Reporting Findings in the Cone Beam Computed Tomography Volume

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KEYWORDS

- Cone beam computed tomography • CBCT • Diagnostic • Reporting • Liability
- Interpretation

KEY POINTS

- It is the responsibility of health care providers to acquire information data from patients to best determine the health status of patients and if treatment is indicated and to provide a basis for informed patient consent.
- The use of CBCT for dental treatment planning poses a situation in which the additional data in the acquired image volume that are outside of the scope of the primary dental concern could detect systemic conditions that possibly have a direct influence on the overall health and longevity of a patient.
- Patients can make informed decisions about their health or dental care and treatment. The CBCT report becomes a component of the informed consent standard of care.
- Who provides the report may not be as important as whether or not a report is actually performed.
- The quality, accuracy, and use of a report are subject to medicolegal scrutiny, and knowledge of such issues determine whether or not a primary provider or a secondary radiology reader evaluates the image data and issues the final report.

INTRODUCTION

As in any disruptive technology introduced to a profession, the education lags far behind the technological advance. This is especially true of cone beam imaging. Dentists and dental professionals are quick to grasp the advantages and applications of using cone beam technology but, once adopted, often make the following statements:

These images are great, but what am I looking at? and

Where can I get more information on interpreting the scan?

Unfortunately, there is no easy answer and no quick way for dentists to re-educate themselves. Understanding CBCT takes time and effort and even some guidance.

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Dent Clin N Am 58 (2014) 687–709
http://dx.doi.org/10.1016/j.cden.2014.04.006 dental.theclinics.com

Manufacturers, also quick to understand the popularity of this technology, often fail to provide even the basic education that is necessary so that clinicians do not inadvertently cause harm to patients. Reporting the findings in a CBCT volume is probably the most essential process in the total diagnostic evaluation of a patient, even if it is something as simple as implant planning. Dentists and dental specialists must not be caught in the trap of only looking at the data they are interested in, such as an impacted tooth or implant site evaluation or characterization of some pathologic entity that they found in another radiograph. They must examine all the data in the scan and must do so in a systematic and somewhat regimented fashion.

This article is designed to help clinicians understand the process and expose them to the methodology the authors use and a software tool the authors developed to help dentists completely examine and report all findings in a scan and take the appropriate next steps when the findings dictate additional action, such as referral to a dental specialist or a colleague in the medical profession. This methodical, diagnostic approach is for precise communication with the referring clientele. When the authors examine and report findings in a 3-D scan, they are looking for occult pathology, that is, anything that might have an impact on a patient's health that the dentist needs to know about and sometimes takes action on.[1,2] The authors cannot afford to miss an important finding or fail to communicate these findings to referring clinicians. For those individuals to examine their own data, this is also true. No clinician would be in trouble for misdiagnosing a condition or problem, but that same clinician is definitely placing himself or herself at risk for not examining the volume for these occult findings. The authors support each of the areas of discussion with cases from their files to illustrate the common and not so common findings discovered in cone beam scans and know this will be helpful to all dentists.

SYSTEMATIC REVIEW OF IMAGE DATABASE

A. Confounds: axial sections, smaller field-of-view (FOV) confusion, and anatomy outside the dentists' comfort zone
B. Suggested method of review

Confounds—Some of the Obstacles to Overcome When Examining the Volume

Most dentists carefully and systematically examine bitewings for interproximal carious lesions; periapical radiographs for signs of bone loss or apical problems; or panoramic images for dental, temporomandibular joint (TMJ), and sinus problems. Through training and clinical experience, they develop their own approaches for a systematic review of the radiographic images. All these images that they were taught to look at, however, are oriented in a sagittal anatomic plane of section. That is, all these images of a patient are looked at from the side. Cone beam data sets significantly alter this paradigm. The coronal and axial anatomic planes of section can also be viewed. Although the coronal plane is understandable, the axial plane of section is a significant departure from the dental paradigm. **Fig. 1** demonstrates a finding in the 3 planes of section.

In addition to the confound of these new planes of orientation, dentists were also informed by the manufacturers that a smaller FOV represented less diagnostic responsibility. Unfortunately, although this is true in most cases, an axial image from a limited field cone beam machine, such as the unilateral capture of the TMJ condyle, when seen in a axial orientation, is confusing. **Fig. 2** illustrates this point.

Another obstacle dentists must overcome is educating themselves to look beyond the dental bases to anatomic regions with which they are less familiar. These include

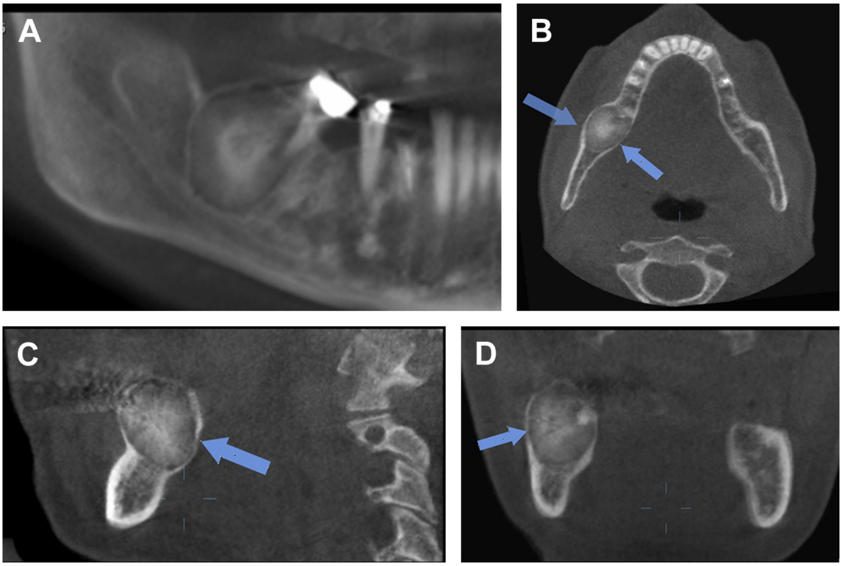


Fig. 1. (*A*) Right side of panoramic-type view showing large, well-defined periapical lesion attached to distal root of tooth #31. The lesion is somewhat ball-shaped and has a radiolucent rim. It has displaced tooth #31. It was diagnosed as a cementoblastoma. There is no suggestion of the expansile nature of this lesion. (*B*) CBCT axial view revealing expansile nature of lesion *NOT* appreciated on the panoramic image. (*C*) Thin-slice sagittal CBCT view suggesting expansion. (*D*) Thin-slice coronal CBCT view confirming the expansion seen in the axial view in (*B*). The blue arrows show the expansile features of the lesion in (*B*) and (*D*).

the cranial vault, the paranasal sinuses, the nasal cavity, the airway, and the cervical spine. Those dentists thinking that a smaller FOV relieves them of all this responsibility are wrong. Moving the area of capture with a small volume sometimes captures pathology in the anatomic areas listed previously. Figs. 3–5 illustrate this concept.

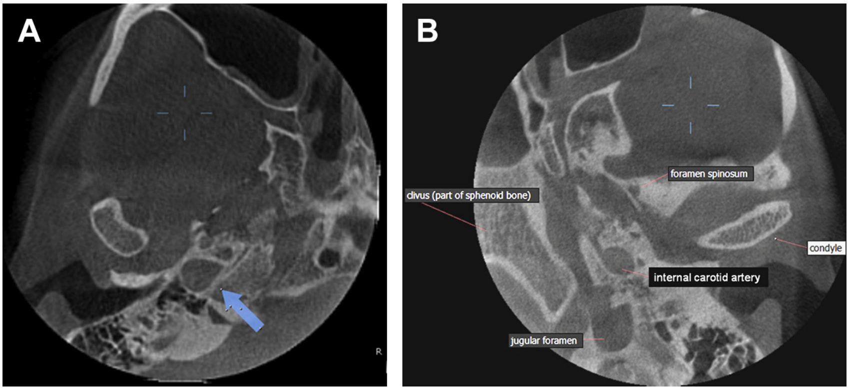


Fig. 2. (*A*) Axial slice, right condyle with small FOV. The blue arrow in (*A*) is the internal carotid artery. (*B*) Axial slice through left condyle with small FOV with anatomy labeled. ([*A*] *From* Miles DA. Color atlas of cone beam CT for dental applications. 2nd edition. Hanover Park (IL): Quintessence Publishing; 2013.)

