TREATMENT PLANNING OF COMPLICATED ENDODONTIC CASES WITH THE USE OF CBCT

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Abstract

Cone beam computed tomography (CBCT) imaging is useful in various clinical situations including assessing dental morphology prior to endodontic treatment, locating tooth perforations, separated endodontic files, and resorptions. The aim of this paper was to present the usefulness of CBCT in endodontic treatment planning, through the review of two complicated endodontic cases.

Two cases of failed endodontic treatment were presented in which CBCT allowed for correct diagnosis, as well as endodontic treatment qualification and planning.

CBCT is especially useful when assessing endodontic treatment complications such as overextended root canal obturation material, separated endodontic instruments, and/or localization of perforations. Having the pros of CBCT in mind, one always has to weigh the added diagnostic value of CBCT with the economic cost of the tool employed, in order to make the best informed decision regarding accurate diagnosis and treatment.

Keywords: CBCT, endodontic treatment, OPG, perforation, resorption

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Introduction

Accurate diagnosis is the key factor for successful treatment both in dentistry and in general medicine. Traditionally, in the field of dentistry, the most challenging and difficult procedure is endodontic treatment. In order to successfully perform endodontic treatment, one needs both sound knowledge regarding general root canal anatomy, as well as detailed information on the specific anatomy of the treated tooth [1]. Various techniques using x-rays, as well as direct live visualization using an operating microscope are the most effective tools to achieve the above [1]. Since the introduction of x-ray machines in the early 20th century we slowly begun observing the development of various x-ray-based visualization methods [2]. One of the more recent developments in this field available for dentists is cone beam computed tomography (CBCT). This technique is based on a cone-shaped x-ray beam directed through the patient and received by a flat 2D detector [3]. A series of 2D images is later rendered into a 3D image available on the computer screen as a 2D image or a 3D image reconstruction [4]. CBCT was designed to overcome some of the limitations of conventional computed tomography (CT) scanners such as decrease patient exposure to radiation or large output file size [2]. Further advantages of CBCT include reduction of irradiation area, increased image accuracy, short scanning time (10-70 seconds), reduction of artefacts, and the availability of dentistry-specific processing software [3].

CBCT imaging is useful in various clinical situations including assessing dental morphology prior to endodontic treatment [5], locating tooth perforations [6], separated endodontic files [7], as well as resorptions [6,8].

The aim of this paper was to present the usefulness of CBCT in endodontic treatment planning, through the review of two complicated endodontic cases.

Case report 1

A 35-year-old patient was admitted to the University Dental Clinic in Krakow for a consultation concerning treatment possibilities for his upper left first molar. During a previous, external consultation the patient was informed that

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the prognosis for the toot 26 was serious due to a previous unsuccessful endodontic treatment attempt. During this consultation the patient was advised to have the tooth extracted.

On the OPG signs of radiolucency around tooth 26 and a possible cyst in left maxillary sinus were observed (Fig. 1). The periapical x-ray revealed a large periapical lesion surrounding the tooth and a broken endodontic instrument in the palatal root canal (Fig 2).

A CBCT scan was performed to evaluate the anatomy of root canals. The CBCT revealed a large, well demarcated, oval radiolucency surrounding the palatal root of tooth 26 (Fig. 3).

Having discussed with the patient various treatment options, including extraction and endodontic surgery, a two-step endodontic treatment was proposed. Informed consent was obtained from the patient.

As a first step of treatment, canals of tooth 26 were prepared using Mtwo mechanical files. Due to difficult access and reached potency of palatal root, broken instruments were left in place. Canals were temporarily filed with calcium hydroxide paste, that was repeatedly replaced for three months. After visible signs of healing of the periapical lesion stared to be seen, root canals were obturated and the tooth was restored with composite cement. During follow-up at six months, the tooth demonstrated proper healing of periapical tissues (Fig .4). The patient reported no pain or discomfort regarding tooth 26.

Fig. 1. Case 1. OPG revealing radiolucency surrounding roots of tooth 26 and possible lesion located in the left maxillary sinus.

Fig. 2. Case 1. Periapical X-ray revealing a large periapical lesion of tooth 26 and a separated instrument in the palatal canal.

Fig. 4. Case 1. Dental periapical X-ray. Six months follow-up showing proper healing of periapical tissues of the tooth 26.

Fig. 3. Case 1. CBCT scan showing a large, well demarcated, oval radiolucency surrounding half of palatal root of tooth 26.

Case report 2

A generally healthy 36-year-old female was referred to the University Dental Clinic in Krakow for treatment of tooth 11 with perforation. According to the patient, the perforation was a result of an attempted endodontic treatment two weeks earlier. The reason for undertaking tooth 11 endodontic treatment was its discoloration due to pulp necrosis that occurred about 15 years ago due toot trauma. No endodontic treatment was performed at the time of initial trauma. The patient was advised to have the tooth extracted due to the potential impossibility of endodontic treatment and size of perforation.

An OPG was taken prior to endodontic treatment. There was no visible patency of root canal in tooth 11 (Fig. 5).

The patient was referred for a CBCT, that revealed the exact location of the perforation (Fig. 6) and existence of root canal patency (Fig. 7).

Resin-modified flowable glass-ionomer cement (Geristore) and MTA cement were used to seal a perforation and root canal treatment was performed (Fig. 8). Follow-up at three months showed proper healing.

