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## X-rays and the risk

• A study prompts debate between researchers and dentists about the benefits and risks of dental imaging

By Markian Hawryluk / *The Bulletin*

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Concerns over the effects of radiation from medical imaging in recent years have led to increased attention on minimizing unnecessary X-rays and CT scans in hospitals and clinics. Imaging ordered in dental offices, on the other hand, hasn't received nearly the same scrutiny.

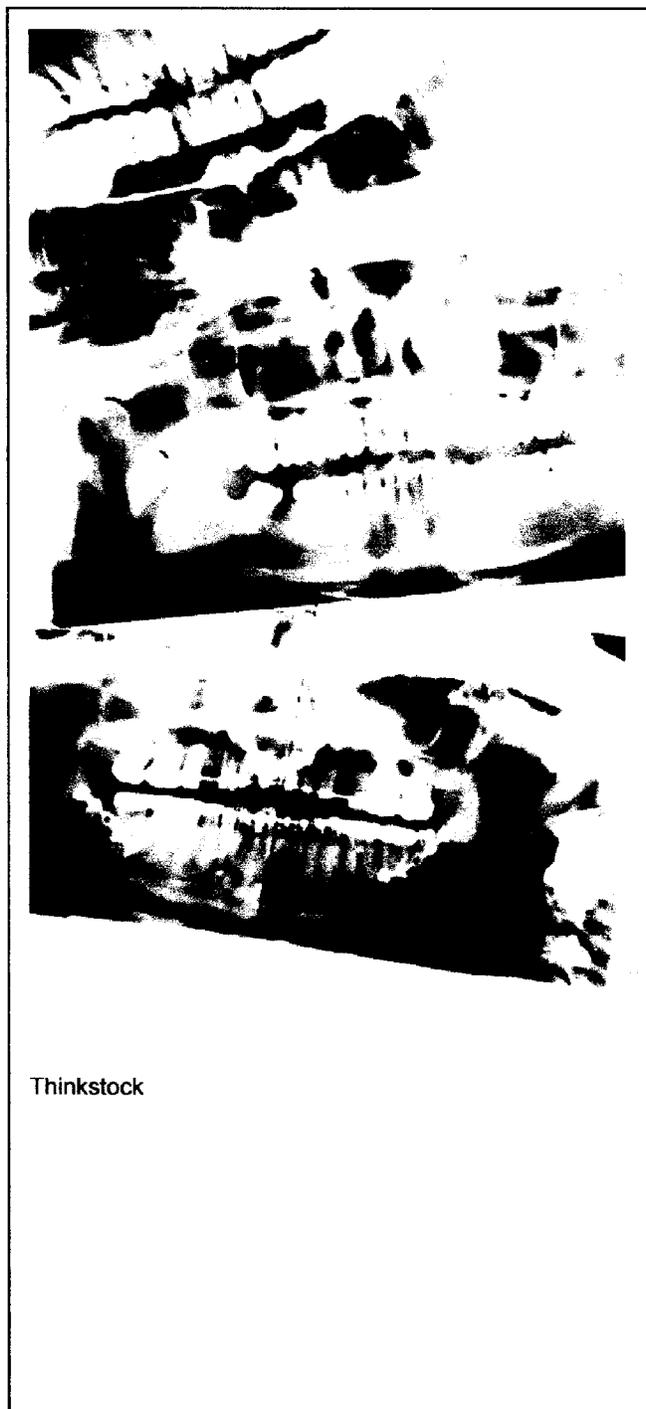
Now a new study has launched discussion of whether dentists might be too quick to order up sets of X-rays in patients without good cause.

The study, conducted by researchers at Yale University, asked patients with a type of usually benign brain tumor known as meningioma about their dental X-ray history. These tumors are thought to grow spontaneously out of the covering of the brain. Exposure to ionizing radiation, such as the type used in X-rays, is the largest known risk factor.

The researchers then surveyed a matching group of healthy individuals and compared their dental X-ray histories. The patients with meningiomas were more than twice as likely to report having had a bitewing exam, a type of X-ray where the film is held in place by biting down on a cardboard tab. Those with tumors were also more likely to have had a panorex exam, a panoramic type of X-ray that shows all of the teeth on a single film. The meningioma patients were five times as likely to report getting the exam before age 10.

The researchers, led by Yale professor and neurosurgeon Dr. Elizabeth Claus, cautioned that such studies cannot prove a causal connection, but can find links that suggest a reason to be concerned.

The lifetime risk of developing a meningioma is quite small; about five out of every 100,000 adults will develop a tumor. In worst-case scenarios, the tumor can cause seizures or other problems when it compresses brain



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tissue. Claus says about half of the tumors don't cause any symptoms and don't need to be addressed. The study design did not allow researchers to estimate how much dental X-rays increase that risk.

The study, however, may have limited applicability for current dental practice. For one reason, the patients in the studies were predominantly older, with a mean age of 57, and had received X-rays years ago when slower film and less-advanced equipment presented a much higher radiation risk. Additionally, the study relied on patients' recall of X-ray history from decades earlier.