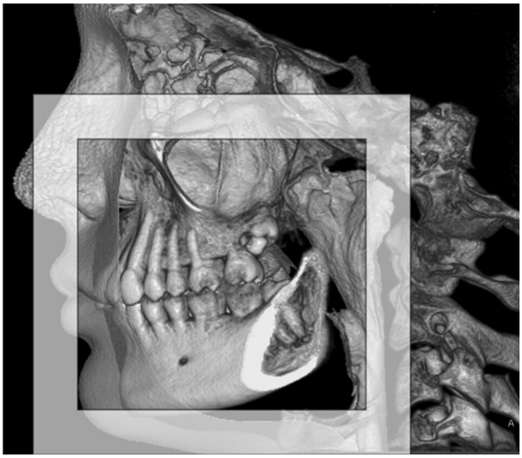


Fig. 3. Illustration of a small FOV volume (8 × 8 cm) capturing dental bases.

A Suggested Method for Scan Review

Even within the medical radiology community there continues debate between the utility of a structured radiology report versus a narrative report.[3] According to Dr Curtis P. Langlotz, Professor and Vice Chair for Informatics in the Department of Radiology at the University of Pennsylvania Health System, approximately 98% of medical radiology residents received no formal training in radiology reporting. Most, apparently (78%), learned the process from a fellow resident. Concerning a structured report, however, he was quoted in the online journal, *Diagnostic Imaging*:

> *the purpose of structured reporting is to communicate to colleagues in a clear way and to make that reported information accessible to the software applications that are meant to improve communication.*

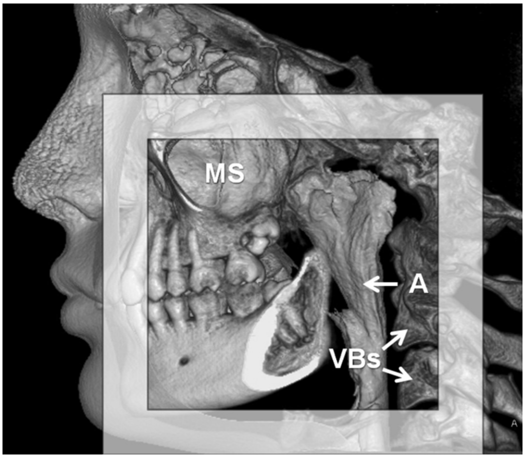


Fig. 4. Even when FOV is moved slightly posteriorly to capture third molar, the airway (A) and vertebral bodies (VBs) are now imaged and must be evaluated. The maxillary sinus (MS) is also in the FOV.

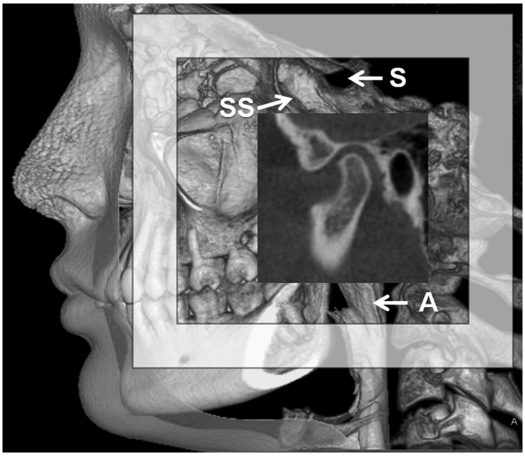


Fig. 5. When FOV is moved slightly posterior and superior to capture the condyle, the airway (A), sphenoid sinus (SS), and sella tursica (S) are imaged and must be evaluated.

It seems, then, that the adoption of a formal reporting system in the dental profession that helps dentists and dental specialists review their CBCT volumes competently is desirable. Recently, the authors, in combination with a large cone beam dental software company, released reporting software, called *EasyRiter*, in an attempt to fill this void. The model for the software was developed from their approach to provide structured, interpretive reports for their clinician/clients. So that they themselves ensure that they examine every portion of the volume, the following anatomic regions, when present, are always examined each time in the same fashion to determine abnormal conditions or occult pathology to report to their referring clients:

1. Paranasal sinuses
2. Nasal cavity
3. Airway
4. Cervical structures
5. TMJs
6. Dental findings
7. Other findings

From any abnormal findings discovered, clinical impressions, differential diagnoses, and medical recommendations are provided to a referring dentist supported by the images embedded in the report. In addition, when necessary, citations about the import conditions are included to help assist dentists with their referral to an appropriate medical specialist. A sample report appears in Appendix 1.

According to Wilcox, failure to communicate clearly and effectively to a referring health care provider is 1 of the 3 most common reasons for malpractice suits.[4] The authors agree with this. Wilcox further asserts that the report must be understandable to both the patient and referring clinician. Many of the authors' clients use the reports chairside to present these significant findings to a patient. Unlike medical radiology reports, embedding the pertinent images in the report allows a dentist to visually display to patients a significant finding. The authors think that the use of the formatted report allows clearly communicating the importance of the findings to the clinician, who then subsequently discusses these findings with patients. One example of such a report is in **Appendix 2**.

COMMON FINDINGS IN ANATOMIC REGIONS IN CBCT DATA SETS BY ANATOMIC REGION

Paranasal Sinuses

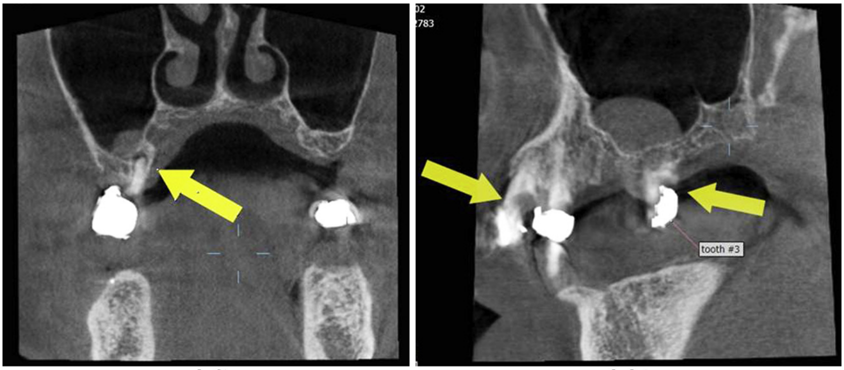
As reported in a previous article by Parks, the paranasal sinuses include the frontal, sphenoid bone, and maxillary sinuses as well as the ethmoid air cell complex. Most dentists are familiar with inflammatory changes that might occur in the maxillary sinuses. Common changes in the maxillary sinuses include mucosal thickening, mucus retention phenomenon (antral pseudocyst), and, although less common, the occasional antrolith. When the inflammatory changes seen in the maxillary sinus are extensive, often the other paranasal sinus spaces are involved. **Figs. 6–9** show examples of common changes.

It is important to consider the possibility of inflammatory change in the other paranasal spaces when significant portions of the maxillary antra are involved. In some cases, this may mean immediate referral to a primary care provider and/or an otolaryngologist for clinical and endoscopic evaluation of all the paranasal sinuses, even if only a portion of the maxillary antra is visualized in the limited FOV scan.

More rarely, sinus mucoceles (destructive inflammatory lesions, unlike those of the salivary gland type) can also develop in the paranasal sinus spaces; these occur much less frequently than the mucus retention phenomenon (antral pseudocyst) in the maxillary sinuses but when they occur are more commonly located in the frontal and sphenoid sinuses as well as the ethmoid air cell complex. **Fig. 10** shows an example of a mucocele.

The most common bony radiopacity occurring in any of the antral spaces, especially the frontal sinuses, the ethmoid air cell complex, and sphenoid sinuses, is the osteoma, sometimes called ivory osteoma. Examples are shown in **Fig. 11**.

Many other intrinsic and extrinsic lesions tumors and systemic disorders can affect the maxillary sinus and the other paranasal sinus regions. Complete discussion of these changes is beyond the scope of this article. Most of the radiographic change seen in the paranasal sinus spaces appears as a diffuse, homogeneous radiopacity, less dense than the surrounding bone. The following radiographic changes observed



left **right**

Fig. 6. (*Left*) An example of periapical mucositis—inflammatory change in the right maxillary sinus immediately adjacent to a dental problem, in this case, apical periodontitis. (*Right*) A dome-shaped radiopacity arising from the floor of the right maxillary sinus consistent with a mucus retention phenomenon (antral pseudocyst). Yellow arrows identify gross carious lesions.

