

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