

CASE REPORT

The use of cone beam computed tomography in the management of displaced roots into the maxillary antrum

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Abstract

Displacement of roots into the maxillary antrum is an intraoperative complication during extraction of upper molar teeth. A combination of panoramic, intraoral and occipitontental radiography is normally considered the imaging method of choice in assessing the position of the displaced roots. We describe the use of cone beam computed tomography (CBCT) in the management of displaced roots in the antrum. CBCT aids in localising displaced roots and informs surgical access.

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Case reports**Case 1**

A 48-year-old male was referred by his dentist to the exam and emergency department at the dental hospital regarding displaced roots within the left maxillary antrum, following an attempted extraction of the upper left first molar tooth. He complained of pain over the left cheek and a feeling of 'air running through' into his left antrum. On examination, it was hard to visualise an oroantral communication (OAC). A sectional panoramic radiograph showed the likely presence of two displaced roots within the left maxillary antrum (Fig. 1). No further conventional images were obtained. Instead, a cone beam computed tomography (CBCT) of the maxilla was carried out using the Classic i-CAT CBCT unit (Imaging Sciences International, Hatfield, PA, USA) with the following scanning parameters: 6 cm height, 20 s scan time, 120 kV, reconstructed on a 0.4 mm voxel. This confirmed that the roots were in the antrum and localised their exact

position (Fig. 2A and B). The roots were removed under local anaesthetic via a Caldwell-Luc procedure, and the patient made an unremarkable recovery. On follow-up, healing was excellent, and the patient was subsequently discharged.

Case 2

A 24-year-old female had all four third molars removed under general anaesthesia. During this procedure, the curved root of her upper left wisdom tooth fractured and was displaced superiorly into the maxillary antrum. A panoramic radiograph showed a radiopacity superimposed on the zygomatic buttress consistent with the missing root (Fig. 3). Subsequently, a CBCT examination was performed using an 8 cm height volume to localise the root. The scan demonstrated the root within the inferior-posterior aspect of the antrum. The scan also showed opacification of the base of the antrum, which was likely due to blood. Arrangements were then made to remove the root under general anaesthesia. (Fig. 4A and B). Post-operative healing



Figure 1 Cropped panoramic radiograph showing the presence of two roots within the left maxillary antrum.



Figure 3 Cropped panoramic radiograph showing the upper left third molar root superimposed on the zygomatic buttress.

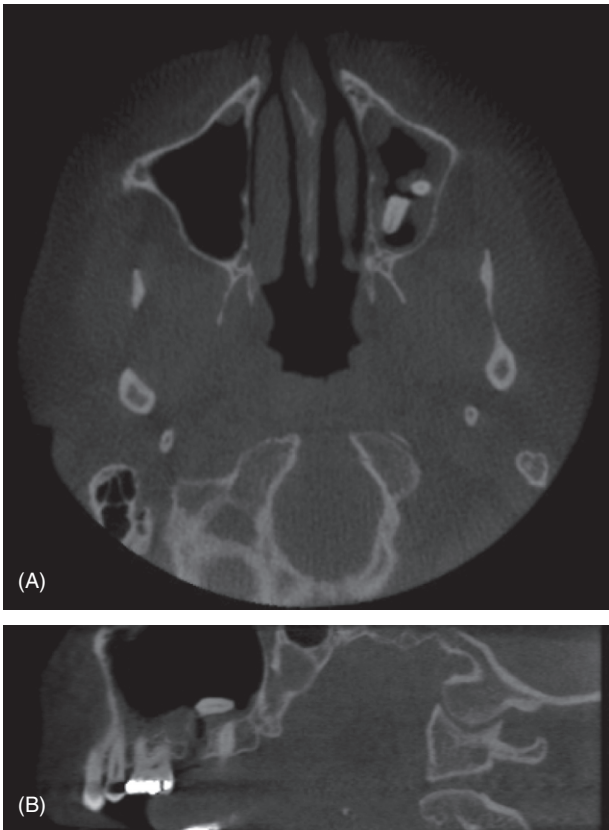


Figure 2 (A) Axial and (B) sagittal cone beam computed tomography images showing the loss of the corticated floor of the maxillary antrum in the left first molar region and the exact position of the two roots within the left maxillary antrum.

