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CASE REPORT

Assessment of Healing of a Large Radicular Cyst using Cone Beam Computed Tomography: Two Years Follow-up

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ABSTRACT

Surgical enucleation of a radicular cyst is a common treatment in endodontics but the pretreatment planning and assessment of the post-treatment healing in the cystic cavity is of utmost importance. The advantage of cone beam computed tomography (CBCT) in endodontics is that it demonstrates anatomic features in three dimensions that is not possible with intraoral periapical (IOPA) and panoramic radiographic images. In this case report, a CBCT was done to evaluate the size and extent of the radicular cyst in the maxillary anterior region and was enucleated. Apicoectomy was done and the hollow cavity was filled with platelet rich fibrin. A postoperative CBCT was done 2 years later to assess the healing. Specific situations, both pre- and postoperatively, where the understanding of spatial relationships afforded by CBCT facilitates diagnosis, influences treatment and assess healing.

Keywords: Cone beam computed tomography, Cone beam computed tomography periapical index score, Cyst healing, Digital follow-up, Mineral trioxide aggregate, Platelet rich fibrin, Radicular cyst.

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INTRODUCTION

The diagnosis and management of endodontic pathosis is reliant on radiography. However it has inherent limitations, such as the three-dimensional (3D) anatomy of the area that is radiographed is compressed into a two-dimensional (2D) image. It also has the disadvantage of magnification, distortion and superimposition. The introduction of maxillofacial cone beam computed tomography (CBCT) in 1996 provided the first clinically practical technology demonstrating application of 3D imaging for endodontic considerations.[1] Cone beam computed tomography uses a cone-shaped beam of radiation to acquire a volume in a single 360° rotation around the patient thus representing the patient's anatomy. The voxels are isotropic and enables the objects within the volume to be measured accurately.

Surgical enucleation of a radicular cyst is a common treatment in endodontics but the pretreatment planning and evaluation of the post-treatment healing and bone formation in the cystic cavity is of utmost importance. The advantage of CBCT in endodontics is that it demonstrates root canal and the periapical anatomy in 3D that is not possible with intraoral periapical (IOPA) and panoramic radiographic images. This case report emphasizes the role of CBCT in preoperative assessment of radicular cyst and 2 years postoperative follow-up and evaluation of bone healing.

CASE REPORT

A 54 years old male patient reported to the dental hospital with swelling in the right palatal area. This was associated with moderate pain on biting in the same area. On extraoral examination, there was no obvious swelling and intraoral examination revealed a well defined swelling in the right side of the anterior hard palate which was firm in consistency, non mobile, 3 cm wide anteroposteriorly and 2 cm wide mediodistally, not crossing the midline. Teeth 12 and 13 showed nonvital response to the pulp sensibility tests and were tender on percussion. Intraoral periapical X-ray showed large periapical radiolucency with sclerotic borders involving the apex of 11 and 12. Access opening of 12 and 13 was done under rubber dam isolation and pus was drained from the canal. However, a CBCT showed a clear picture of presence of a well defined radiolucency with well defined sclerotic border at the apex of 13 involving the apices of 12 and 14 measuring 19.76 × 19.74 mm in the largest dimension, extending superiorly up to the level of the middle meatus of the nasal cavity, eroding the right nasal floor, inferiorly

