10 PATIENTS On WHOM You SHOULD TAKE CBCT SCANS

by Jack Fisher, DMD

The advent of 3D imaging technology has raised a debate: does CBCT imaging significantly benefit patients or aid in the diagnosis and treatment planning of patients?

With the older CBCT models, radiation was certainly a concern. Now, with low-dose machines like the new unit from Planmeca, radiation is delivered at a dose of 14ms. This takes a full scan at 600 um, which undermines the radiation argument.

The specialty of orthodontics has had a recent influx of technology. From intraoral scanners and digital impressions to 3D printers replacing plastic models, it seems we need to decide how to best use this technology for the benefit of our patients. We should be judicious with technology and use it to benefit, not to overtreat.

Here are 10 patients on whom you should take a CBCT scan.

1. The Patient with Impacted Maxillary Canines

Only 1-2 percent of the population has impacted canines. If impacted canines are the main reason for taking DICOM, imaging may be better to outsource, as purchasing a machine for such a small percentage of the population isn't cost effective. A 2D pan or ceph will not adequately image the impacted teeth for surgical planning or for treatment planning.

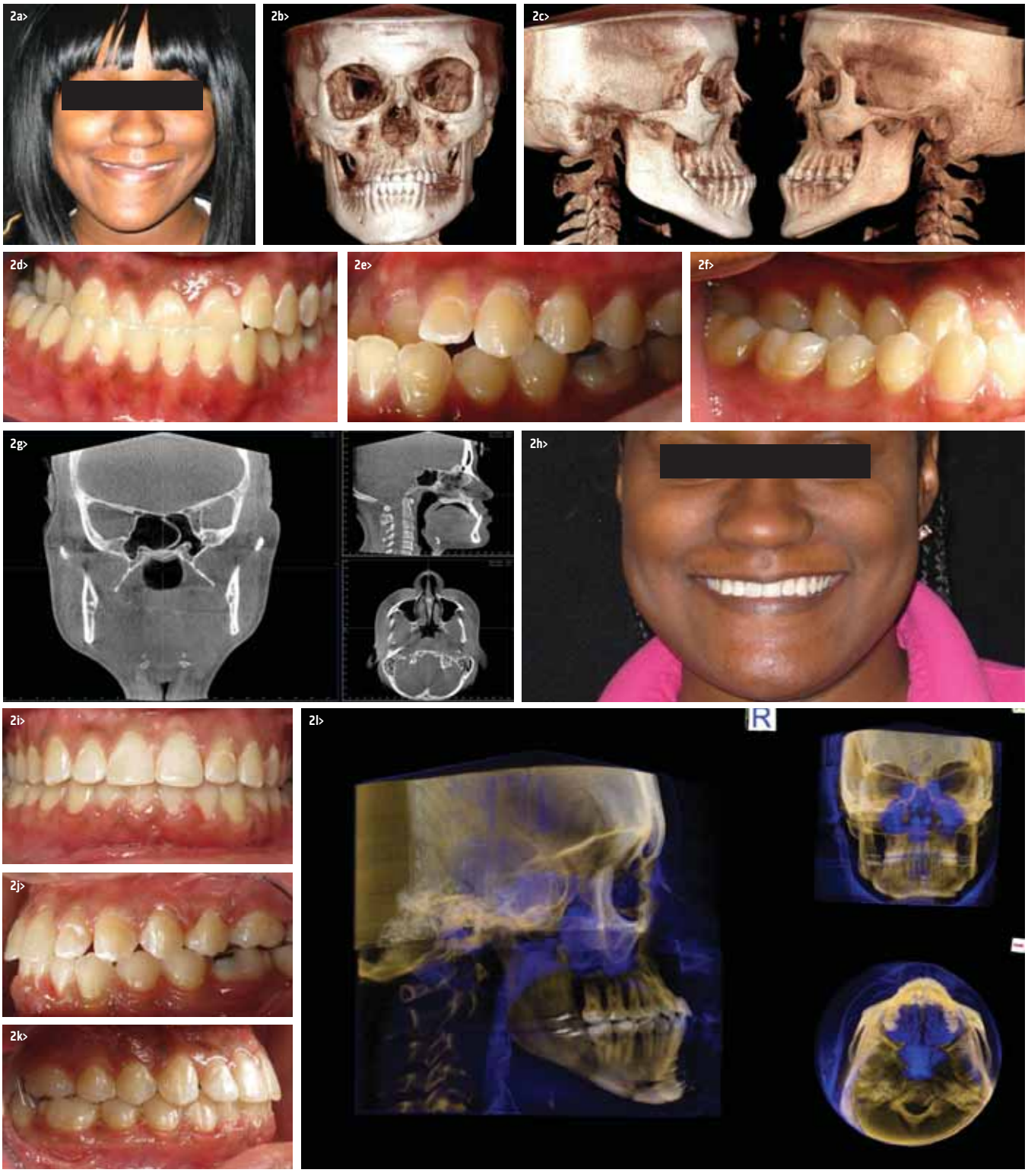
It has been reported that 62 percent of paletally impacted canines are touching the roots of laterals and centrals. This is information that 3D imaging illustrates. This information can change the mechanics needed to properly position the canines without damaging the roots of adjacent teeth.

