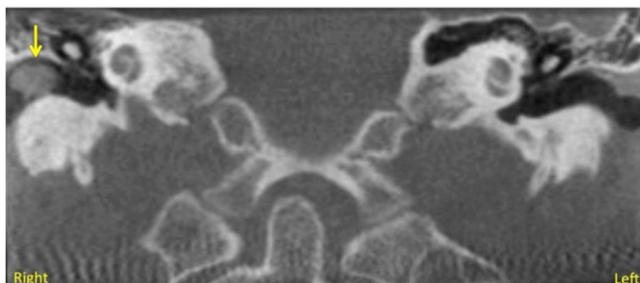


Incidental Findings From Cone-Beam Computed Tomography During Implant Therapy

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Introduction: This report reviews relevant literature on foreign bodies identified with cone-beam computed tomography (CBCT) and documents a rare case of a foreign body that was serendipitously identified during routine implant treatment planning.

Case Presentation: The literature shows a frequent occurrence of incidental findings with CBCT. This case documents incidental findings in the maxillary sinus and external auditory canal that were identified during routine CBCT used for implant treatment planning. The finding in the maxillary sinus was diagnosed as a mucous retention pseudocyst that did not require treatment. The finding in the external auditory canal was diagnosed as a foreign body (remnant of a cotton swab). Removal of the foreign body was prompted because of its presumed association with chronic headaches that were unresolved. Removal of the foreign body alleviated the chronic headaches, and implant placement proceeded uneventfully.

Conclusions: This review and case underscore the importance of a thorough review of the entire tomographic image volume. Using advanced technology for treatment creates new responsibilities and places more liability on providers not to overlook findings that may be significant to the patient's health. *Clin Adv Periodontics* 2016;6:94-98.

Key Words: Cone-beam computed tomography; dental implants; ear canal; foreign bodies; incidental findings; maxillary sinus.

Background

Recent advancements in radiography and imaging include the use of cone-beam computed tomography (CBCT) in dentistry.¹ With the introduction of inexpensive x-ray tubes, high-quality detection systems, and powerful personal computers, CBCT machines have found their way into dental practices.² A systematic review of this topic supports the use of this advanced imaging modality and recommends interpretation of the entire image volume for possible incidental findings.³

Incidental findings are common during thorough evaluations of radiographs and can range from variations of normal anatomy to pathology.⁴ Failure to identify these findings can cause medical complications for the patient and medicolegal issues for the provider.⁵ A study found that 943 of 1,000 CBCT scans contained unusual findings inside or outside the primary area of focus.⁶ This evidence

underscores the importance of having a radiologist provide a comprehensive interpretation of a CBCT scan to ensure that incidental findings are not missed.⁶ Furthermore, a systematic review found that $\approx 24.6\%$ to 93.4% of CBCT scans had some sort of incidental finding.⁴ Older populations have a higher probability of presenting with, for example, carotid artery or ligament calcifications.⁶ Although incidental findings of foreign objects are more common in young children, they are not limited to specific age groups.⁷

A review of the literature revealed two case reports of unusual foreign bodies.^{8,9} One case involved a CT scan that was used for tumor staging and the scan incidentally revealed a foreign body, later identified as an air gun shot sustained 50 years earlier.⁸ Another case involved a CT scan used to explore retromolar pain and the scan revealed two metal nails that accidentally slipped through an open socket after loss of a primary tooth. The patient was a shoemaker, and it was customary to hold nails between their teeth while working.⁹

A 5-year retrospective study reviewed cases of foreign bodies inserted in the ear, nose, and throat.⁷ Of 594 cases analyzed, 59.9% were of foreign bodies in the ear. Foreign bodies in young children were common, but 31.9% of patients were older than 15 years. Foreign bodies in adults

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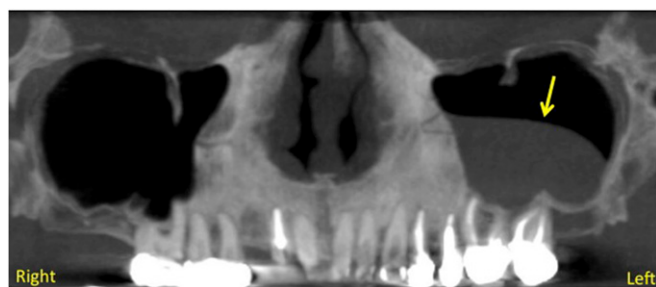


FIGURE 1 CBCT reconstructed panoramic view showing the mucous retention pseudocyst (arrow).

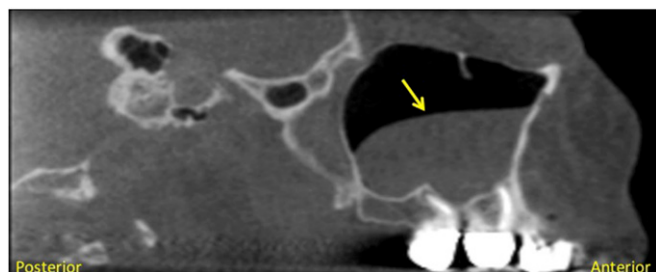


FIGURE 2 CBCT slice in the sagittal plane of the left maxillary sinus showing the mucous retention pseudocyst (arrow).

