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Successful nonsurgical management of large periapical lesion – a case report*

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ABSTRACT
This article presents a case where an extensive inflammatory change in the periapical tissues was successfully treated by conservative root canal treatment. A patient was referred to a specialist endodontic clinic for apicoectomy of tooth 22. Despite the presence of extensive changes in the bone, it was chosen not to perform resection and instead to perform conservative root canal treatment to decompress the cyst through the root canal. The treatment was successful, as confirmed over an 8-year observation period. Cone beam computed tomography (CBCT) was used to diagnose the lesions and monitor the healing process. A CBCT scan performed after the treatment indicated that sealer had been introduced beyond the anatomical opening; however, this did not disturb the healing of the periapical tissue. This case is an example confirming the value of limiting the hasty use of endo-surgical or surgical treatment.
Keywords: nonsurgical management; periapical lesion; root canal treatment; tomography.

INTRODUCTION

Inflammatory changes in the periapical tissues may be acute, chronic, or chronic exacerbated processes. Although such inflammation can occur in different forms, all derive from pulp necrosis. If the pulp dies and proper root canal treatment is not implemented in a timely manner, the tissues surrounding the tooth root may become inflamed [1]. This process may remain asymptomatic for many years or may manifest itself as pain, swelling, or a fistula. When these symptoms develop, the patient will typically seek treatment before large inflammatory changes and extensive bone destruction occur. However, in some cases, the changes in the periapical tissues can only become apparent during routinely performed X-rays, and these are often large and with a worse prognosis. Even extensive bone destruction in the form of granulomas or cysts may result in no clinical symptoms for many years [1, 2].

It is estimated that the incidence of periapical granulomas ranges 9.3–87.1%, and cysts (within periapical lesions) – 6–55% [2, 3]. As the size of the periapical lesions increases, the proportion of root cysts increases. However, it should be remembered that not all extensive inflammatory changes in the periapical tissues are cysts [4]. The final, decisive differential diagnosis should be preceded by a histopathological diagnosis. However, this is not frequently performed. The indications that the lesion is a cyst rather than a granuloma are as follows:

— in a clinical trial, during treatment: straw-amber fluid leaking through the canal and/or during aspiration from the lesion,

— in radiological examination: lesion larger than 200 mm^2, with an osteosclerotic rim [3, 4].

It is worth noting that sometimes even quite extensive changes are not visible on X-ray images; in which case, tomographic imaging is extremely helpful [5]. For many years, X-ray imaging has been inseparably associated with root canal treatment for diagnosing chronic inflammatory periapical lesions and monitoring the healing process [5, 6]. Despite being a necessary radiological examination in endodontics, X-ray imaging has several limitations, the key one being that it can only form a 2-dimensional image of teeth and their neighbouring anatomical structures. X-rays may therefore mislead the dentist and are not always a sufficient or appropriate method of radiological assessment of the clinical situation; indeed, some cases have been reported of additional root canals or inflammatory periapical lesions remaining undiagnosed following X-ray examination [7].

Cone beam computed tomography (CBCT) scans allow fuller visualization of all root canals and provide an accurate estimate of the presence and degree of changes occurring in the bone [8, 9, 10]. It is also possible to make an objective and comparable evaluation of the extent of periapical lesions presented on scans [7, 8]. Irrespective of the size of inflammatory periapical lesions, they should be first treated using a non-surgical approach, i.e. by root canal treatment. In the event that non-invasive therapy fails, surgical treatment should be undertaken [5, 11, 12, 13].

The following case reports describe the management of a particularly large maxillary periapical lesion involving the anterior teeth by nonsurgical endodontic treatment. Cone beam computed tomography was used to diagnose the lesions and monitor their healing.

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CASE PRESENTATION

A patient (male, Caucasian) was referred to the specialist endodontic clinic for apicoectomy of tooth 22 (Fig. 1). The referring dentist had begun root canal treatment of tooth 22, but found that conservative, non-surgical root canal treatment was ineffective and impossible due to persistent root canal exudate. The same doctor referred the patient for a CBCT examination. The CBCT examination revealed extensive destruction of the maxillary alveolar process bone near the apex of the root of tooth 22 (Fig. 2). The inflammatory lesion in periapical tissues was so large that only a thin layer of the bone remained on both the vestibular and palatal aspects (Fig. 2).

