



## Implant imaging: Exploring the evidence

Dr Stuart C. White, professor emeritus and former chair of Oral & Maxillofacial Radiology at UCLA School of Dentistry, discusses "An ounce of prevention" in a 2004 guest editorial<sup>1</sup> and makes a compelling case for the use of advanced imaging such as computed tomography (CT) or cone beam computed tomography (CBCT) in treatment planning for root-form implants. He based his opinions on both his experience as an oral and maxillofacial radiologist and as a frequent expert witness in medicolegal cases. He added that in many instances, adverse outcomes may have been avoided by the use of cross-sectional imaging. I had the privilege of being a guest of Stu and Liza White at UCLA when I was invited to speak at the American Academy of Orofacial Pain's annual session in Beverly Hills, California. Stu and I have common interest in implant imaging, and I knew that Stu meant every word he wrote in his guest editorial. Stu has used a canal digital dive-in and fly-through simulation using CBCT volume for teaching and has served as an expert witness in multiple medicolegal cases. In one memorable case, he demonstrated to the jury that a dental implant penetrated completely through the inferior alveolar nerve canal. The patient's neurological symptoms were explained by the nerve injury. It was clear that the implant was placed without any regard to the 3D anatomy, resulting in the violation of the canal space. "The evidence was compelling," said Stu. "Technological innovations in imaging, as well as the digital capture and display of the information, changed everything," Stu said. I couldn't agree more.

As a current member of the position paper committee of the American Academy of Oral and Maxillofacial Radiology (AAOMR), my committee members and I are constantly on the lookout for the level of evidence required to work on our recommendations. Even though cross-sectional imaging via CT or CBCT is well accepted clinically and has been in place for more than a decade, the published peer-reviewed literature has yet to demonstrate the evidence that the CT or CBCT technique is superior to all other existing radiographic imaging procedures for placement of implants.

Among all the radiographic techniques that are in existence today, film-based intraoral periapical radiographs have the best spatial resolution. The digital counterparts for the films have reached the same levels of resolution over the years. In spite of the advances in the image resolution, they remain 2D. Panoramic imaging, also 2D, is actually even less of an appropriate choice for implant assessment due to its inherent dimensional distortions. The third dimension must be accurately demonstrated before the intraosseous placement

of root-form implants. Complex motion tomography, even though it shows the cross-sectional anatomy, is clinically impractical for the dentist.

Dental reformatting software, such as DentaScan (GE Healthcare), designed for medical CT volumes, came along as a more reliable implant-imaging solution before being replaced with more user-friendly CBCT hardware and software. CBCT was a good substitute for skeletal imaging and was DICOM-compliant with the ability to reconstruct the 3D images from the DICOM sets. CBCT quickly become an established implant-imaging modality. Quicker scan times and developments in the flat panel detector technology led to the acceptance of this procedure almost universally. CBCT has become the de facto standard of imaging for all implant-related procedures.<sup>2</sup> CBCT DICOM datasets are being used for fabrication of stereolithographic models. Software including SimPlant (Materialise), Nobel Guide (Nobel Biocare USA), VIP (Implant Logic Systems), and ImplantMaster (I-Dent) are used for virtual placement of implants. The evidence-based studies to authenticate their use in implant-related procedures are few and far between.

In a recent survey of active members of the British Society of Periodontists, it was found that over 80% of those surveyed did not follow the preimplant imaging guidelines and selection criteria authored by the Faculties of General Dental Practice and the American Academy of Oral and Maxillofacial Radiology.<sup>3</sup> This practice is troubling and perhaps represents a more global trend. Implant-related imaging should be repeatable, reliable, dose-sparing, and most importantly, affordable. It should be prescribed with regard for anticipated benefit to the patient. Implant dentistry should be practiced safely and predictably. High-level evidence-based studies are required to demonstrate the clinical superiority of a technique like CBCT over all other imaging modalities. There is perhaps no better time than now to initiate these studies.

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## REFERENCES

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