3D imaging of impacted teeth is certainly advantageous to the orthodontist or oral surgeon who will surgically expose the non-erupted teeth. The doctor can readily see the benefits to the patient for using the 3D imaging technology for this treatment (Figs. 1a-c).


1a>


1b>


1c>



2. The Patient Needing Orthognathic Surgery

A 3D scan is more diagnostic in all three planes of space than a 2D ceph image. The DICOM images give the orthodontist a more accurate visual treatment objective prior to treatment. Many oral surgeons can now use the scan to send to medical modeling companies for the construction of the splints used during the surgery. The patient in figures 2a-l shows different types of images that can be generated from a set of DICOM images. With very little radiation, the orthodontist can obtain a pan, ceph and many types of 3D images.

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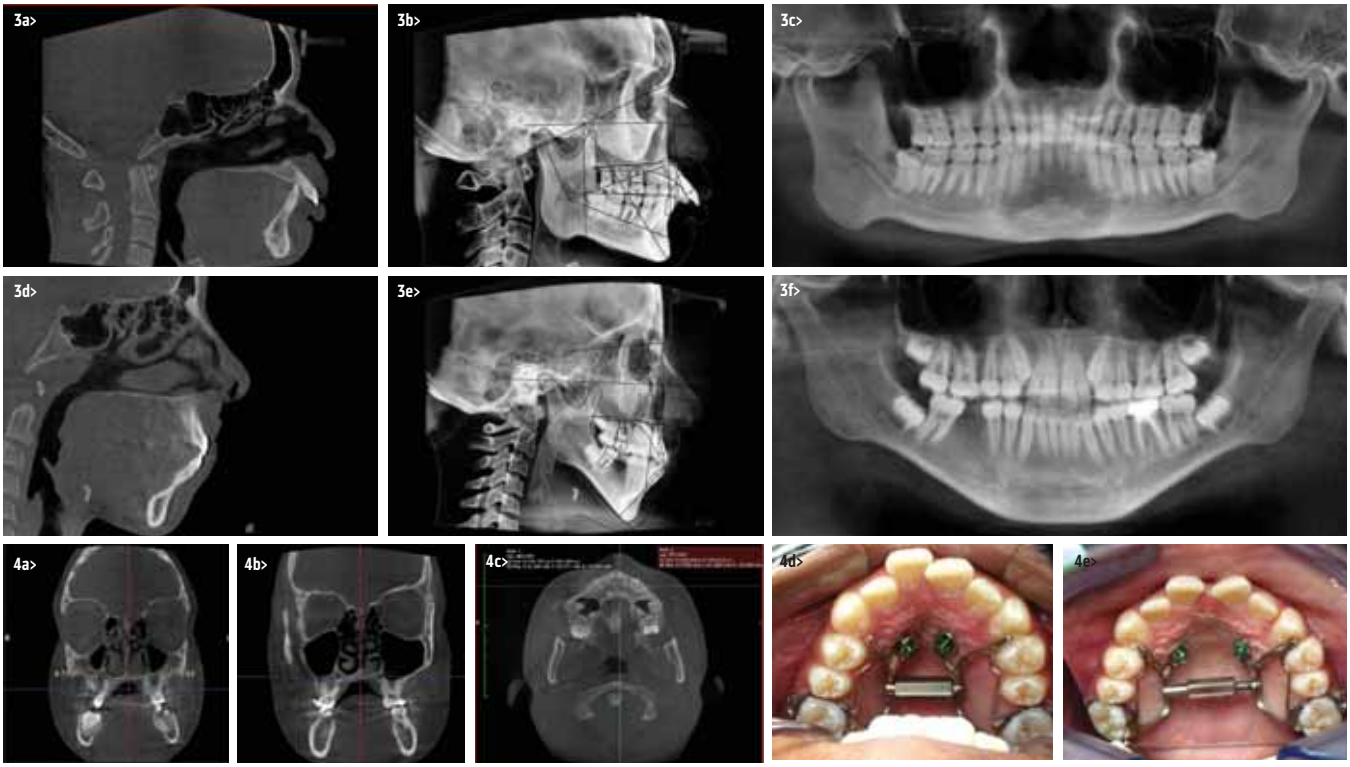