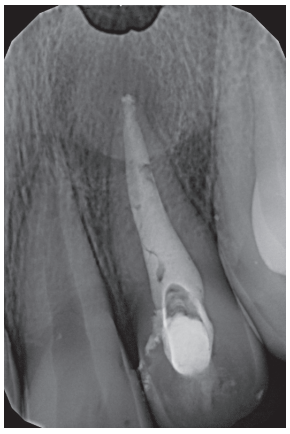

FIGURE 1. X-ray before root canal treatment in the endodontic clinic. Rarefaction of periapical bone structure and the temporary material in the canal are visible

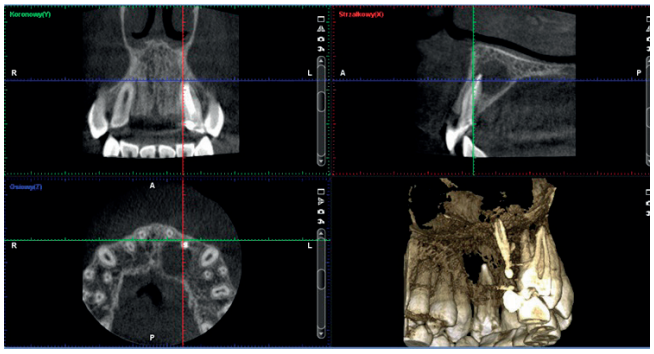

FIGURE 2. Cone beam computed tomography scans before root canal treatment in the endodontic clinic. Extensive destruction of the maxillary alveolar process bone near the apex of the root of tooth 22 is visible

The collected interview revealed that the patient had sustained an injury to the face 2 years earlier: he had been hit by a ball in the region of the upper teeth while playing tennis. The patient did not report to the dentist directly after the event. However, as tooth 22 did not demonstrate any reaction to stimuli during a routine dental examination a year later, root canal treatment was initiated. Information obtained from the patient and relevant medical documentation indicated that despite the presence of intracanal dressings, a large amount of persistent exudate was observed in the root canal. On an X-ray taken before the treatment at the endodontic clinic, rarefaction of the periapical bone structure and the temporary material in the canal were visible (Fig. 1). However, the massive bone destruction was only visible on CBCT, as in the X-ray image, the brightening (meaning inflammatory change in the bone) was hardly visible and did not reflect the degree of destruction.

In spite of the existence of an advanced inflammatory lesion and the ongoing exudate, whose presence was observed after removing the dressing, it was decided to continue the non-invasive treatment of the tooth. Written consent to treatment was obtained. A rubber dam was placed at the beginning of the procedure. The dressing was removed from the canal, and the canal was chemo-mechanically prepared with file #60 at the apex. About 1.5 mm^3 of a straw-coloured fluid was removed from the canal. In response to the presence of the continuous exudate, a calcium hydroxide-based antiseptic dressing was introduced into the canal. A sterile cotton wool pallet was placed at the canal orifice, and the tooth crown was filled temporarily with a glass-ionomer cement. The next appointment was held in 10 days. No exudate was observed in the root canal after removing the dressing, rinsing out, and drying. The patient did not report any complaints associated with the treated tooth 22. The root canal was chemo-mechanically prepared with the step-back technique (Master Apical File = MAF# 70). During the final lavage, passive ultrasonic activation of sodium hypochlorite solution (NaOCl -5.25%) was applied. After drying, the root canal was filled by cold lateral condensation of gutta-percha and AH Plus® (Dentsply Sirona) sealer. After filling the cavity within the crown, a follow-up radiograph was taken (Fig. 3). On a subsequent check-up visit, 1 year upon the completion of treatment, no alarming clinical symptoms were stated, and CBCT scans revealed total healing of inflammatory lesions in the bone (Fig. 4). In addition, no lesions were detected in the bone by X-ray examination performed 3 years later (Fig. 5). The patient attended subsequent follow-up visits 7 (Fig. 6) and 8 (Fig. 7) years after the end of treatment. Each time, a clinical examination, an interview and an analysis of the X-ray images were performed. The patient has not reported any problems associated with the treated tooth following the completion of the treatment.