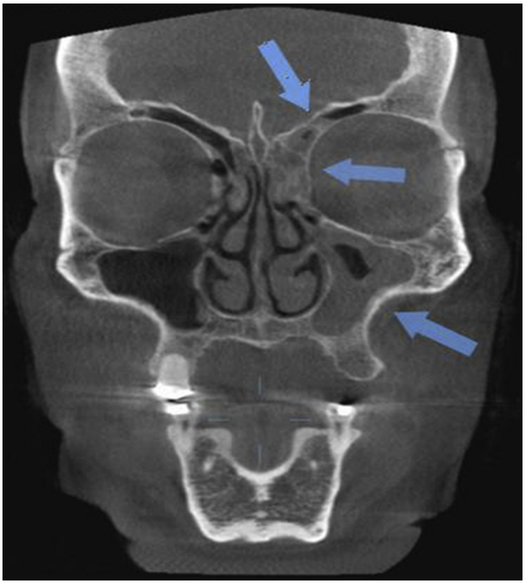


Fig. 7. Inflammatory change unilaterally in the left maxillary sinus, left ethmoid air cell complex, and left frontal sinus and ear region, called the *lateral recess*.

within any of the paranasal sinuses should, however, raise a clinician's index of suspicion and should prompt making an appropriate referral:

1. Expansion or displacement of the wall of the space (see Fig. 10)
2. Destruction of the bony wall of the space (Fig. 12)
3. Thickening (hyperostosis) of any wall surrounding the space (Fig. 13)
4. A pansinusitis (major portions of multiple spaces opacified) (Fig. 14)

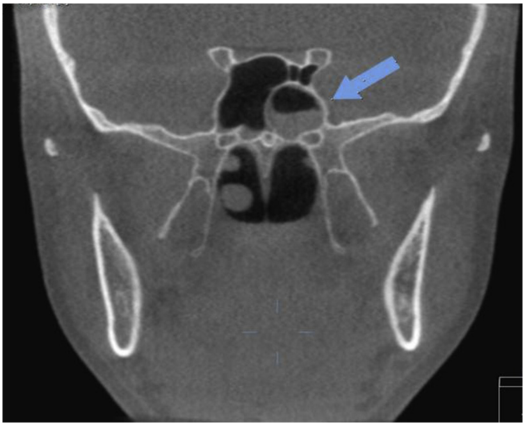


Fig. 8. Inflammatory change in the lower half of the left sphenoid sinus.

Fig. 9. The upper blue arrow identifies inflammatory change in the right frontal sinus. There is also change in the ethmoid air cell complex and both maxillary antra.

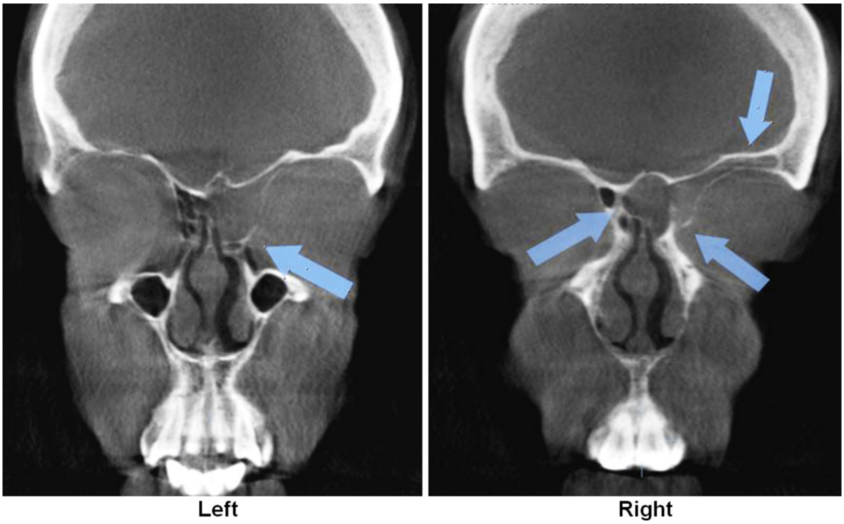
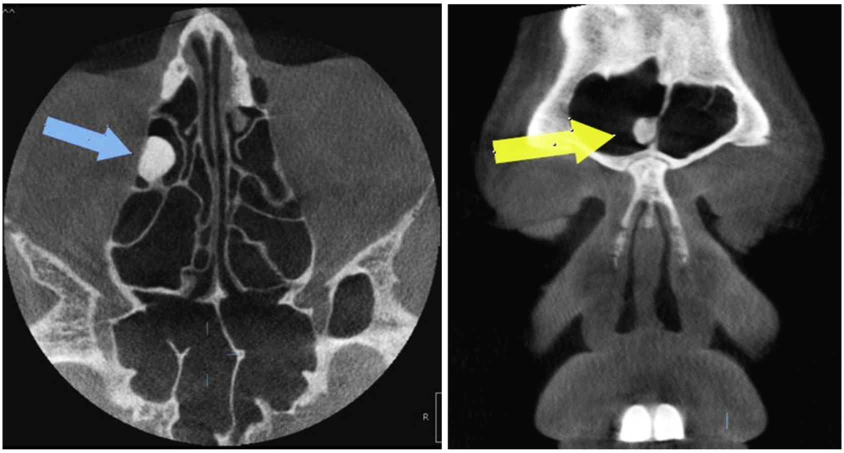


Fig. 10. (*Left*) All the left ethmoid air cell complex appears opacified. There seems to be a displacement of the medial wall of the left orbit by this suspected inflammatory change. Displacement of the orbital wall is not a good sign. (*Right*) A more anterior slice showing a rounded appearance, obliteration of the ethmoid air cells, and possible extension into the left frontal sinus (*upper blue arrow*). These changes raise suspicion for a more ominous lesion like a mucocele.



Left Right

Fig. 11. (*Left*) An osteoma in the right ethmoid air cell complex. (*Right*) An osteoma in the right frontal sinus.

Patients with the findings seen in the examples of the radiographic changes, listed previously, must all be referred to an otolaryngologist for clinical and endoscopic evaluation. Whether from inflammation or tumor, all these changes result in clinical symptoms for patients of pain; headache; referred pain; and, in many cases, classic signs of a sinus infection, such as rhinorrhea, nasal congestion with or without fever, and, in cases involving a pansinusitis or severe maxillary sinusitis, commonly tooth pain.

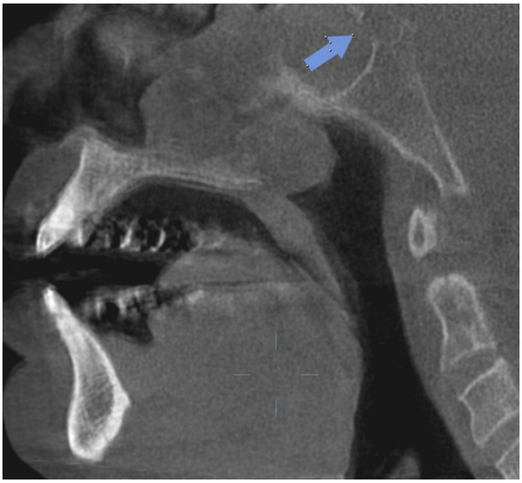


Fig. 12. A large lesion occupies the ethmoid air cells and back of the nasopharynx. The lesion also appears to occupy the sphenoid sinus and has caused a loss of bone adjacent to the sella turcica. This dehiscence is an ominous sign.

Fig. 13. (*Left*) There is significant inflammatory change in the sphenoid sinus. All the walls are grossly thickened. This is termed, *hyperostosis*. (*Right*) The changes seen in the sagittal view on the left are comparable in this coronal section especially along the inferior border of this sinus space.

Nasal Cavity

Common findings that dentists see in the nasal cavity include a deviated septum, enlarged or hypertrophic turbinates and/or the lining mucosa (often narrowing the adjacent meatal spaces), the anomaly called *concha bullosa* (see description elsewhere in this issue), and missing walls usually due to sinus surgery. Figs. 15 and 16 demonstrate some of these findings and anomalies.