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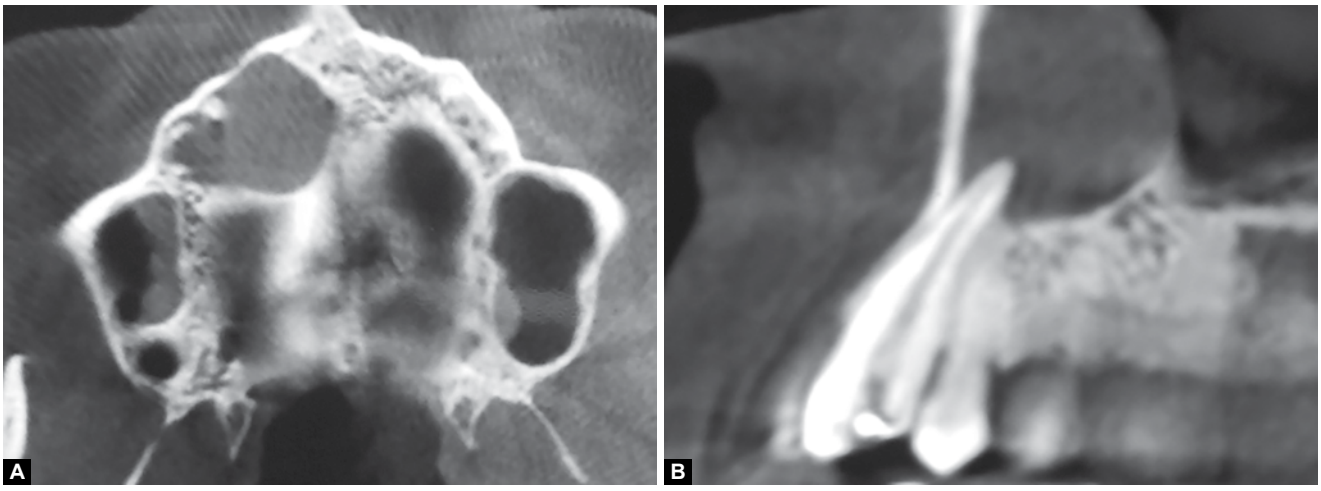


Figs 1A and B: (A) Preoperative CBCT scan image—axial view and (B) preoperative CBCT scan image—sagittal view

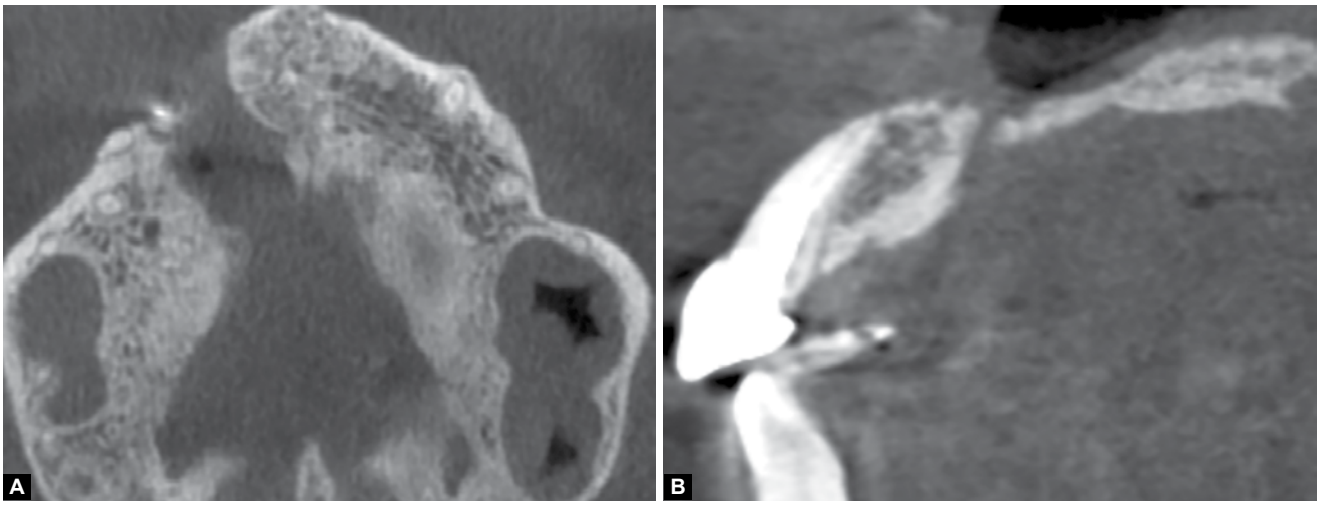
perforating the floor of the palatal vault (Figs 1A and B). The cone beam computed tomography periapical index (CBCTPAI) score of 5+D was given.[2]

A provisional diagnosis of pulpal necrosis with radicular cyst was done and the cyst was surgically enucleated. Apicoectomy was performed with 12, 13 and retro filling of MTA was done. The hollow cavity was filled with patient's own platelet rich fibrin (PRF) and the flap was sutured back. A 2 years postoperative CBCT revealed presence of ill-defined radiolucency with respect to 11 with 2 mm diameter. A CBCTPAI score of 2 was given[2] (Figs 2A and B).