3. The Patient Needing Anterior Teeth Moved in the Sagittal Plane

Since a traditional ceph image is a composite of the cephalic, the true amount of bone either anterior or posterior to the roots of these teeth is not visualized with a ceph or pan.

When there is not adequate bone to move the roots of teeth into, the clinician has only two options. Either have bone placed by a periodontist or maintain the patient's inclination of these incisors.

The use of Class II correctors has grown tremendously causing many issues. These devices often flare the lower incisors as much as 10 degrees. Fenestrations and the lack of bone support results. Is this a stable environment for incisors? We also often recline the upper incisors. Is the alveolus wide enough in the sagittal plane to accommodate the roots of the teeth? Now, with the use of skeletal anchorage devices, we are more likely to exceed the patient's biological limit. Traditional ceph and pan don't show the true anatomy of this plane. The axial plane, shown with 3D scan, gives the clinician a more thorough understanding of the availability of bone to move the incisors.

Figure 3a-f illustrates a patient seeking treatment for a severe overjet and overbite. The pan and ceph do not reveal enough information to properly diagnose. After imaging the sagittal view with a CBCT, the doctor can readily see the lack of bone to move the upper incisor. The pictures show a patient with a lack of bone around the lower incisors. Again, something unseen on traditional pan/ceph.

4. The Patient Needing Temporary Skeletal Anchorage Devices Placed

Clinicians who have become proficient and confident with the placement of TSADS place them on about 23 percent of their cases. When evaluating the placement site in all three planes of space, the clinician can be very exact and avoid the structures that need to be avoided.

More TSADS are being placed in the infazygomatic area and a 3D image is the best way to determine placement for stability in this area. In figures 4a-b, note the thickness of the bone in the infrazygomatic crest. This demonstrates bone that is too thin for placement of TSADS.

TSADS are often placed in the pre-maxilla. A visual of this area is essential pre-placement. One must consider the thickness of bone in this area to a void tips from penetrating the nasal cavity and to avoid the roots of the teeth in this area (Figs. 4c-e).