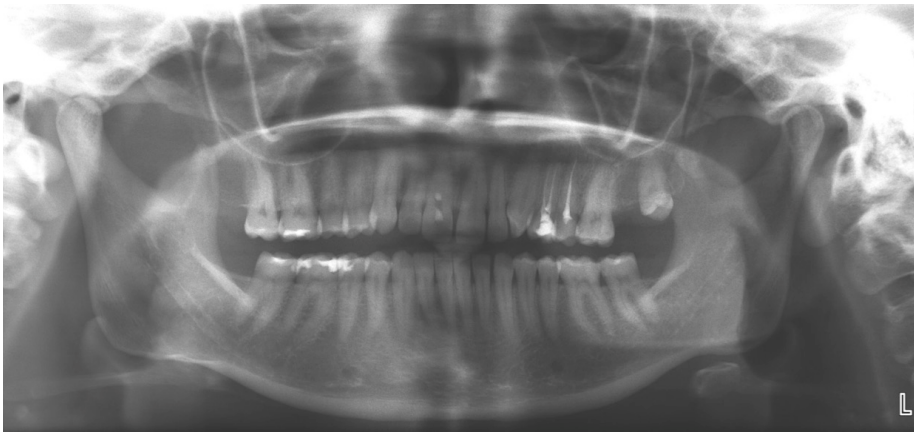

Fig. 5. Case 2. OPG. No visible canal of tooth 11.

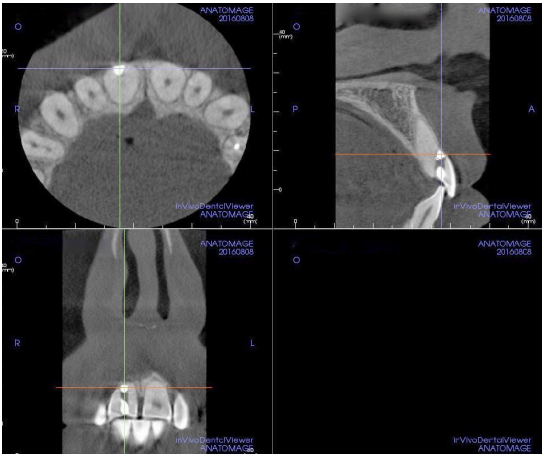

Fig. 6. Case 2. CBCT scan revealing the exact location of the perforation.

Fig. 7. Case 2. CBCT scan. Different cross-section exposing tooth 11 root canal patency.

Fig. 8. Case 2. Periapical X-ray. Tooth 11 after perforation management and root canal treatment.

Discussion

In current clinical practice the use of CBCT is widespread and common in various clinical situations [6]. Appropriate and careful diagnosis and planning, with the use of adequately chosen tools allows doctors to make the most accurate prognosis and allows to achieve the best treatment results [1]. However, in some cases, it is difficult to choose the ideal tool that will be most effective and appropriate for the given clinical situation, as well as the preferences and experience of the dentist [9]. One has to always balance the potential, beneficial biological outcome with the economic cost of the tools employed to achieve this, in order to make the best informed decision [2].

To assess the exact position of a separated endodontic file one can use an operating microscope, a periapical radiograph or a CBCT, potentially with a 3D reconstruction [7]. According to Garg and Grewal [7] the retrieval of fractured instruments might compromise the remaining tooth structure and subsequently resistance to tooth fracture. The dentist should assess the situation beforehand as accurately as possible and proceed with the most appropriate treatment. The risk of root fracture depends on the location of the separated instrument and the method employed to remove it [10].

For the assessment of root perforation one might use an electronic apex locator, an operating microscope or radiographic methods such as conventional periapical radiographs, digital periapical radiography, orthopantomography, and CBCT [11,12]. However, in several studies [6,13–15] CBCT was found to be the most accurate imaging method for this clinical situation.

According to the American Association of Endodontists (AAE) and the American Academy of Oral and Maxillofacial Radiology (AAOMR) limited field-of-view CBCT should be the imaging modality of choice for nonsurgical endodontic retreatment, especially when assessing treatment complications such as overextended root canal obturation material, separated endodontic instruments, and/or localization of perforations [16].

Concluding, CBCT is an excellent diagnostic tool to supplement thorough clinical examination, when planning endodontic treatment or retreatment. CBCT is especially useful when assessing endodontic treatment complications such as overextended root canal obturation material, separated endodontic instruments, and/or localization of perforations. However, having the pros of CBCT in mind, one always has to weigh the added diagnostic value of CBCT with the economic cost of the tool employed, in order to make the best informed decision regarding accurate diagnosis and treatment.

Resumo

Enkonduko kaj celo

Bildigo per konusradia komputila tomografio (CBCT) estas utila en diversaj klinikaj situacioj, ankaŭ por pritaksi dentan morfologion antaŭ endodontika kuracado, lokante dentajn perforaĵojn, apartigitajn endentajn fajlilojn kaj sorbadojn. La celo de tiu artikolo estas prezenti la utilecon de CBCT por la planado de endodontika kuracado per rerigardo al du komplikaj endodontikaj kazoj.

Prezentado de kazoj

Du kazoj de sensukcesa endodontika kuracado estas prezentita, en kiuj CBCT ebligis korektan diagnozadon kaj planadon de bonkvalita endodontika kuracado.

Konkludoj

CBCT estas speciale utila kiam oni pritaksas komplikaĵojn de endodontika kuracado kiel ekzemple troe obturadan materialon de denta radika kanalo, apartigitajn endodontikaj ilojn, kaj / aŭ lokalizon de perforaĵoj. Havante la avantaĝojn de CBCT en menso, oni ĝiam devas pezi la kroman, aldonitan valoron de CBCT por la diagnozado kontraŭ la ekonomia kosto de la uzata ilo por fari la plej bone informitan decidon koncerne precizan diagnozon kaj kuracadon.

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