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WEB SURVEY

Am I glowing yet?

What to know about radiation from cone beam computed tomography and how to explain the scans to your patients.

by Noah Levine, Senior Editor



A patient sits for a scan in Imaging Sciences International's i-CAT cone beam system.

Diagnostic imaging—especially the stunning 3-dimensional pictures provided by [cone beam computed tomography](#) (CBCT) scans—offers incomparable advantages to dentists planning and delivering a wide range of treatments, but the scans do involve exposing patients to small but not-insignificant amounts of radiation.

X-rays have been common in medicine and dentistry for many years and CT scans of one variety or another have become far more common in recent years. However, a recent string of news reports such as the New York Times series "[The Radiation Boom](#)" have raised public concern about the risks and misuse of the technology in medical settings.

While the rewards of properly used CBCT technology certainly outweigh the risks, it is important for clinicians to only use them

Experts say 3D scanning technology such as this should only be used when there is a clinical need.

Photo: Imaging Sciences Int'l

when the information provided is key to the case being treated and to use them in a way that limits patient exposure to radiation as much as possible. Clinicians also need to be prepared to explain to their

patients why the scan is needed and how the radiation exposure is being limited.

“There has to be risk within reason. The dose is low, but there has to be a need,” said Dr. Allan G. Farman, President of the [American Academy of Oral and Maxillofacial Radiology](#) (AAOMR).

CBCT radiation realities

CBCT systems emit a cone-shaped beam of radiation at the targeted area. The beam is circled around the target with a receptor on the other side ready to receive beam. Dr. Bruce Howerton, a specialist in Oral and Maxillofacial Radiology and expert in CBCT who runs Carolina OMF Imaging, explained that CBCT is very different than medical CT scans where a thin “fan” beam of radiation is used to scan the patient and a larger tissue volume often is exposed to capture the necessary information to create a useful diagnostic image dataset.

“Whereas with cone beam computed tomography, all the radiation emitted to the source, is captured by the receptor, therefore not as much radiation is required,” he said.


In terms of how much radiation is required for a typical CBCT scan, Dr. Howerton said it is the equivalent to the exposure required to take three to four dental panoramic images. To explain this in terms patients might understand, Dr. Howerton said one CBCT scan exposes the subject to approximately four days worth of the background radiation people experience every day from the sun, cell phones and other radiation emitting technologies and materials.

Knowing those basics can be helpful, but Dr. Farman said it is important to realize that not all CBCT systems are the same in terms of the radiation they use. He said it is important to look at the newer system generations as many of them use lower radiation doses, and this can be limited even more by using a system that allows the beam to be suitably collimated.

"While it is the truth that with most cone beam CT systems one can reduce the dose by at least one order of magnitude in comparison with medical multi-slice CT, and even further than that to maybe two orders of magnitude with some of the limited area cone beam CT systems, some of the earlier machines were relatively high dose," he said.

Deciding when to scan in 3D

While the dose is smaller than a typical medical multislice CT scan, CBCT should still be used only for cases where the information from the



12%

of GPs currently own a cone beam

scan volume will benefit the patient. Dr. Farman said this concept should apply to all dental imaging, not just CBCT. The key is to take an image with a specific use in mind rather than taking a 3D scan of a patient just so there is a 3D record of that patient's oral anatomy on file.

"That would be like taking radiographs of your feet every time you buy a pair of shoes. It doesn't make any sense," Dr. Farman said. "I would say, having read radiographic volumes that have been sent to me, that some practitioners are indeed taking more radiographs than they need to, and when I make reports, I tell them that."

The AAOMR is currently working with the [American Association of Endodontists](#) and the [American Association of Orthodontists](#) to develop position papers and guidelines on proper use of CBCT scans in dentistry. Dr. Farman hopes the guidelines will be ready by the fall because they should help clear up questions from dentists about whether they are using their CBCT systems appropriately.

While some diagnostic situations are ideal for the scans, other cases are as yet ambiguous. Dr. Farman said CBCT scans should be the standard of care for implant cases both because of their benefits to treatment planning and because the implant patient population tends to be older, and thus the risks from radiation exposure are

imaging system.

3%

of GPs plan to purchase or upgrade a cone beam imaging system in the next 12 months.

Source: March 2009 DPR Technology Survey

reduced. However, when it comes to orthodontic patients who tend to be younger, the risks can be much greater, and 3D imaging selection criteria guidelines could greatly benefit dentists using the technology.

“We would like to have better evidence that CBCT images are necessary when we are increasing the dose in a patient population which is highly sensitive to radiation,” he said. “For sure in those cases where one really didn’t need a two-dimensional image, one certainly doesn’t need a three-dimensional image. No radiographs should be made merely as a routine.”

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Explaining scans to patients

Knowing the clinical reasons why a CBCT scan is needed is important, but knowing how to explain those reasons to a patient can be just as critical. Dr. Howerton said clinicians should follow the ALARA or As Low As Reasonably Achievable principle when it comes to the radiation doses being used and that should be explained to patients and referring practitioners.

While patients should be informed that there is some radiation exposure, it can be very helpful to be able to explain to them all the ways the exposure and risks are being limited. This means lead aprons and when appropriate thyroid collars should be used, and staff should wear dosimeter badges to track their cumulative exposure.

“The radiation emitted is very small, but we like to provide protection no matter how much radiation is used,” he said.

It also is important to make sure the CBCT system is working properly. It is quite possible that a patient might ask when the machine was last serviced; so being ready with an answer can be helpful. Calibration should be conducted per the manufacturer’s recommendation and differs machine to machine, but is likely to be around once a week. Similarly, regulations on the systems differ from state to state. It is absolutely critical to service a machine if any problem arises, and the system should not be used while it is waiting to be serviced.

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—Dr. Allan G. Farman

“If there’s any problem with the machine the images will not look similar to images that have been seen in the past,” Dr. Howerton said.

Patients should be given a clear reason for the scan and made comfortable about the safety of the procedure. Both Drs. Howerton and Farman said it is important for CBCT technology not to be overused or scans to be conducted as “fishing expeditions” looking for general problems. However, there may be times when the

scan captures more anatomy than the dentist intended, or the scan volume contains pathologies that the dentist does not recognize. In those cases, it is to the patient's benefit to have all the data examined by an expert.

"Certainly there is anatomy captured in this data that can be outside the maxilla or the mandible," Dr. Howerton said. "If a dentist captures data that they are not sure about or not familiar with, it is very easy and inexpensive to have the data analyzed by an oral maxillofacial radiologist."

The bottom line

The potential benefits of CBCT scans often outweigh the risks, but that is not true in every case. Dentists using the systems need to be aware of how they work, and be ready to explain both the rewards and the risks to patients who will be scanned. With 3D imaging technology—like all dental technology—there must be a clear benefit to the patient before it is put into use.

"Cone beam computed tomography is changing how dentistry is performed in that it allows the dentist to see anatomy in three dimensions that practitioners have not been able to see in the past, but it is a modality that should be used only to capture information that is going to help the patient," Dr. Howerton said.

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