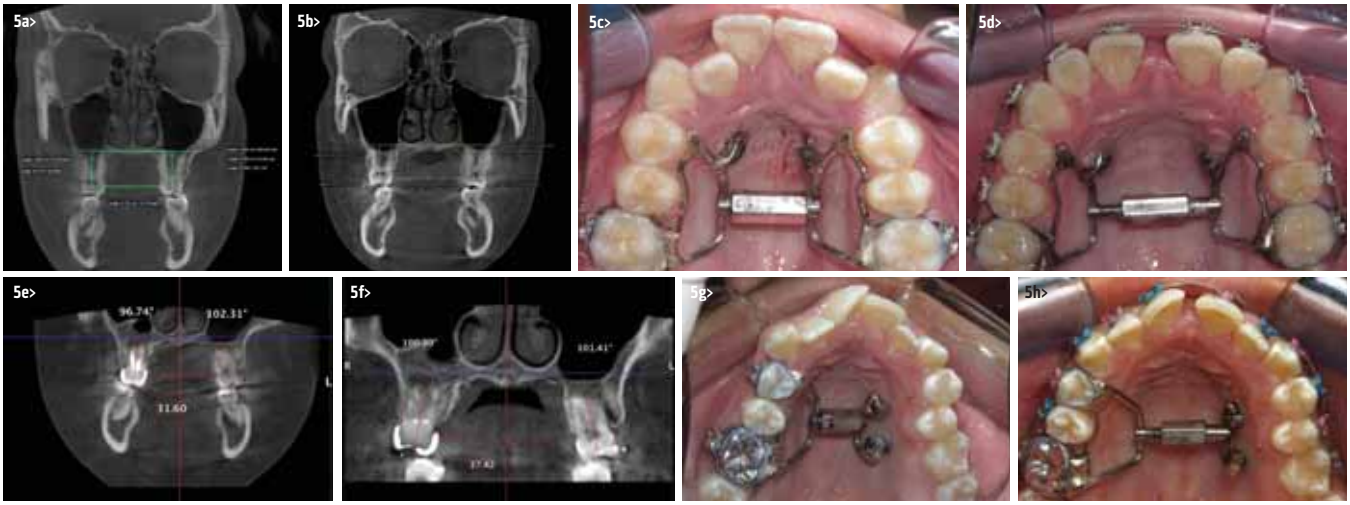
5. The Patient Who Needs Expansion of the Maxilla

In this case, determining the crossbite as skeletal or dental is essential. The clinician can readily determine this if the molars are inclined in a crossbite or if the entire maxilla is constricted. This can help determine what forces are desirable to correct the crossbite.

The 3D image allows the clinician to evaluate the amount of bone around the roots of the teeth that are to be expanded. It can also aid in choosing the type of forces to be used. It's possible that bone augmentation is indicated so the roots are not fenestrated through the cortical bone creating a less stable environment. Figures 5a-h illustrates the maxilla after expansion and illustrates a molar being tipped lingually.

6. The Patient Who Will Receive a Permanent Implant

The clinician placing implants will need to evaluate the bone to determine how much area is needed between the teeth and



also, the thickness of the bone receiving the implant. Permanent implants are used as anchorage during orthodontic treatment. The evaluation of the bone in all three planes of space is important for the placement and stability of permanent implants (Figs. 6a-b).

For patients 7-10, a scan must be taken to understand the problem. The problem cannot be determined pre-scan.

7. The Patient Suspected of Having a Compromised Airway

Obviously you don't know if a patient has a compromised airway until the scan is completed, however, if there is an inadequate airway, the location of the constriction could determine the type of treatment a patient receives. For example, this knowledge could change the treatment plan from a camouflaged treatment to a mandibular advancement.

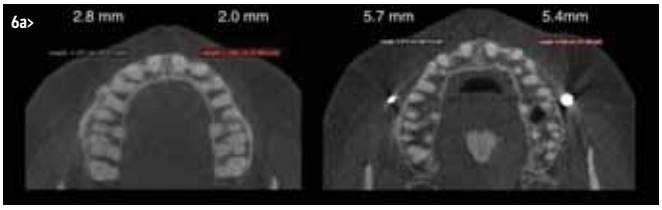
A traditional ceph is not adequate in determining the size of an airway. Many advancements in the subject of compromised airways have come about in recent years. These patients deserve a multi-disciplinary approach, perhaps more than any other type of patient. DICOM images are vitally important for the proper diagnosis and treatment of these types of patients.