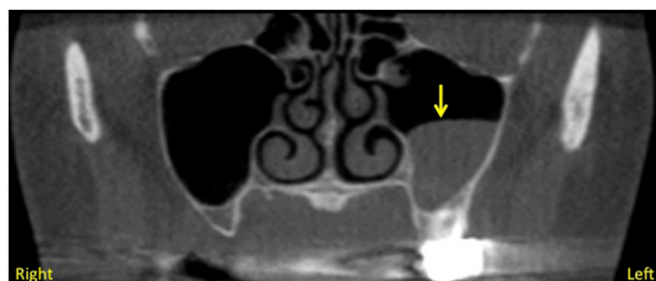


FIGURE 3 CBCT slice in the coronal plane showing the mucous retention pseudocyst (arrow).

were predominantly cotton buds that were used for ear cleaning. Of the patients that presented with foreign objects in the ear, 56% were asymptomatic.⁷

Clinical Presentation

Dental practitioners are using CBCT technology for numerous applications, including evaluation of pathology in the jaw, evaluation of bone for implants, and for orthodontic, endodontic, and temporomandibular joint assessments.² In the case being discussed, a CBCT scan was taken for evaluation of implant placement in a 51-year-old female who presented to the University of Michigan School of Dentistry (Ann Arbor, Michigan) in the winter of 2010. The patient's health history was not significant for systemic disease. She did experience seasonal allergies and severe headaches that recurred monthly. The patient was taking oral contraceptives and "lots of over-the-counter pain relievers for migraines."

Case Management

During treatment planning, the maxillary right canine (tooth #6) was found to have large caries lesions. The



FIGURE 4 CBCT slice in the axial plane showing the mucous retention pseudocyst in the left maxillary sinus (arrow).

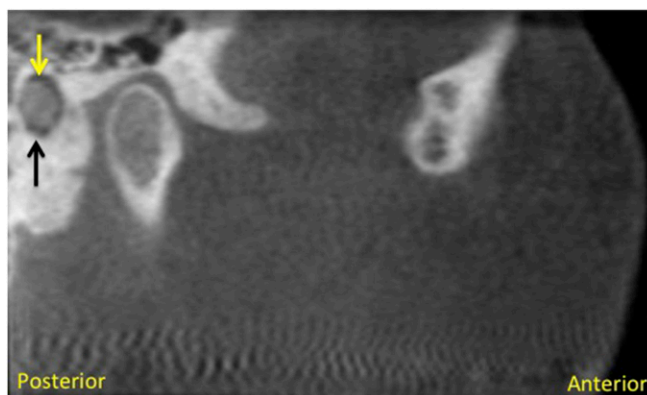


FIGURE 5 CBCT slice in the sagittal plane showing the foreign body (yellow arrow) in the right external auditory canal (black arrow).

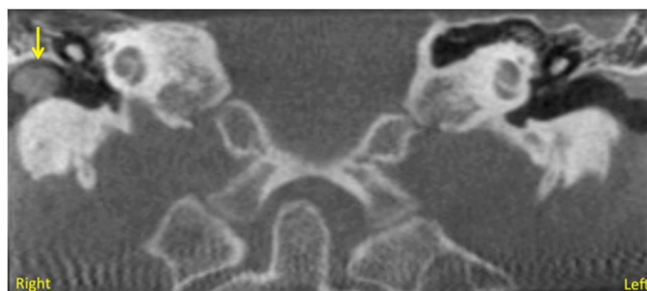


FIGURE 6 CBCT slice in the coronal plane showing foreign body in the right external auditory canal (arrow).

patient was given possible treatment options and informed written consent for an implant to restore tooth #6 was obtained. At the time of extraction, an allograft consisting of cortical and cancellous bone particles was used with a resorbable collagen membrane to preserve bone volume. Six

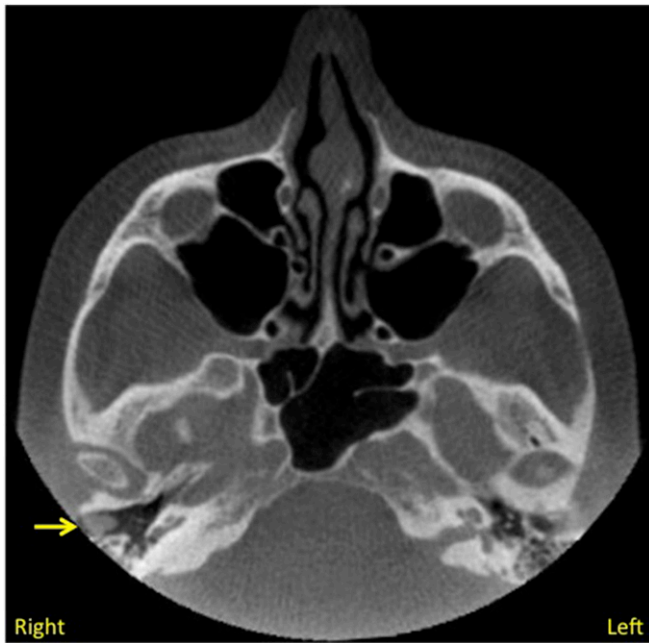


FIGURE 7 CBCT slice in the axial plane showing foreign body in the right external auditory canal (arrow).