FIGURE 3. X-ray immediately after root canal filling

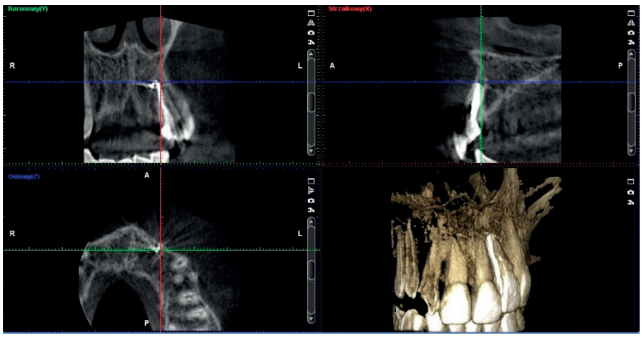

FIGURE 4. Cone beam computed tomography scans 1 year after root canal treatment. The structure of bones was rebuilt. The pushed sealer did not disturb the healing process

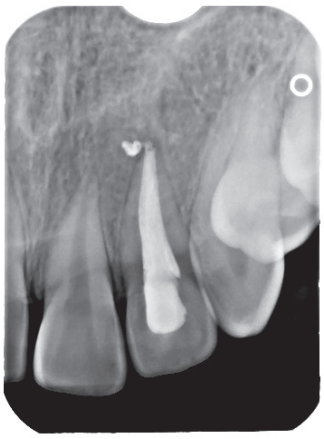

FIGURE 5. X-ray after 3 years after root canal treatment

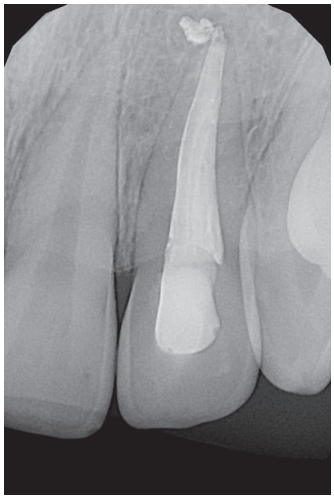

FIGURE 6. X-ray after 7 years after root canal treatment

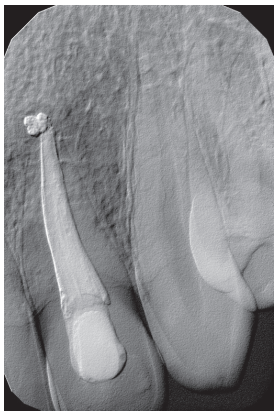

FIGURE 7. X-ray after 8 years after root canal treatment

DISCUSSION

Cone beam computed tomography allows clinicians to detect more than 60% of lesions in the apical periodontium than X-ray examination, particularly in the region of the 2nd molars [14]. As the presented case illustrates, particularly extensive lesions are not always clearly visible on dental radiographs in the region of the maxillary anterior teeth. However, CBCT allows a precise location of the losses in the bone or roots of teeth in relation to the adjacent anatomical structures, such as the inferior alveolar nerve canal, mental foramen, or maxillary sinus [15, 16]. This information is not only very useful for root canal treatment, but also for surgical or endodontic-surgical procedures [15]. Moreover, CBCT images have been found to be highly compatible with the results of histological examinations in diversifying granulomatous periodontitis and cysts [17]. Cone beam computed tomography is also a valuable method for detecting bone calcifications or fenestration, injuries to the hard tissues of the tooth as a result of the internal or external resorption of the tooth, and root or bone fractures, which are often invisible in X-ray images [18, 19, 20]. In the presented case, the use of CBCT allowed the detection of extensive bone loss and the exclusion of cracking/fracture of the tooth root, despite an injury in the past. Extensive bone destruction and the type of exudate, together with the CBCT image, suggested that the lesion was characteristic of a cyst. In spite of this diagnosis, it was decided to continue conservative root canal treatment of tooth 22, instead of immediate resection. The above management approach is in accordance with the guidelines of the European Society of Endodontology and with up-to-date professional reports [11, 12]. Traditional root canal treatment was performed together with fluid aspiration from the root canal. This is a very simple and efficient method, in which fluid is evacuated from the root canal system with an ordinary syringe and needle [21]. The size of the needle depends on the degree of root canal widening, the size of the access cavity, and anatomy of the causal tooth. This technique for aspiration is particularly recommended in the case of straight and wide root canals, prepared to such a size so that the needle can be freely inserted into the area of the apex. The method is not recommended in teeth with thin walls around the roots, e.g. the mandibular incisors. Some authors propose that the presence of the purulent exudate is also a relative contraindication for applying this method. After confirming the presence of cyst-like lesions and a persistent exudate which cannot be dried in the traditional way, it is also possible to perform aspiration through a drain inserted from the side of the vestibule or palate. However, such management is associated with a greater degree of discomfort for the patient and a greater risk of complications than the aspiration of the fluid directly