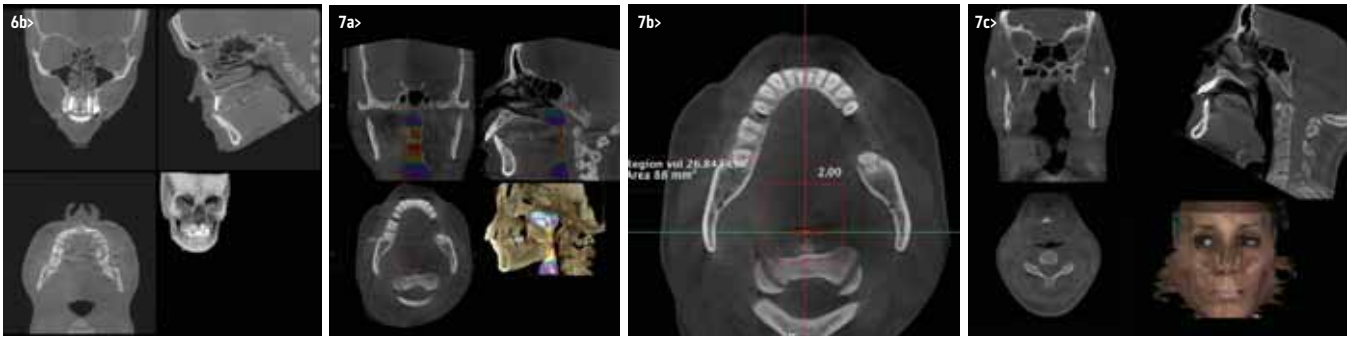
Figure 7a-b illustrates an example of this type of patient (who had a chief complaint of overjet). She could be treated with the retraction of the upper anteriors. After the 3D scan, the clinician decided that mandibular advancement would best serve her. Note the osteophyte on C1 that is constricting the airway. The osteophyte needs to be removed. In this case, the DICOM image changed the treatment plan.

Figure 7c shows another patient seeking treatment after surgical relapse. This patient will need surgery again. Note the restricted airway at the hypopharynx, and the upper centrals which have been torqued through the lingual cortical bone — two problems not seen with 2D.

8. The Patient with TMD

Internal joint disorders are often found during the manipulation of the DICOM images. For example, the etiology of an open bite in a female teenager may be due to idiopathic condylar resorption. Is it not best to know this on the front end of orthodontic treatment? Many joint conditions are asymptomatic for patients seeking routine orthodontic treatment. Most joint problems are not seen on pan/ceph. Being able to image the TMJ on all three planes of space is imperative in patients receiving comprehensive orthodontic treatment.





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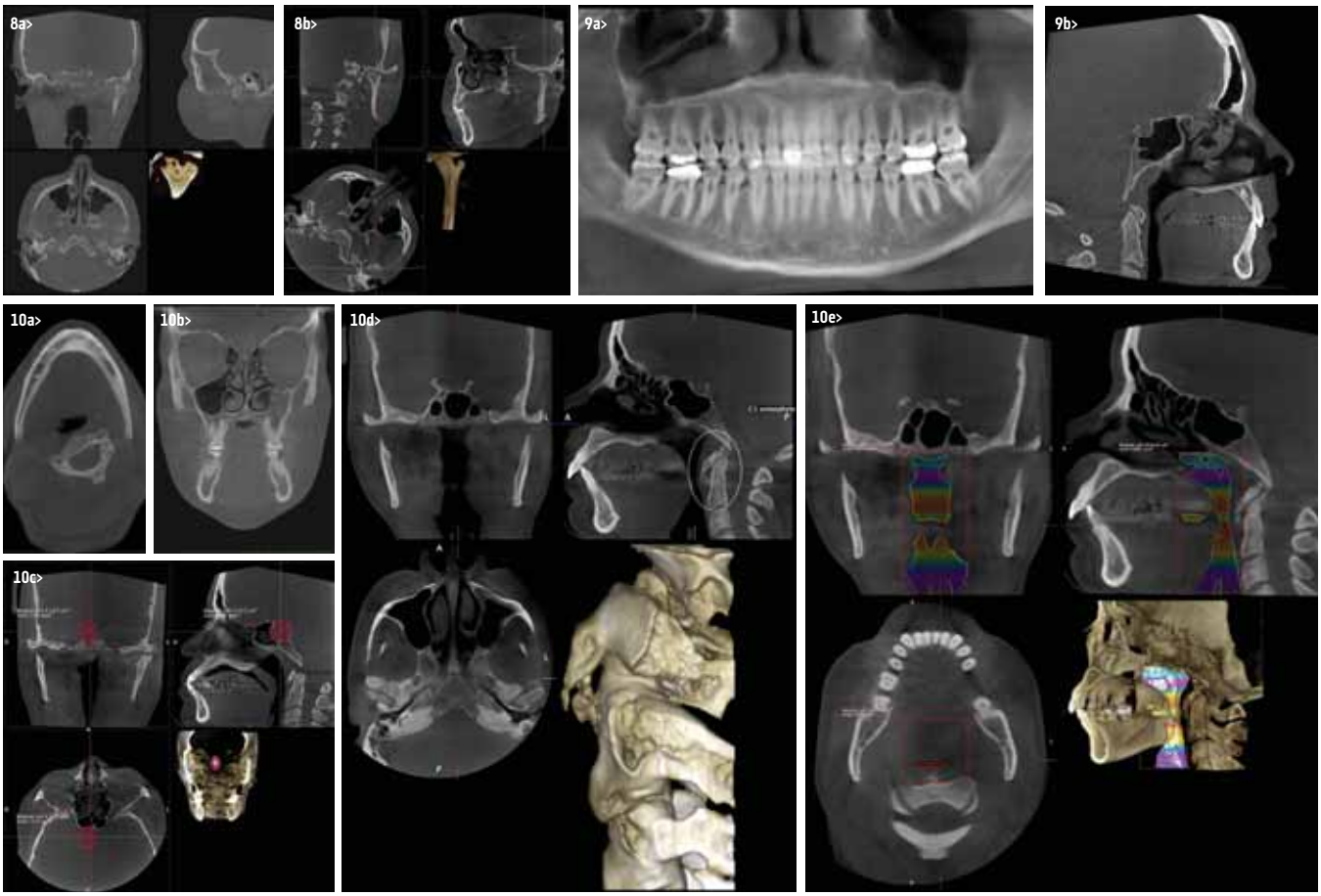