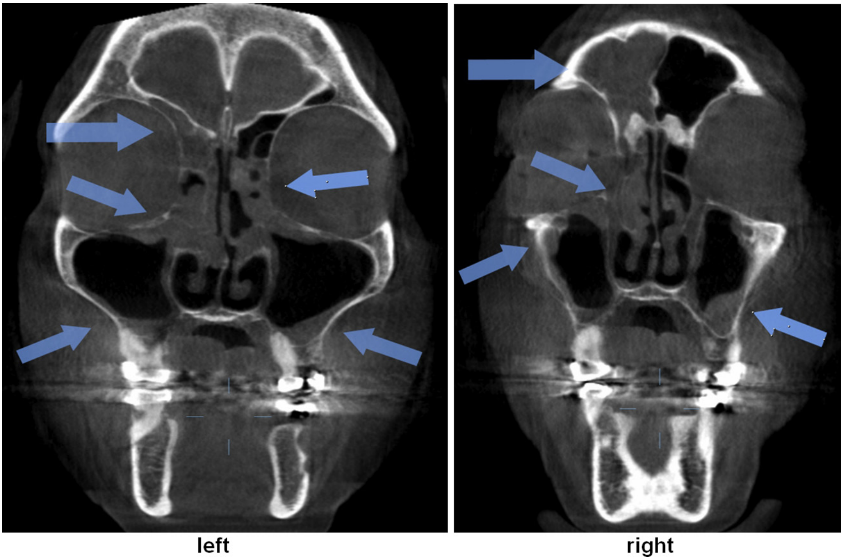


Fig. 14. (*Left*) Mucosal change affecting the inferior portions of both maxillary antra, the ethmoid air cells bilaterally extending into the lateral recess of the left frontal sinus on the right side. The ostiomeatal complex is blocked on both sides (*middle blue arrows*) so that drainage cannot be established and the infection/inflammation persist. (*Right*) The remainder of this patient's right frontal sinus is totally opacified from extension of the ethmoid air cells and the blocked ostium on that side.

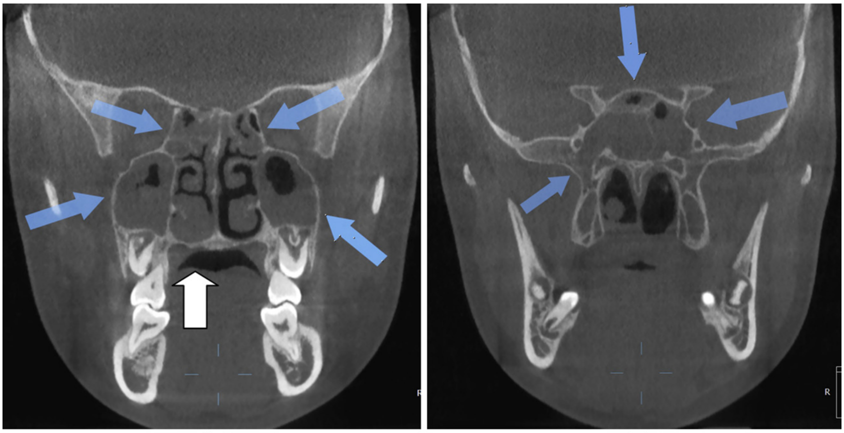


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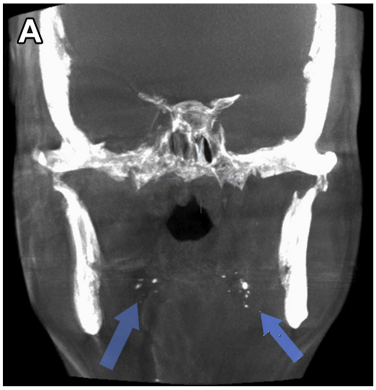
Fig. 15. (*Left*) Blue arrows point to inflammatory changes in both maxillary antra and much of the ethmoid air cell complex. White arrow points to a hypertrophic right inferior turbinate and soft tissue changes that have occluded the inferior meatal space and part of the common meatal space. (*Right*) Extensive inflammatory change in the same patient in the sphenoid sinuses, both left and right. The right sphenoid sinus even extends into the pterygoid bone (*lower left blue arrow*), which also shows the inflammatory change. This patient had a severe pan-sinusitis and was referred to an otolaryngologist.

Airway

Enlarged tonsils and/or adenoid tissues are seen frequently in CBCT volumes. More commonly, there can be calcifications that are single, multiple, unilateral, and/or bilateral, which represent tonsilloliths. Tonsilloliths are concretions of mucus, bacteria, and sometimes fungi that reside in the tonsillar crypts and frequently cause malodor (bad breath).[5] **Fig. 17**A shows some of these changes.

Left **Right**

Fig. 16. (*Left*) Bilateral pneumatization of the middle turbinates, an anomaly called concha bullosa. Both of these spaces are patent. (*Right*) Inflammatory change within the concha bullosa anomaly (*upper blue arrow*) with mild septal deviation to the left. Lower blue arrows are simply identifying furcation defects.



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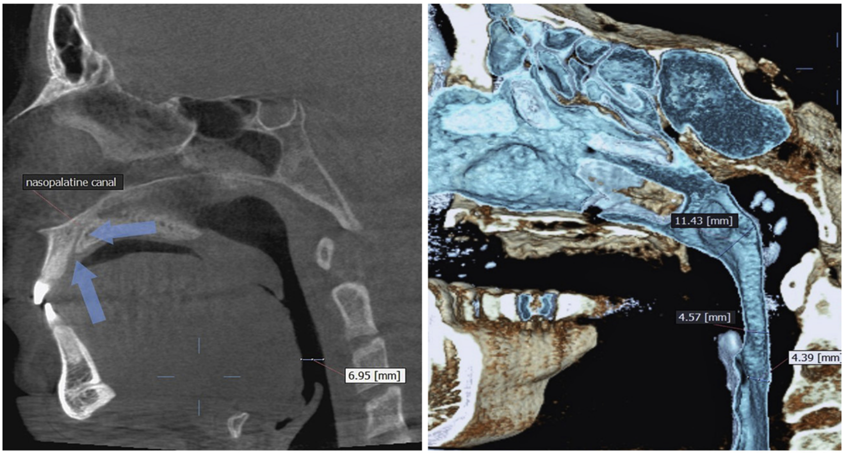

Fig. 17. (*A*) Calcifications in the crypts of the tonsillar tissues in a maximum intensity profile presentation at 10-mm slice thickness. (*B*) (*Left*) 2-D gray-scale thin-slice sagittal image, (0.1 mm), showing center region of volume and measurement at narrowest portion of airway. (*Right*) 3-D color reconstruction at approximately 30-mm slice thickness demonstrating measurements in 3-D with airway opened up.

Dentists and dental specialists who treat patients for sleep-disordered breathing or obstructive sleep apnea (OSA) frequently assess the width, area, and volume of portions of the oral pharynx and pharynx when looking at a patient's airway. A discussion of OSA and the applications/tools of CBCT are beyond the scope of this article. Fig. 17B demonstrates the types of images that are useful in OSA.

Cervical Spine

The changes that are common to osteoarthritis are common in the vertebral bodies and facet joints of the cervical spine. Osteophyte and subchondral cyst formation, loss of joint space, subluxation between 2 joints, and loose bodies are frequently seen in CBCT data sets. These are demonstrated in Figs. 11–29. Another change

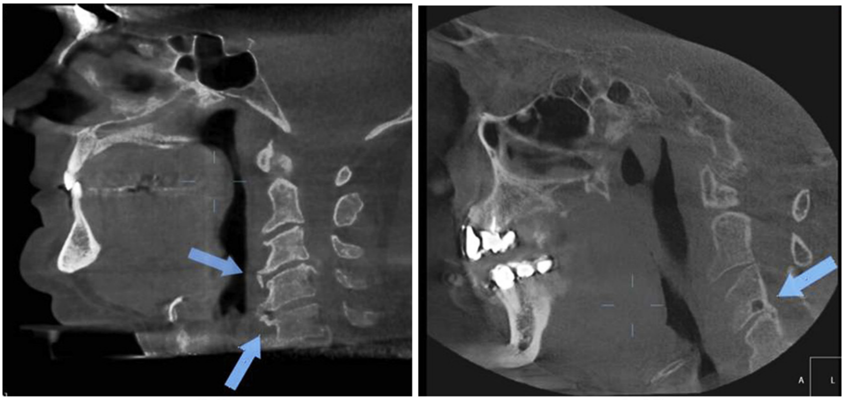

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Fig. 18. (*Left*) Osteophyte formation on vertebral bodies C3 and C4. (*Right*) Subchondral cyst formation on C3. These changes and loss of joint space between the vertebral bodies are common.

seen in larger FOV volumes associated with the vertebral bodies is calcification of the anterior paraspinal or posterior paraspinal ligaments (see Figs. 11–20). Radiolucencies that are not consistent with subchondral cyst formation might represent metastases from some of the more common cancers, such as prostate, lung, cervical, and breast cancers. Any change that looks unusual to a clinician is reportable and referral, in most cases back to the primary care provider and/or an orthopedic specialist, internist, or rheumatologist.

