A 3-D imaging interview with Dr. Martin D. Levin

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Less than a decade ago, affordable 3-D imaging in endodontics was largely an unimaginable concept. Today, cone beam computed tomography (CBCT) systems are being adopted by an increasing number of endodontic specialists. The following is a candid conversation between endodontist and educator, Dr. Martin D. Levin, and the vice president of dental imaging for PracticeWorks Inc., Dr. David Gane, on the topic of high-resolution, focused-field CBCT, and its impact on endodontic diagnosis and treatment.

GANE: Why is imaging so important to endodontists, and is high-res CBCT the next big technology for endodontists?

LEVIN: Endodontics is an image-guided treatment that depends on visualizing the maxillofacial complex and the spacial relationships of anatomic structures. Radiographic imaging provides information on dental caries, the location and number of canals, pulp chamber size and degree of calcification, root structure, direction and curvature, fractures, iatrogenic defects, resorption, and the effects of periradicular disease. Any technology that moves us from 2-D-planar to 3-D-volumetric — especially at resolutions that allow us to visualize the anatomy in hundredths of a millimeter — facilitates a detailed understanding of a patient's condition. Let's face it: we're dealing with 3-D patients with 3-D restorations and 3-D disease, so why not use 3-D imaging to enhance our knowledge of these structures to improve the outcomes for our patients?

GANE: What exactly is focused-field, high-resolution CBCT imaging?

LEVIN: CBCT is an imaging technology used to scan and acquire a specified volume of the patient's jaw. It generates a 3-D dataset at a much lower radiation dose than its medical CT counterparts. CBCT represents the latest generation in medical imaging devices and provides numerous advantages — namely its accuracy, speed, safety, and cost effectiveness — over the other imaging modalities.

The two key terms that you've asked about are "focused-field" and "high-resolution," so let's look at each separately. First, focused-field units provide volumetric data on a limited region of interest. This reduces radiation to the patient and limits the need to interpret areas, such as the cranial base, airway, and vertebral column, which are often depicted on larger field of view (FOV) machines. Advantages of limited FOV include less time to generate an image and less time to read the scan volume.

Second, these volumes with spacial resolutions of 0.076 mm (Kodak 9000 3-D) and 0.125 mm (J. Morita Veraviewpocs 3-D) show exquisite detail, allowing us to view the lamina dura, missed canals, fractured roots, and other critical tissues — all in 3-D. Work by Bauman, confirmed by our own observations, suggests that resolutions on the order of 0.125 mm or less are optimal for endodontics.

GANE: Why did you decide to purchase a focused-field CBCT unit so soon after they were introduced?

LEVIN: I had been sending occasional patients for 3-D imaging studies for a few years, but was disappointed by the low resolution and significant radiation dose inherent in the larger FOV machines. Then Low et al. published research in the *JOE* comparing periapical radiography with limited CBCT in posterior maxillary teeth. They found that CBCT showed 34% more lesions than periapical radiography in the maxillary posterior. The evidence was clearly in favor of using the newly introduced focused-field unit produced by Kodak to meet the need for endodontic imaging in my practice. What's more, the capital outlay was low enough to make this technology available to all our patients.

GANE: As an endodontist well into your career, tell me what influenced your decision to purchase a CBCT for your practice?

LEVIN: Even though I have limited my practice to endodontics for the past 35 years, it's no secret that my patients benefit from advancements in technology that are proven advantageous by scientific findings. It just seemed like the right thing to do. Besides, these kinds of game-changing technologies inspire me to continually improve my services to patients and have fun at the same time.

GANE: How long have you had your system, and what was it like to navigate the learning curve?

LEVIN: Our practice has used the system for 18 months and has imaged more than 500 patients. Fortunately, it is easy to learn because the restricted FOV areas that are

imaged are familiar to us. The software is straightforward, and the scans can be easily uploaded to an oral and maxillofacial radiologist for cases that require over-reads. That said, our CBCT unit has the option of extending the FOV to produce a study of the entire maxilla or mandible. These full-arch scans are especially helpful to colleagues who refer patients to my office for implant assessment.

GANE: What can you tell me about the return on investment?

LEVIN: Coupled with Section 179 benefits and other tax incentives, our CBCT is cash flow positive, so ROI has been very favorable. The bottom line is that our patients, neighboring colleagues, and practice have all benefited from this technology. In addition, the discovery of occult findings has not only improved outcomes for our patients, but proven to increase the volume of endodontic procedures that our practice provides. Additionally, our system is multimodal, so we can incorporate panoramic imaging when indicated.

GANE: How does high-resolution, focused-field CBCT differ from standard CBCT systems?

LEVIN: The smaller scan volume creates opportunities for images of higher spacial resolution at lower doses. Since the initial sign of periapical pathosis is usually discontinuity in the lamina dura and widening of the periodontal ligament space, using a CBCT that provides the highest resolution image will allow the earliest detection of periradicular changes associated with pulpal disease. Standard CBCT systems cannot provide the needed resolution. Additionally, traditional medical CTs produce much higher doses of radiation, show much larger areas than required for endodontic therapy, and often cost much more. Where 3-D imaging is necessary in the dental setting, some radiologists consider CBCT as the standard of care.

GANE: I understand that you continue to use digital periapical and bitewing images on every new case referred for possible treatment. What percentage of your patients receives 3-D imaging? How do you decide when to use 3-D imaging?

LEVIN: My associate and I have imaged 58% of the cases that have been referred for consultation since we acquired our focused field CBCT system. Specifically, we use CBCT in three areas: preoperative assessment, as an intra-operative aid, and in postoperative evaluations. Clearly, all revision treatment, presurgical planning cases, and any diagnoses involving complex anatomy or a high degree of uncertainty are great applications for this technology.

GANE: Do you think that high-resolution CBCT could soon be as valuable an imaging tool to endodontists as the operating microscope?

LEVIN: While that comparison is interesting, both the operating microscope and CBCT imaging are now essential tools in our practice. We could not practice without both technologies. CBCT is a brilliant technological leap forward that helps us improve our pretreatment assessment and operative success. It also reduces the number of exploratory procedures, to the benefit of our patients. I am convinced that CBCT imaging will quickly be adopted by more of my endodontic colleagues as evidenced by the increasing implementation of this technology by the endodontic residency programs in the United States.

To learn more about endodontic applications of high-resolution, focused-field CBCT, send an e-mail to Dr. Levin at marty@endonet.com, or visit his Web site at www.endonet.com. DE

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Dr. David Gane has a long-standing passion for dental imaging, and has published and lectured nationally and internationally on the topic. Dr. Gane serves as vice president of dental imaging for PracticeWorks, the exclusive maker of Kodak Dental Systems. Reach him at david.gane@practiceworks.com.