"We absolutely realize that recall bias is a problem," Claus said. "But you're not going to stop looking at questions because it's a problem."

The study did confirm an association identified by previous studies, and other researchers have found a patient's recall of dental X-rays largely match with his or her dental records.

"This is the association we found. We know this is past exposure, we know there are caveats, but it probably means that we should take a closer look at what we're doing," Claus said. "These people reported a much higher rate of obtaining these dental X-rays than the American Dental Association seems to suggest in their guidelines."

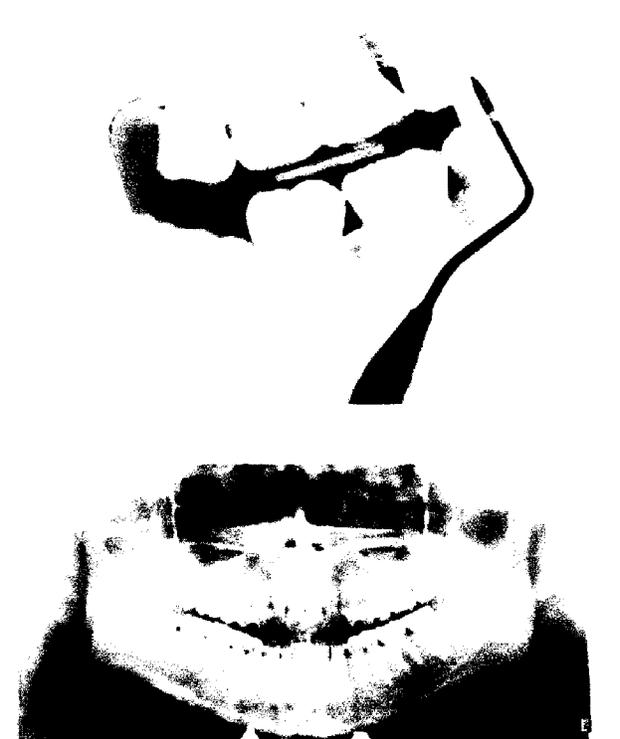
The dental association issued a statement acknowledging the study and its weaknesses, and pointed to its long-standing recommendation that dentists order X-rays for patients only when necessary for diagnosis and treatment. Current ADA guidelines call for one set of dental X-rays every one to two years in children, every 18 months to two years in teens, and every two to three years in adults. The guidelines say there is little evidence to support using X-rays of all teeth for patients who are not experiencing any symptoms.

Still many dentists routinely order four bitewing X-rays for their patients every year, and patients rarely ask why.

#### *Dentists react*

Dentists counter that while the risk associated with X-rays is real, it's very low and getting lower each year.

"Fortunately, the digital era has really reduced exposure," said Dr. Brad Hester, a dentist with Bend Family Dentistry. "It's made a big difference in how much our patients are exposed to X-rays."



Submitted photo



A modern digital X-ray exposes the patient to about a 10th the radiation of a traditional film X-ray. A chest X-ray provides 10 to 40 times the exposure of a dental film X-ray, and a CT scan in a hospital could be more than 1,000 times the exposure.

"It used to be pretty routine that everybody had four films taken every year," Hester said. "Now you see a lot more patients going out two, three years before you have to take a film."

The bitewing X-rays identified in the Yale study are crucial for allowing dentists to see cavities in between teeth where they otherwise elude detection. But the frequency of those X-rays should depend on the patient's individual risk of cavities.

"You don't take X-rays unless you need to see something that you can't see otherwise," said Dr. Cate Quas, a pediatric dentist with Bluefish Dental in Bend. "Basically, we can catch conditions that would otherwise be undetected."

The difficulty for dentists is finding the balance between reducing the frequency of X-rays and catching cavities early. Decisions have to be made on a case-by-case basis as cavities develop at different rates. Some children might do fine going a year or two between X-rays, while others could develop a cavity that needs dental work within a span of six months.

"If their risk factors are low — the parents don't have a lot of cavities, good diet, good home care, they keep them clean — you can really stretch how often you're taking X-rays," Quas said. "You predicate your decisions on what you're seeing from the patient's risk factors."

Dentists also rely on the guidelines from their professional dental societies, which can review the latest research and find the ideal balance between benefit and risk.

"The tightrope you walk is, 'What's the standard of care?'" said Dr. Greg Ginsburg, with Ginsburg Family Dental Care in Redmond. "If you miss something or you don't diagnose something because you didn't have an X-ray and you didn't see it, the risk of missing an infection, an abscess is probably greater than the risk of that minuscule amount of radiation."

#### *Complex work*

More complex dental work may also require more X-rays, so dentists and oral surgeons can locate key structures such as nerve canals or nasal cavities, gauge the size and location of cysts and tumors, or determine whether there's enough bone to handle an implant or other work.