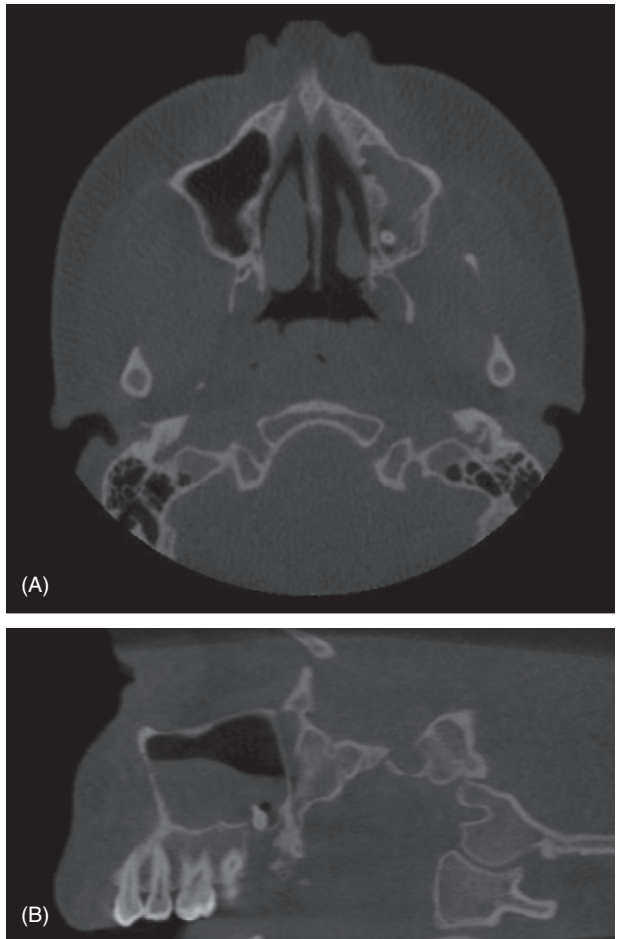


Figure 4 (A) Axial and (B) sagittal cone beam computed tomography images showing the exact position of the displaced root and the loss of the corticated floor of the maxillary antrum.

was good, and the patient was discharged 6 weeks following the procedure with no further follow-up.

Discussion

OAC most commonly occurs following displacement of a fractured root into the antrum or simply after extraction of an upper posterior tooth. If the communication is left untreated it may heal spontaneously. Alternatively it may epithelialise and persist as an oroantral fistula, and give rise to symptoms including recurrent sinusitis, and reflux of fluids and food into the nose from the mouth¹. When a part or the entire tooth is pushed into the maxillary antrum, the operator should arrange for its removal. Radiographic confirmation of root position is essential. Most commonly used radiographs for demonstrating a root in the antrum include periapical radiographs, oblique occlusal views, and panoramic radiographs². Occipitomental radiographs may also be used to aid localisation. Visualisation of roots in the inferior part of the antrum can be difficult on occipitomental radiographs due to superimposition of the petrous temporal bone. Blood or fluid within the antrum may also obscure any roots that might be present. Panoramic radiographs will only show roots if they lie within the focal trough. Even if traditional radiographic techniques demonstrate the presence of the root(s), localisation can still prove difficult. This was the reason why we felt that CBCT was required in these cases. The first case was referred into the hospital, and although two roots were visible on plain films, it was possible that there were further root or bone fragments present. CBCT confirmed the number of root fragments present and confirmed that they were within the antrum. CBCT was carried out in the second case to confirm that the root had definitely been displaced into the antrum, and to localise its exact position. Three-dimensional imaging techniques, as used here, increased the confidence of the surgeon and ensured that the appropriate treatment was carried out, although it is accepted that in these particular cases, CBCT probably did not alter the overall management.

The effective dose from an occipitomental radiograph is 22 μSv , a panoramic radiograph 20 μSv and a periapical radiograph in the region of 5 μSv ³. CBCT is the ideal imaging modality in that it is low dose and high resolution^{4,5}. The effective dose from a 6 cm height scan of the maxilla is 36.5 μSv ⁴. The dose for the 8 cm height scan is likely to be in the region of 50 μSv , which is similar to that of the complete series of conventional radiographs. Conventional CT has the disadvantages

of a relatively high radiation dose in comparison with CBCT and high cost.

It is also possible on many CBCT units to adjust the exposure factors and reconstruction voxel size. When trying to identify roots in the antrum, lower exposure factors and a larger voxel size can be used to further reduce the radiation dose. The CBCT unit used in these cases is a 'large-volume' scanner. If a 'small-volume' scanner was used, the radiation field can be collimated down to include just one antrum, reducing the effective dose even further.

The limitations of CBCT are that it provides low-contrast resolution and that it is therefore difficult to distinguish the various soft tissues from one another. However, this did not affect the management of either patient, as the root is high contrast and so could be visualised easily within the antrum.

Guidelines have been produced regarding the use of CBCT, but these have not addressed the use of the modality in imaging antral conditions⁶. Even though CBCT is lower dose than the conventional CT, each examination must be fully justified and should only be used when plain radiographic techniques are unlikely to supply the required information⁷. We suggest that CBCT should be reserved for those cases where plain film imaging is equivocal for the presence of roots within the antrum. However, the threshold to use small-volume scanning is lower and may be the initial imaging modality of choice where the radiation dose is lower than traditional radiographic techniques. CBCT has not been previously described in the management of displaced roots into the maxillary antrum, and the authors feel that CBCT may become a valuable tool in the management of these patients; however, further research is required to find out whether CBCT makes a difference to patient outcome.

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