The use of CBCT preoperatively helped to assess the extent of the cyst and plan the surgery better than as with the conventional radiographs. Cone beam computed tomography's 3D imaging helps in visualizing anatomical relationship of the roots and root apices to surrounding anatomical structures in any plane. In addition, the thickness of the cortical plate, the cancellous bone pattern, fenestrations, the shape of the maxilla and mandible as well as the inclination of the roots of teeth planned for periapical surgery should be able to be determined before starting surgery.[3] Mineral trioxide aggregate (MTA) was used as a root end filling material because it has shown 89% clinical success with a follow-up time ranging from 4 to 72 months.[4]

Platelet rich fibrin was used as a gingival tissue regeneration membrane as it can be used to promote wound healing, bone regeneration, graft stabilization, wound sealing and hemostasis.[5] The fibrin matrix of PRF is better organized and is able to more efficiently direct stem cell migration and the healing.[6]

The CBCTPAI scores are calculated by analysis of the lesion in 3D, with CT slices being obtained in mesiodistal, buccopalatal and diagonal directions. The measurement of lesion depth contributes significantly to the diagnosis and consequently to improve case prognosis. The addition of the variables expansion of cortical bone and destruction of cortical bone to CBCTPAI scoring system permits the analysis of two possible sequels to



Figs 2A and B: (A) Postoperative CBCT scan image—axial view reveals decrease in the size of cyst to 2 mm and (B) postoperative CBCT scan image—sagittal view reveals the formation of cortical plate of palatal

apical periodontitis that might be missed by periapical radiography.[7] In the present case report, a CBCTPAI score of 5+D was given which was because of the large size of 19 mm and perforation of the palatal cortical plate.[2] Two years postoperative CBCT evaluation scored a CBCTPAI score of 2 suggestive of a healing site. This is in accordance to a case report of nonsurgical endodontic treatment of a radicular cyst where the pretreatment CBCTPAI score was 5+E+D and 10 months post-treatment CBCTPAI was 4.[8] The reason for persistence of the radiolucency can be attributed either to the ongoing healing process or to the periapical tissue scar. In a study, it was seen that on average, the periapical bone defect measured on periapical radiographs was approximately 10% smaller than on coronally sectioned CBCT images 1 week postoperatively. More remaining defects were detected 1 year after periapical surgery on CBCT images than on periapical radiographs, however they are uncertain how this information is related to success or failure after root end resection.[8]

In a similar case report, a 2-year follow-up radiograph revealed changes, such as the increase in density of the lesion and trabecular regeneration which confirmed healing.[9] However the success of root canal treatment followed by apicoectomy is better assessed and compared by a CBCT rather than conventional radiographs. Intraoral radiography is based on the transmission, attenuation, and recording of X-rays on an analog film or digital receptor, and requires optimized geometric configuration of the X-ray generator, tooth, and sensor to provide an accurate projection of the tooth. The image produced is a 2D representation of a 3D object. If any component of the imaging chain process is compromised, the resulting image may demonstrate exposure or geometric errors and be suboptimal.[10]

When using appropriate tomographic techniques it is possible to look at each root separately. Slice angles can be chosen so that the frontal and sagittal slices, respectively, become parallel with the longitudinal axis of the root and, therefore, the axial slices perpendicular to it. These factors make high-quality tomographic techniques superior over conventional radiography in endodontics.[11] Cone beam computed tomography should not be done unless it is necessary and do more good than harm. Once done, the whole image dataset should be assessed completely to maximize the resultant clinical data.[12] However, the limitations of CBCT apart from the cost and increase in radiation exposure includes beam scattering due to dental fillings, root canal fillings, posts and dental implants, which often show dark bands and cupping artifacts.[13] Cone beam computed tomography typically is not calibrated to conform Hounsfield units to measure bone density and are not suitable for soft tissue assessment.[14]

CONCLUSION

Although conventional intraoral radiography provides clinicians with cost-effective, high-resolution imaging and continues to be the front-line method for dental imaging, CBCT is a very useful imaging modality and technology in comprehensive endodontic evaluation. There are, however, specific situations, both pre- and postoperatively, where the understanding of spatial relationships afforded by CBCT facilitates diagnosis and influences treatment. More clinical trials are necessary to evaluate long-term assessment of periradicular healing.

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