Temporomandibular Joints

The TMJ complex, at least the condyles and related bony structures, are easily and accurately imaged with CBCT both in 2-D gray-scale imaging and in 3-D color

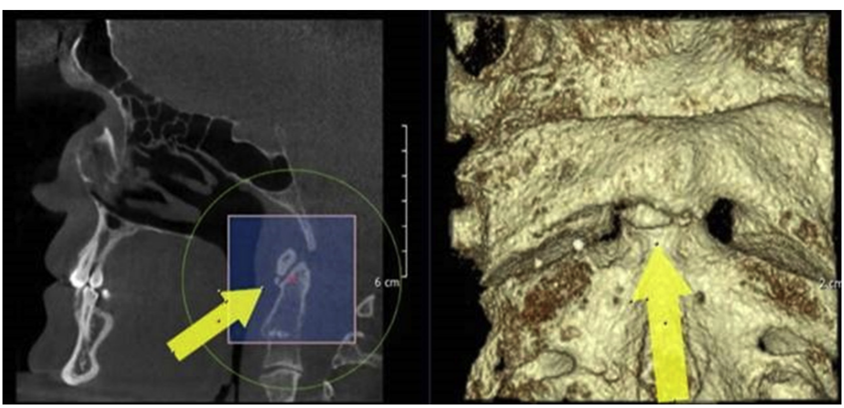


Fig. 19. Loose body (*yellow arrows*) in atlantoaxial junction in 2-D gray-scale and 3-D color reconstruction. The color reconstruction was performed simply by using a "cube tool" in the *OnDemand3D* software (Cybermed, Irvine, CA).

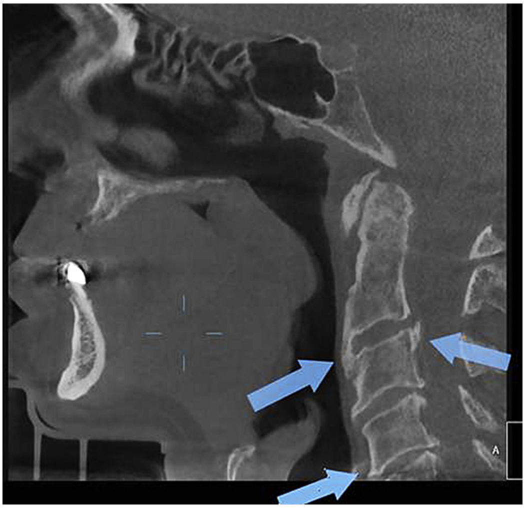


Fig. 20. The linear opacities seen between C2 and C3 on both the anterior and posterior surfaces represent calcification of the longitudinal paraspinal ligaments. This finding can be confused with osteophyte formation, which is far more common.

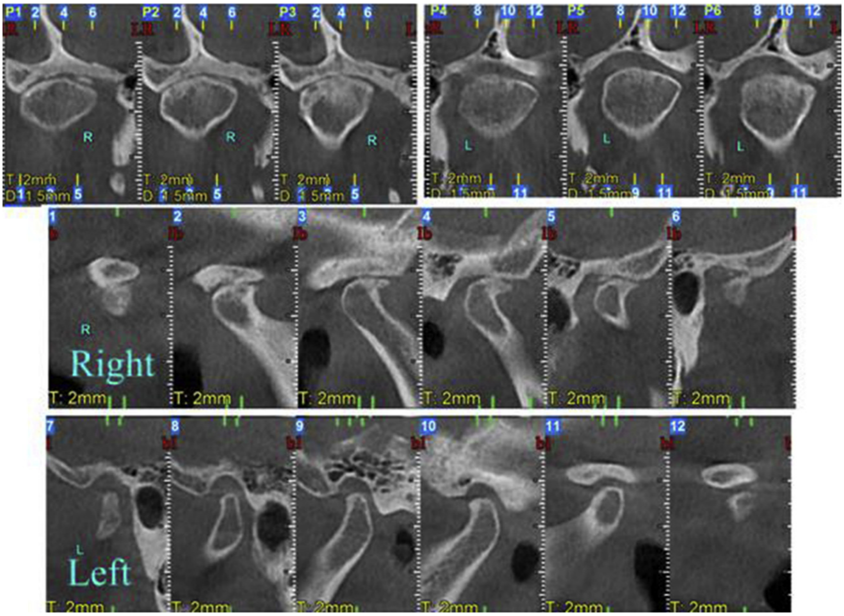


Fig. 21. TMJ comparative joint series of serial coronal (top row, right and left joint respectively) and sagittal views (middle row, right joint and bottom row, left joint) showing subchondral sclerosis and subchondral cyst formation of both condylar heads with anterior surface lipping of the left condyle and anterior osteophyte formation of the right. The articular surfaces of the right joint show a shallow fossa configuration and a flattened articular slope of the eminence with loss of the superior joint space. By comparison, the left joint articular surfaces are considered normal. The left condyle appears somewhat inferiorly positioned in the fossa.

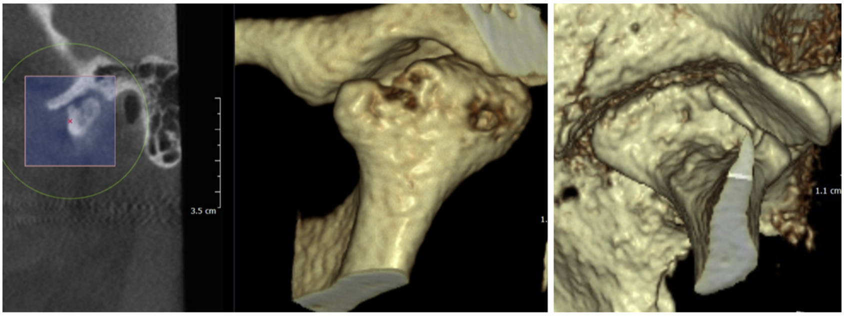


Fig. 22. Osteoarthritic changes on TMJ condyles. (*Left*) Surface erosions. (*Right*) Lipping of the anterior surface and comparable change on the articular eminence latterly.

reconstruction. Similar to the changes seen in the vertebral bodies, subchondral sclerosis, subchondral cyst formation, loose bodies, and alterations of joint space are optimally visualized. Unlike the cervical spine, synovial chondromatosis is seen with some frequency in the TMJ complex. Figs. 22–24 show examples of all these changes.

Dental Findings

Because a dentist or dental specialist has examined and charted a patient as well as taken a complete dental and medical history, most oral maxillofacial radiologists confine their description of the changes in the section bone levels, missing teeth, lesions of endodontic origin (new or residual), impactions, and malocclusion in this dental findings section of the report. If there is an odontogenic cyst or tumor; suspected systemic condition, such as osteomyelitis or systemic disease; fracture; or symmetry, these are also reported by most radiologists in this section.

More often an oral maxillofacial radiologist is looking to uncover occult pathology that the referring dentist is not looking for because it is not the primary reason for the cone beam examination. If dentists or nonradiologist dental specialists decide to examine their own volumes, however, then they are held to the same standard of

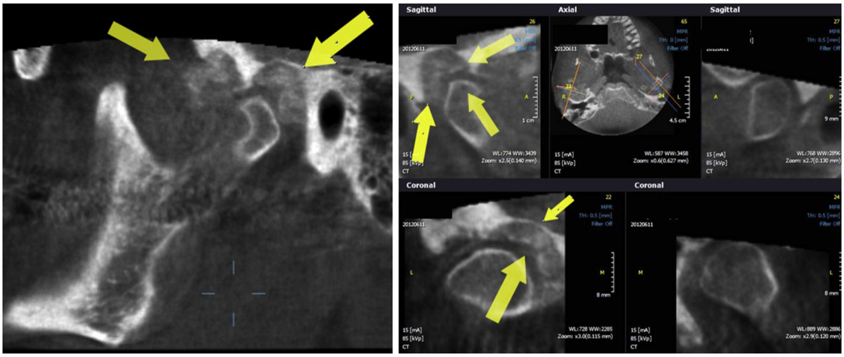


Fig. 23. Multiple, diffuse radiopacities in the right TMJ space apparently displacing the condyle inferiorly. This is a case of synovial chondromatosis.