from the root canal. Insertion of a drain through the tissues surrounding the root requires also greater skills on the part of the clinician, and any drain can be blocked by food particles and other debris before the next visit. Additionally, oral mucosa wounds can develop and become infected [21, 22]. Potential alternatives to liquid aspiration are passive or active decompression. Passive decompression, however, requires active cooperation with the patient: the canal should be regularly rinsed with chlorhexidine solution and the patient faces the additional inconvenience of maintaining the drain for up to 5 years. Furthermore, the drain can sometimes be lost before the date of the check-up visit or the oral mucosa can become infected. In contrast, although the appropriate apparatus is needed, active decompression does not require active participation of the patient and the treatment is much shorter [23, 24, 25]. The presented case suited the use of the aspiration technique, as the causal tooth was an upper incisor with a wildly-prepared canal and a non-purulent exudate. Directly after the aspiration of the fluid, the amount of exudate in the canal decreased, but upon the completion of canal preparation, it was not possible to drain the root canal system entirely. Therefore, a calcium hydroxide-based dressing was used. Short-term application of this kind of filler offers considerable advantages as an antiseptic. In an aquatic environment, calcium hydroxide undergoes dissociation to Ca^{2+} and OH^- ions, resulting in the pH increasing to as much as 12 or 13; this alkaline environment inactivates the enzymes of the bacterial cytoplasmic membrane, thus disturbing the division, growth, and metabolism of bacteria [21]. Hydroxyl ions also damage the bacterial DNA, increase the permeability of the bacterial membrane and denature the proteins within. Calcium hydroxide also exerts an antibacterial effect by oxidizing lipids of cell membranes and inhibiting the release of lipopolysaccharides from Gram-negative bacteria, thus inactivating the enzyme-stimulating activity of osteoclasts. In addition, calcium hydroxide also limits the growth of bacteria from the *Actinomyces* and *Capnocytophaga* families through the adsorption of calcium dioxide. It also plays an important role in the reconstruction of bone tissue and the healing of inflammatory lesions in periapical tissues [26]. Significant antibacterial activity is not the only advantage associated with the use of calcium hydroxide preparations. It is known that inflammatory lesions in periapical tissues are mainly induced by necrotic pulp and bacterial infection. For cyst-like lesions, healing requires not only antibacterial and bacteriostatic activity but also a drying action and the consequent enhancement of osteoblast activity. By reducing the permeability of blood vessels, calcium hydroxide decreases the production of exudate in the root canal [27]. Additionally, calcium ions cause an increase in the concentration of alkaline phosphatase, an isoenzyme responsible for releasing mineral salts from the blood; among these, calcium phosphate is needed for bone reconstruction. In addition, optimal conditions for alkaline phosphatase activity are created by hydroxyl ions [11, 28]. Despite these clear advantages, calcium hydroxide is known to have a destructive impact on dentinal hardness during long-term application. Therefore, calcium hydroxide preparations should not be left in the root canal for longer than 14 days; after this period, the antibacterial effect of the preparation is significantly reduced. In the presented case, the antiseptic dressing was inserted only for 10 days following the commencement of root canal treatment in the endodontic clinic; after this time, the expected effects had been achieved. At the next visit, after 1.5 weeks, the root canal was completely dry and could be finally obturated. A year after the completion of the treatment, CBCT scans showed complete healing of lesions (Fig. 4). A slight overextension of sealer was observed beyond the anatomical apex of the canal but this did not disturb the healing process (Fig. 4, 5). This case is one of many examples confirming the value of limiting the hasty use of endo-surgical or surgical treatment [11].

CONCLUSIONS

As far as possible, the initial stage of root canal treatment should be conservative, even in the case of large inflammatory cyst-like lesions in the periapical tissues. Dental radiographs, despite being a necessary and basic method of radiological imaging for endodontic therapy, do not always highlight the presence or extent of lesions in the bone.

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