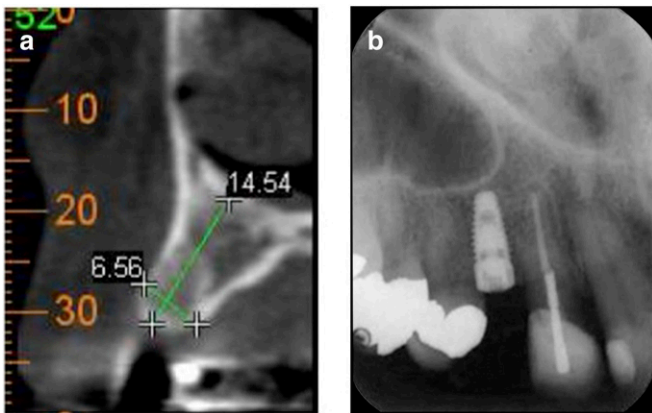


FIGURE 8a CBCT cross-section of proposed implant site. **8b** Periapical radiograph after implant placement.

months after extraction and site preservation, the patient presented for evaluation of the area. A periapical radiograph and clinical examination revealed questionable bone volume in the region of interest. The patient was referred for a CBCT scan at the University of Michigan. The CBCT scan was reviewed by an oral and maxillofacial radiologist (EB) for a more detailed evaluation of bone dimensions and the full-image volume.

Review of the CBCT scan confirmed sufficient bone volume for implant placement. The CBCT report noted a large

mucous retention pseudocyst in the left maxillary sinus (Figs. 1 through 4) along with a “soft tissue lesion or foreign body” within the right external auditory canal (Figs. 5 through 7). The patient was given copies of the report and scan and was advised to see a physician due to symptoms including chronic migraine headaches and allergies. The pseudocyst was suspected to be non-pathogenic, requiring no treatment, and the soft tissue lesion or foreign body was distant from the site of implant placement. Therefore, an implant was placed shortly after the CBCT report.

Clinical Outcomes

The patient was seen approximately 6 weeks after implant placement (Fig. 8) and, in the meantime, was able to see a physician for the incidental findings noted in the CBCT report. The patient confirmed that the cyst-like lesion in the left maxillary sinus did not require treatment, whereas the finding in the right external auditory canal was deemed a foreign body. The foreign body was removed and determined to be the end of a cotton swab covered in cerumen (ear wax). The patient conveyed that her migraines, which included symptoms of vertigo and dizziness, were subsiding. The patient was unable to recall when the end of the cotton swab was unintentionally lodged in the external auditory canal.

Discussion

Advanced technology that is now available to dental practitioners brings along new possibilities but also additional responsibilities. It is the duty of the requesting provider to thoroughly review the entire volume of any radiographic image, not just the primary area of interest.³ It has been recommended to limit the field of view when possible because the patient is exposed to less radiation and the originally planned treatment can still be successfully completed.¹⁰ This is not always feasible because there are many CBCT machines with varying settings. One systematic review recommended that “practitioners adopt CBCT equipment-specific protocols to incorporate the imaging goal for the patient’s specific presenting circumstances.”^{9,10} Also, reduction of the field of view decreases the volume that needs to be reviewed, thus decreasing the medicolegal responsibility of the provider. Even with a limited field of view, analyzing the entire image volume is crucial. In the present case, if the patient did not have a CBCT scan for implant treatment planning, her migraines and symptoms would have continued without a known cause. A patient’s overall health should be a practitioner’s main goal, and, whenever possible, steps should be taken to fulfill that goal. ■

Summary

Why is this case new information?

- Given the high rate of incidental findings on CBCT images, this report reviews relevant literature, provides practitioners with examples of common CBCT incidental findings, and presents a rare case of a foreign body identified during routine imaging for implant planning.

What are the keys to successful management of this case?

- Clinically, it is important for practitioners to conduct a comprehensive review of their CBCT images, and of the entire image volume, due to the high rate of incidental findings.
- Incidental findings should be correlated with any presenting symptoms.

What are the primary limitations to success in this case?

- Failing to adequately review CBCT images and acknowledge incidental findings compromises patient care and places more liability on practitioners.
- Using advanced technology for treatment creates new responsibilities for providers.
- Incidental findings should not be overlooked.

Acknowledgment

The authors report no conflicts of interest related to this case report.

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