"It's the only way we're going to know, and the last thing we want to do is have people guessing or speculating without that X-ray," said Dr. Keith Krueger, a Bend oral and maxillofacial surgeon. "We want to minimize radiation up until someone refrains from that and misses something significant because they didn't get this minimal exposure."

Krueger's work sometimes calls for advanced imaging such as a CT scan that provides a three-dimensional view of the teeth and jaw. Until recently, patients had to be sent to medical facilities to undergo a CT scan. Several years ago, technological advances led to cone-beam CT scanners, which can provide the same images within a dental office.

Hester also uses a cone-beam CT scanner in his office, mainly for patients getting dental implants. The scanner can give a precise 3-D image of the jaw bone, allowing Hester to place a virtual implant in the correct spot on a computer. The computer then guides the placement of the actual implant in the patient with remarkable precision.

The cone-beam CT scanner has been controversial in the dental community, with many raising fears that dental providers would broaden the use to more and more patients, potentially increasing their radiation exposures. While a cone-beam scanner uses less radiation than a medical CT scanner, it's significantly more exposure than from an X-ray.

And because the scanner is expensive — sometimes more than \$150,000 per unit — dentists who purchase it may feel a need to use it more often to offset the costs.

"I don't really sense the push to use it," Hester said. "We may use the machine maybe three, four times a week. But the peace of mind in those cases that you're doing is just invaluable."

Cone-beam has found its way into many orthodontists' offices because of its utility in designing and placing braces and other orthodontic devices. But there is concern that the use of CT scans in young children may have long-term consequences.

#### *Risk vs. benefit*

"The question with any sort of radiation is, 'What's the risk versus the benefit?'" said Dr. Steve Michel, a radiologist with Central Oregon Radiology Associates.

While Michel isn't involved in any dental imaging, just reading the radiation levels involved with digital X-rays today, he said, "The dose doesn't seem like a whole lot."

Michel said determining exposure levels from different scans is often difficult, because published levels represent averages across the country. There's been a huge shift in medical imaging toward using the least amount of radiation possible, and newer scanners and techniques provide a lot less risk than older models. With medical CT, Michel said exposure levels are less than half what they were when he went through medical training a decade ago.

"There's been just a huge focus in the medical community and a real attention to it," he said. "It's something I pay attention to every day at work."

That same focus may now be emerging among dental providers.

Eric Caldwell, a dentist with PureCare Dental in Bend, said his dental training stressed the concept known by the acronym ALARA. It stands for As Low As Reasonable Attainable, a catchphrase borrowed from the push to reduce radiation exposure in medical imaging.

"If we have an X-ray we've already taken, that is still enough information to determine some course of treatment even if it might not be perfect, it's enough to still make a decision, then we don't want to take another one," Caldwell said.

But in the end, dentists may have no other way of ensuring that patients don't have cavities in locations that can be viewed. The low dose of a digital X-ray every year or two may be the lowest reasonable exposure.

"You weigh the risk of having a cavity versus a very, very low dose of radiation," he said. "It tips way in the favor of having that information."

Caldwell uses guidelines from the American Academy of Pediatric Dentistry that call for X-rays every six months if kids have any cavity risk, and once a year in kids with low risk. They do X-rays even less frequently in adults with a low risk of cavities.

"It's a numbers game," Caldwell said. "Any radiation is going to put you at some higher risk. But we're talking about such small numbers."

Clinicians believe that repeated X-rays have a cumulative effect. Each scan may carry a small risk, but the more X-rays you have, the higher your risk. And while electronic health records are starting to track cumulative radiation exposure in the medical setting, there is little tracking going on in the dental arena. Most dentists now have computerized medical records, but those rarely follow the patient.

That's one of the issues the Yale researchers faced. The patients in their study had seen an average of six dentists over the course of their lifetime, and it was impossible to reconcile their memory with actual dental records.

Many dentists argue the radiation levels are so low with dental X-rays, they may not need to be tracked. A series of four digital bitewing X-rays is estimated to be the same level of exposure one gets flying in a plane at 39,000 feet for 90 minutes, or the difference in solar radiation from being at the high altitude of Denver for a week rather than at sea level.

Dr. Keith Black, chairman of the Department of Neurosurgery at Cedars-Sinai Medical Center, doesn't buy that argument.

"That's why it's important to look at these studies," he said of the Yale research. "You're comparing a controlled population who should be exposed to the same amount of flying and being in Denver, compared to the population that's getting these X-rays. You're seeing the increase."

Black said doctors know that ionizing radiation increases the risk of brain tumors, but they're still not sure where to set the threshold above which there is a higher risk. Because these tumors don't appear for 20 or 30 years, it can be difficult to conduct such studies. If there are any risks associated with digital X-rays now, they won't be known for decades, by which time the current imaging technology may be obsolete.

Nonetheless, he said patients should discuss the need for dental X-rays with their providers.

"I do think that most dentists probably do not believe that their X-rays are associated with a higher risk," he said. "But I think it's important that patients understand the risks and the benefits to be able to have an intelligent discussion as to whether or not the procedure is really necessary."

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