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The importance of CBCT imaging to determine the characteristics of a bone sequestrum in a case of chronic osteomyelitis

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ABSTRACT

Chronic osteomyelitis may show a suppurative course with abscess or fistula formation and sequestration at some stages, and persist for a variable period up to many years with intermittent exacerbation. The importance of imaging in osteomyelitis is threefold: to localize the condition, to find out its extent, and to assess the response after treatment. Conventional multislice computed tomography is a useful method of preoperative assessment, but it is not considered as the initial choice for imaging in osteomyelitis because of its reported lack of sensitivity in bone marrow disease. The Cone Beam Computed Tomography (CBCT) is used in dentistry to image high-contrast objects such as teeth and bone and it is particularly important for several applications including treatment planning for dental implants and evaluating dental and osseous diseases in the jaws and temporomandibular joints. However, CBCT provides a lower dose, lower cost alternative to conventional CT that promises to improve the practice of oral and maxillofacial radiology. In this case report the management of a patient with persistent suppurative osteomyelitis and its treatment assisted by Cone Beam Computed Tomography (CBCT) are presented.

Keywords: Chronic osteomyelitis, panoramic radiography, cone beam computed tomography.

INTRODUCTION

Osteomyelitis is an inflammatory condition of bone that involves the medullary cavity and has a tendency to progress along this space and involve the adjacent cortex, periosteum, and soft tissue.[1] It is more common in the mandible than the maxilla because of the dense, poorly-vascularised cortical plates and the single blood supply from the inferior alveolar neurovascular bundle.[2] Although in most of the cases, osteomyelitis of the jaws is attributed to a bacterial infection of odontogenic origin (pulpal or periodontal infection, extraction wounds, presence of foreign bodies or infected fractures), in some cases apparent etiological factor can not be identified.[3] This is usually initiated by inoculation of micro-organisms into the jawbones as a result of trauma or extraction of teeth.[2] Chronic osteomyelitis may show a suppurative course with abscess or fistula formation and sequestration at some stages and persists for a variable period up to many years with intermittent exacerbation.[4] Several reports have concluded that chronic suppurative osteomyelitis can be treated successfully by a combination of antimicrobial therapy with surgery, either sequestrectomy or decortication of the affected bone.[5-7]

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in osteomyelitis because of its reported lack of sensitivity in bone marrow disease.[6, 8] The Cone Beam Computed Tomography (CBCT) is used in dentistry to image high-contrast objects such as teeth and bone and it is particularly important for several applications including treatment planning for dental implants and evaluating dental and osseous diseases in the jaws and temporomandibular joints.[9] It was mentioned that CBCT offered a dose and cost effective alternative to conventional CT for the diagnostic evaluation of osseous abnormalities of orofacial bone structures.[10] CBCT also allows measuring angles and distances with real dimension and without superimposition or distortion.

CASE REPORT

A 25-year-old adult male was referred to the Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Ataturk University, with about 4 years history of discharging pus from a cutaneous sinus at submental region of the mandible. His past medical history revealed that he underwent reconstruction of anterior mandible because of gun shot injury by plastic surgeon 4 years ago. Painful swelling with discharging sinus occurred in the submental region after six months of reconstruction, which was treated by incision and drainage by the same plastic surgeon. Six months later, pus discharged again, his surgeon operated one more time; but lesion did not heal. Subsequently an attempt to treat the patient by administering various antibiotics for three years was carried out at different clinics.

There was no any systemic disease and no history of use of tobacco or alcohol. On examination, a discharging extraoral sinus was present located 2 cm below the lower border of the mandible symphysis (Figure 1). Paraesthesia of the lower lip and mental area was reported by the patient. On radiological investigation, the panoramic view showed radiolucent area around the screws and at the apex of left mandibular canine. Two screws were also observed on the inferior border of the anterior mandible. No sequestrum on panoramic radiography could be detected (Figure 2). The two screws placed in close proximity to the basis of the anterior mandible were unlikely to cause a cutaneous sinus at submental region of the mandible. Following the previous analysis it was decided to take CBCT images for any suspected sequestrum. The cone beam images performed with Newtom 3G (Quantitative Radiology, Verona, Italy) Flat Panel-based CBCT device. The scanner operated with a maximum output of 110 KV and 15 mAs, 0.16 mm voxel size and typical exposure time was 5.4 seconds. Panoramic, cross-sectional and 3D views were obtained on selected axial views using Newtom NNT software program (Quantitative Radiology, Verona, Italy) according to manufacturer's instructions.

Figure 1. Extraoral photograph showing the draining sinus and unaesthetic scarring.