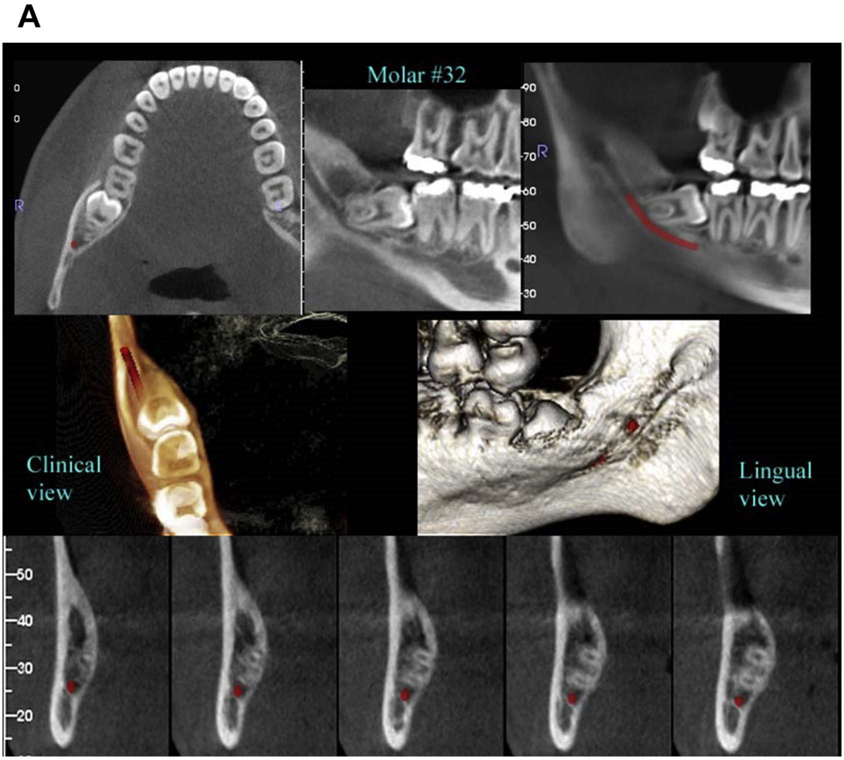


Fig. 24. (*A*) A mandibular impact third molar image series: these images show the anatomic relationship of the impacted molar to the adjacent second molar, if root resorption is occurring, the perifollicular space for abnormalities, the clinical/surgical access and lingual mandibular views, and the position of the inferior alveolar canal to the impact root apices. Such images allow for a presurgical treatment plan that can help reduce the possibilities of undesirable treatment outcomes. (*B*) Various maxillary and mandibular edentulous cross-sectional views showing the ridge crestal configurations, arch widths, vertical bone heights to the sinus/nasal cavity floors, sinus inflammation, bone grafting ridge preservation, the presence of a mandibular lingual surface concavity, and crestal distance to the colorized inferior alveolar canal. The associated guideline measurements can further assist dental implant treatment planning.

care as an oral maxillofacial radiologist and required to find and report any unusual conditions that may reside in that volume. This is a significant responsibility, one that might require additional training for some dentists. Figs. 25 and 26 show some of the dental changes for which clinicians frequently request help. Such requests may include concerns for the relationship of impacted teeth to adjacent structures, such as the inferior alveolar nerve canal and sinus floors, the unerupted maxillary canines to the root apices of the maxillary incisors, and, for dental implants, the location of the inferior alveolar nerve canal and bone configurations of the ridge.

Other

The "Other" section of the authors' structured report allows identifying for a clinician many conditions or findings that need referral of a patient back to the primary care

B

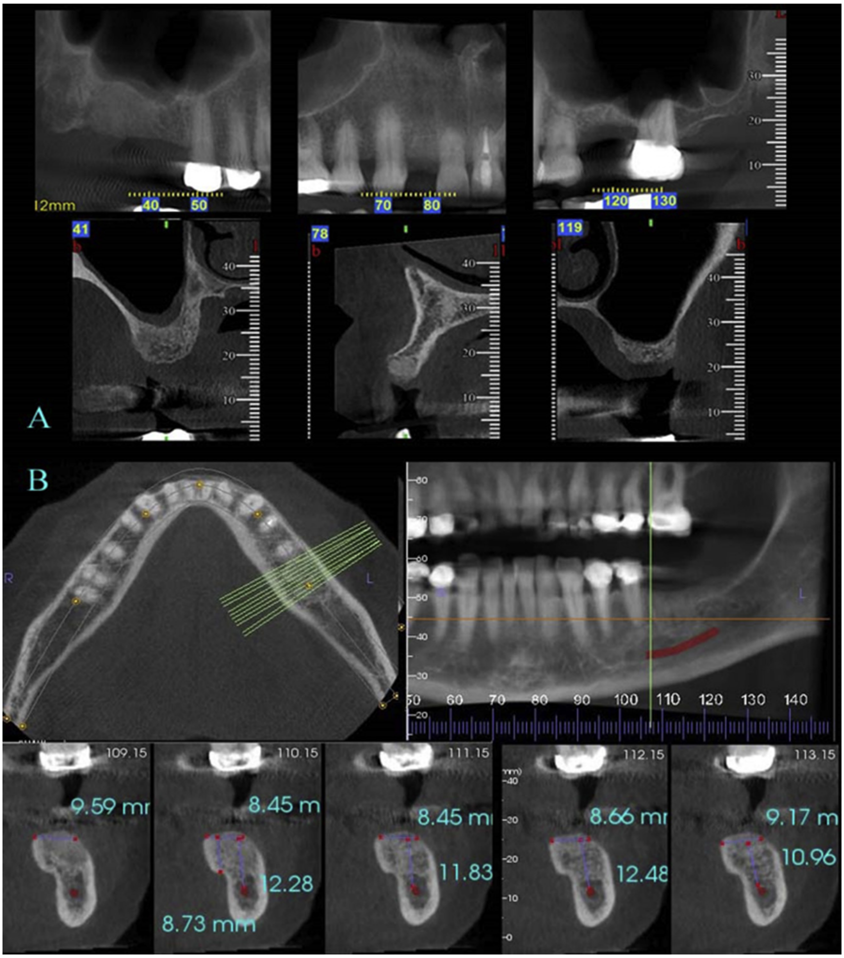


Fig. 24. (*continued*)

provider or to a medical care provider/specialist. In this section, the authors report cranial calcifications; calcifications in the cervical and/or parasellar segments of the internal carotid arteries; calcifications of other arteries, such as vertebral; calcifications in the facial or other soft tissues, such as sialoliths, miliary osteoma, and calcified lymph nodes; and calcifications of the cartilaginous horns of the thyroid gland. Many of these calcifications, such as those of the pineal gland, choroid plexuses, and superior horns of the thyroid cartilage, are physiologic and occur with aging. All arterial calcifications must be referred, however, because they are always related to hypertension and stroke risk as well as dysglycemia and/or renal problems. As common as type 2 diabetes mellitus is in North America, dentists who examined CBCT volumes encounter these calcifications frequently. In long-standing type 2 diabetes mellitus, patients who are uncontrolled or undiagnosed may also have significant renal problems often resulting in end-stage renal disease (ESRD). The arterial changes as the kidney shuts down