Figure 8a illustrates a 14-year-old female with challenges of her condyles. She was asymptomatic. Figure 8b illustrates a bifid condyle that is also asymptomatic.

9. The Patient with Supernumerary Teeth

This is one of those scans where you don't know if the pan/ceph is adequate until you take a CBCT scan. I have personally found supernumerary teeth, as well as mesodens, that were not in the trough of a routine pan. Figure 9a illustrates a situation where the mesodens were not obvious. The extra tooth is imaged on the sagittal view of the scan (Fig. 9b). The etiology of the reclined centrals is the mesodens.

10. The Patient with Pathology

Figure 10 illustrates a few conditions that were discovered on a 3D image but not evident on the traditional 2D image. The first patient in figure 10a shows the axial view where C1 is rotated to the patient's left. This is also restricting the airway. Figure 10b illustrates a patient who was scheduled for a maxillary osteotomy. The maxillary left sinus is not present. This is reported to be a condition present in 1 out of 100,000 people. I think it is more frequent as I've seen this condition in three patients in the last three years. Figure 10c shows the three planes of space with an enlarged pituitary gland. In this case, the gland had to be removed. Figure 10d shows a patient with a large traumatic bone cyst, not evident on the pan because of the size of the lesion.

Figure 10e shows a large nasal bone cyst. After finding this, we discovered several smaller ones as well. The enlarged pineal gland was not shown on the pan/ceph but is evident on the image in the sagittal plane. The patient was referred for a sleep study and was diagnosed with severe sleep apnea. The osteophyte was removed.

The routine use of DICOM imaging in the specialty of orthodontics is approaching. We, as a profession, do not get to determine what is standard of care; this decision is made by the courts. However, if any of these 10 cases were not imaged correctly and were brought to court for less than adequate treatment, we would be liable for all the data. It seems that with machines which deliver such low dosages of radiation, we must learn to use scans to best treat our patients and to protect ourselves. ■

Author's Bio

Dr. Jack Fisher has been practicing orthodontics for more than 28 years. He teaches at NYU, UofL and Vanderbilt Orthodontic post-graduate residencies. He practices in Memphis Tennessee and is a faculty member at University of Tennessee. He is a key opinion leader for Planmeca.