Based on clinical and radiographic findings, the patient was diagnosed with a chronic infection caused by loose miniplate, devitalized left mandibular canine and a sequestrum in the lingual side of inferior border of anterior mandible

Figure 2. Panoramic view showing a long miniplate and radiolucent lesion around screws and left mandibular canine apex.

region. 3D CBCT imaging showed a sequestrum in the lingual side of inferior border of anterior mandible region (Figure 3). A pre-operative antibiotic course for 2 weeks, plate and screw removal, extraction of left mandibular canine, sequestrectomy and fistulectomy were planned. Under general anesthesia, intra-oral incision was placed on the alveolar crest between the mental foramens. Plate removal and left mandibular canine extraction was performed and all granulation tissues around the screws and the apex of left mandibular canine were removed. Then extraorally, sequestrectomy and fistulectomy was performed by submental approach. Two extra screws were seen on the sequestrum (Figures 4 and 5). Post-operative antibiotics (amoxicillin + clavulanic acid, 1000 mgr, twice a day) were continued for 2 weeks. The patient remained symptoms-free at follow up appoitments (Figure 6).

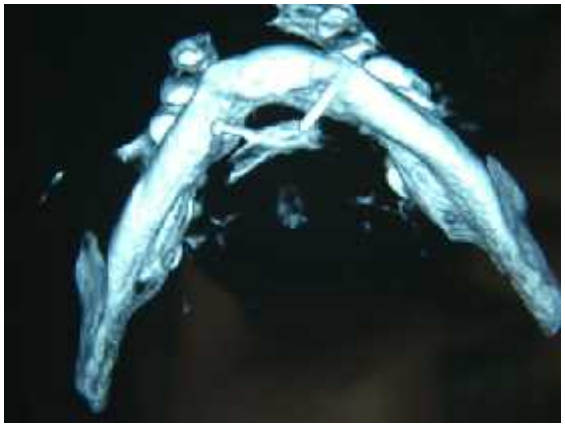

Figure 3. CBCT imaging of sequestrum.

Figure 4. Intra operative photograph of sequestrum.

DISCUSSION

The primary cause of the chronic osteomyelitis is usually bacterial and results from an odontogenic infection, post-extraction complications, inadequate removal of necrotic bone, early termination

of antibiotic therapy, inappropriate selection of antibiotics, diagnostic failure,

Figure 5. Excised sequestrum and titanium screw.

Figure 6. Postoperative six months control.

trauma, inadequate treatment for fracture or irradiation to the mandible.[11] Chronic osteomyelitis of the jaws usually requires both medical and surgical treatments, although occasionally antibiotic therapy alone is successful.[5, 12] Sequestrectomy as an adjunct to medical treatment should be considered as a treatment for such cases.

The patient discussed in this article initially received treatment consisting of conventional therapeutic methods such as antibiotics and analgesics after the initial complaints of symptoms during the previous 4 years. However no resolutive effect could be observed.

Radiologic examination is essential for evaluating the sequel of osteomyelitis. Although plain radiographs are useful in the initial evaluation of suspected cases, CT is an excellent tool for detecting osseous lesions radiographically. However, CBCT provides a lower dose, lower cost alternative to conventional CT that promises to improve the practice of oral and maxillofacial radiology.[13]

Additionally, there are two styles of CBCT scanners available, which differ in their volume capacity: large volume CBCT scanners that can record the entire maxillofacial skeleton or a section of the whole dental arch and limited-volume CBCT scanners that may record small areas corresponding to 3–5 teeth depending on the region being scanned. It has been claimed that large-volume CBCT scanners produce grainier images compared with small-volume CBCT scanners not only because of increased noise from scattered radiation but also because of intrinsic limitation to avoid long reconstruction time.[14] Total radiation dose can be reduced by using small-volume CBCT in cases of jaw osteomyelitis.

Current CBCT machinery (both large and small volume devices) has the ability to image a patient by making a 360° revolution or less around the object. Brown et al.[15] found that reducing the number of projections for 3D reconstruction did not lead to reduced dimensional accuracy and could potentially provide reduced patient radiation exposure. A recent paper found that there was no difference in the diagnostic yield of CBCT images for assessing periapical lesions when the arc of rotation of the CBCT scanner was reduced from 360° to 180°, thus halving the number of projection images and therefore reducing the radiation exposure to the patient.[16]

The panoramic radiography has been the elective imaging approach for most dental and maxillofacial surgery practices. However, it creates only flat, two dimensional, supero-inferior or postero-anterior images and it suffers from superimposition of all the surrounding structures that lie in the path between the x-ray source and the film and the detector. CBCT allows these anatomic entities to be viewed in three dimensions without

distortion and magnification.[17] And it also creates images that are both dimensionally faithful and anatomically accurate.

Bone density has to be reduced by 30-50% to be visible in plain radiography and this usually takes 2-3 weeks in acute osteomyelitis. CBCT depicts the osteogenic and better demonstrates cortical lysis, sequester and periosteal new bone formation. In secondary to chronic osteomyelitis, sequestrum occurs in approximately 90% of cases and is depicted better by CT and CBCT.[18]

In conclusion, two dimensional plain radiography techniques may be misleading for accurate diagnosis of maxillofacial bone lesions. CBCT shows a promising potential to replace conventional radiography to foster a more accurate diagnosis of maxillofacial bone lesions. In this case, improper diagnosis and treatment plan resulted in the relapses of the treatments and in the recurrence of lesion with unaesthetic scars in a young adult. After careful consideration of clinical presentation and the history of the course of the disease with recurrent treatment failures, our emphasis was given to the source of infection, which was successfully treated by surgery and antibiotic course.

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