A

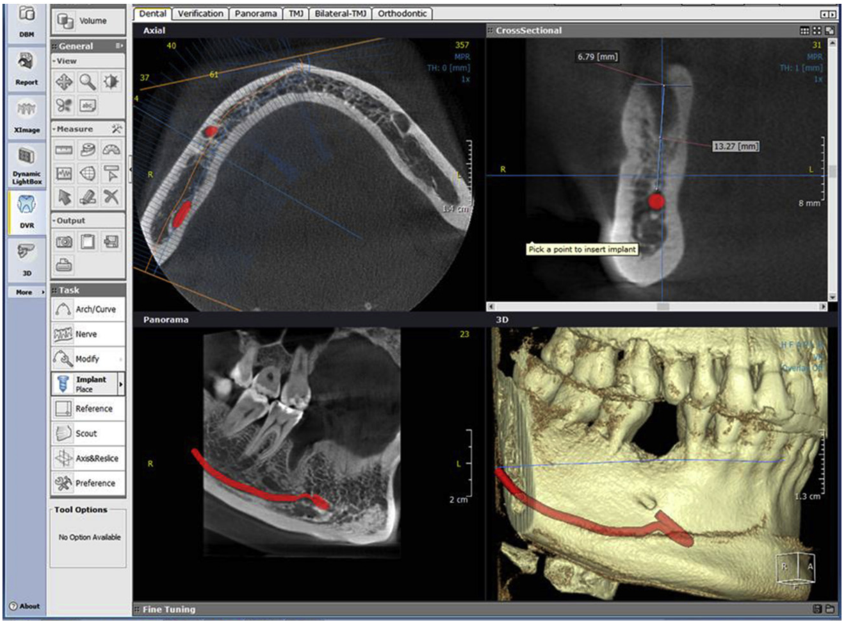


Fig. 25. (*A*) Implant site measurement for placement of a single endosseous implant fixture using a simple, intuitive implant planning software (Cybermed, Irvine, CA). (*B*) Final try-in of the implant icon from the case, showing its relationships within the alveolar bone, the cortical bone, and the inferior alveolar nerve. The measurements and data from the CBCT scan will then be sent to a laboratory for surgical guide construction. (*C*) After construction of a surgical guide seen in the top right image, various implant fixtures are visualized in their locations relative to the anatomic structures including the inferior alveolar nerve. ([*C*] *Courtesy of* Cybermed, Irvine, CA.)

are striking, widespread, and easily recognizable because they usually are seen in several carotid arterial segments, most frequently bilaterally.[6,7]

Examples of most of these findings are shown in **Figs. 26–31**.

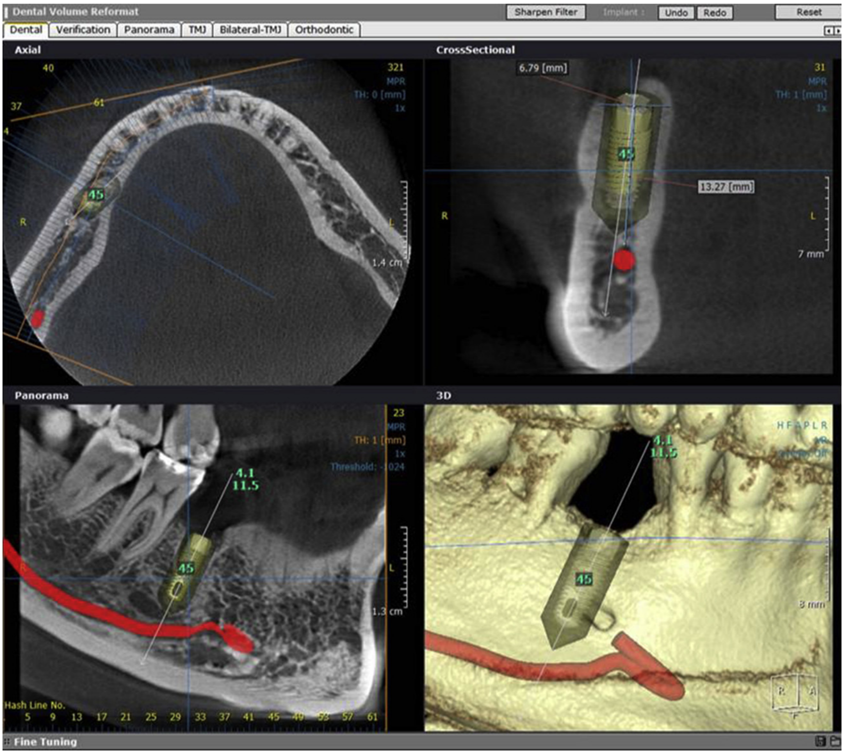
REPORTABLE FINDINGS

Table 1 is an attempt to list frequently encountered reportable findings that the authors have seen in the thousands of volumes examined, all of which involved referral to the medical community for follow-up evaluation and management.

SUMMARY—WHY DO REPORTS?

It is the responsibility of health care providers to acquire information data from patients to best determine the health status of patients, if treatment is indicated, and to provide a basis for informed patient consent. Although such information is usually directed toward a primary condition, there is also the possibility that secondary information is obtained that also could have an influence on a patient's health. The use of CBCT for dental treatment planning poses such a situation in which the additional data in

B



C

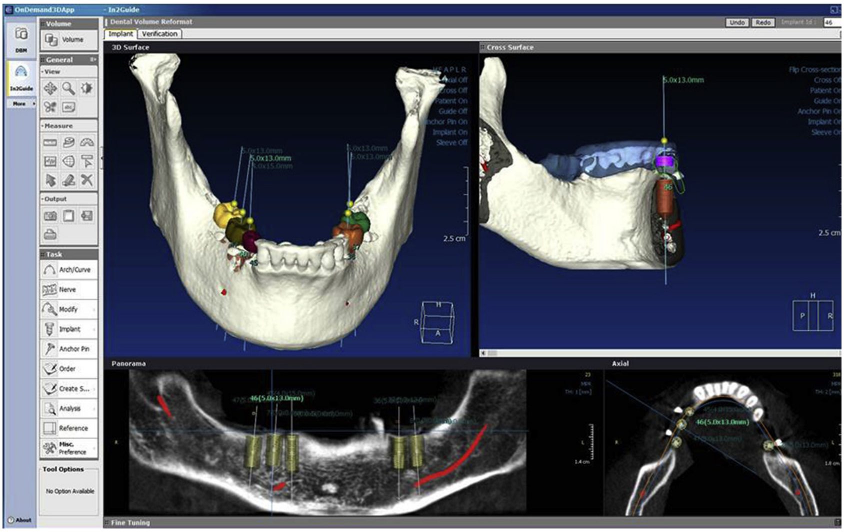
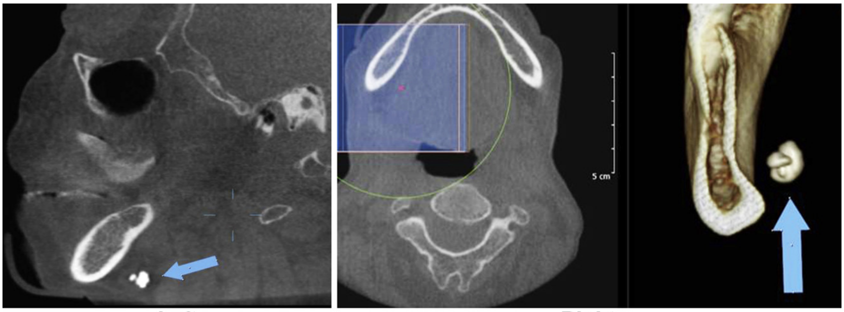


Fig. 25. (*continued*)



Left Right

Fig. 26. An example of a sialolith in the right submandibular salivary gland in both 2-D sagittal gray-scale image (*left*) and 3-D color reconstruction (*right*). This stone is probably at the hilum of the gland.

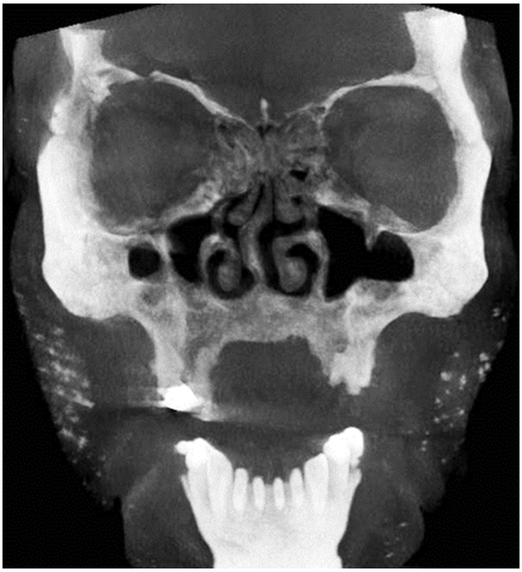
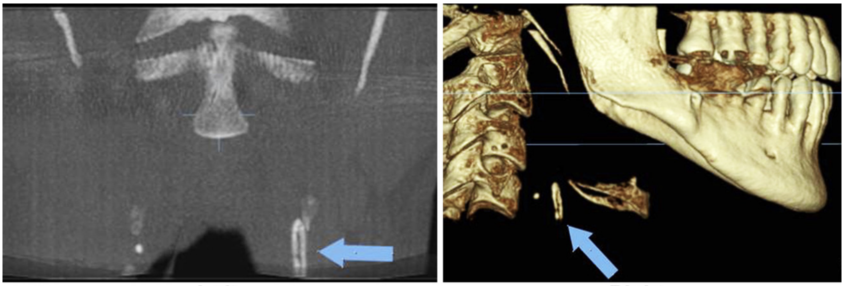


Fig. 27. A coronal section, at 10.0-mm thickness, using a maximum intensity profile tool to demonstrate bilateral parotid sialoliths seen in some autoimmune diseases like Sjögren.



Left Right

Fig. 28. There is unilateral calcification of the superior horns of the thyroid cartilage. The blue arrow shows the most superior portion of this ligament on the left side as it approaches its insertion into the posterior segment of the left hyoid. The right is a 3-D color image. These physiologic changes in the thyroid cartilage can be mistaken for carotid calcifications.

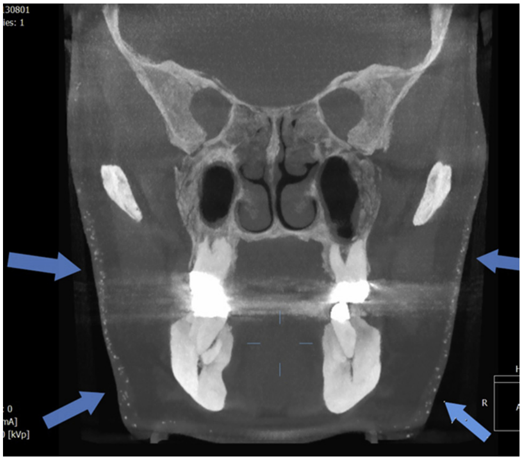
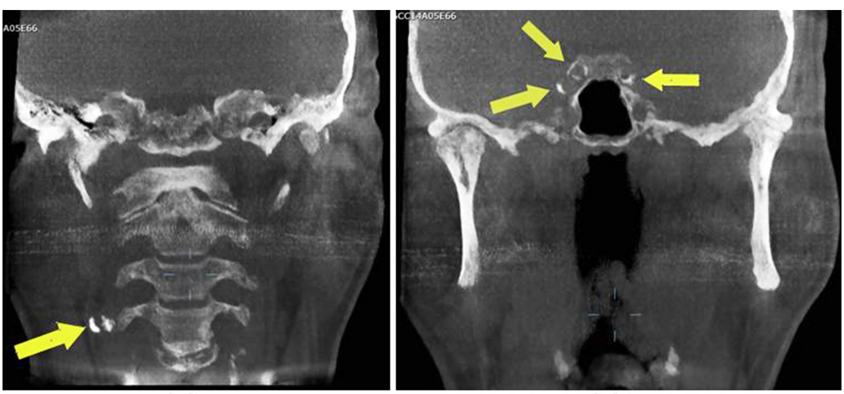


Fig. 29. Multiple, bilateral calcifications in the facial soft tissues consistent with miliary osteoma. Also termed, *osteoma cutis*, these calcifications are a metaplastic reaction to 2 things, such as inflammation, trauma, and even neoplasia.

the acquired image volume that are outside of the scope of the primary dental concern could detect systemic conditions that possibly directly influence the overall health and longevity of a patient. Thus, data collection and reporting the findings from the entire CBCT image data volume are a professional responsibility mandate (see the article elsewhere in this issue by Friedland and Miles).

As such, from knowledge of possible heath related findings detected in the CBCT image data which are not directly associated with the primary dental concern, patients can make informed decisions. The CBCT report becomes a component of the informed consent standard of care. Who provides the report may not be as important



left right

Fig. 30. (*Left*) A diffuse, sclerotic plaque at the level of C3/C4 (the bifurcation of the internal and external carotid artery region) representative of a carotid plaque. (*Right*) Carotid plaques in both the left and right internal carotid arteries in the parasellar region, also known as the carotid cistern. In this case, the patient should be referred back to the primary care provider for evaluation of hypertension and stroke risk.

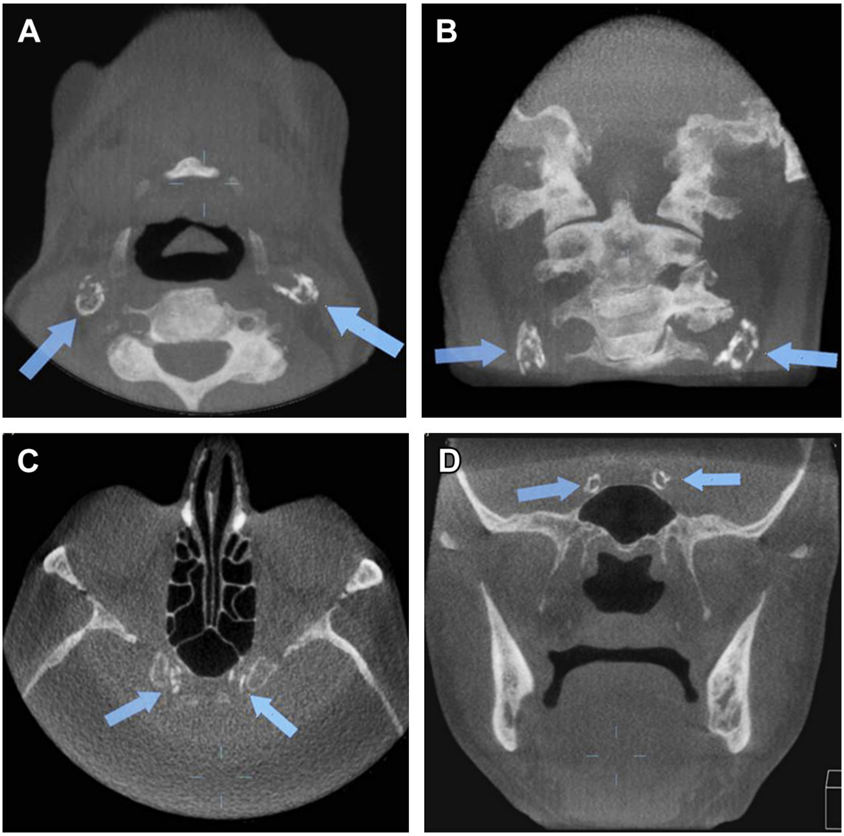


Fig. 31. (*A–D*) Bilateral circumferential carotid plaques in both the cervical and parasellar segments of the internal carotid arteries. These plaques are more indicative of medial arterial calcification, often seen in undiagnosed or uncontrolled type 2 diabetes mellitus and sometimes in ESRD. Patients with this type of appearance and widespread distribution of calcifications are candidates for below-the-knee amputations if not aggressively treated.

Table 1
Reasons and referrals from findings in CBCT scans

Finding/Clinical Impression	Possible Referral
Pansinusitis	Primary care provider and/or otolaryngologist
Mucocele	Primary care provider and/or otolaryngologist
Antro-oral defect	Oral maxillofacial surgeon
Deviated septum and/or hypertrophic turbinate	Otolaryngologist
Mastoiditis/cloudy mastoid air cells	Otolaryngologist
Enlarged tonsils and adenoids	Primary care provider and/or otolaryngologist
Narrowed airway	OSA specialist
Cervical spine changes	Primary care provider and/or an orthopedic specialist
Loose bodies, TMJ	TMJ specialist or oral and maxillofacial surgeon
Tonsilloliths	Otolaryngologist
Carotid plaques (cervical)	Primary care provider
Medial arterial calcification (bilateral, circumferential cervical, and/or parasellar)	Primary care provider
Pineal gland calcification (greater than 1 cm)	Primary care provider

as whether or not a report is actually performed. The quality, accuracy, and use of the report are subject to medicolegal scrutiny, and knowledge of such issues determines whether or not a primary provider or a secondary radiology reader evaluates the image data and issues the final report.

SUPPLEMENTARY DATA

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.cden.2014.04.006.

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