Digital Radiography: Analyzing the Benefits
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Although fewer than 50% of the dental offices in the United States are using digital radiography, it is by no means a new technology. As digital radiography has been around since the early 1990s, what is occurring today is a maturing of the market. Advancements have come in terms of size of sensors and the ability for scanners to process phosphor plates more quickly. In addition, there has been the advent of 3-dimensional (3-D) imaging with cone beam. Now, there is a greater integration of the imaging with other modalities to provide better diagnostics and treatment planning. The sharing of images is making it easier for general dentists and specialists to communicate.

One perceived barrier to the acceptance of digital radiography has been cost. Practices must do an analysis not only of the benefits of digital radiography, but also the benefits of bringing the computer into the operatory. The technology makes it possible to better view radiographs on a 21-inch-wide screen or larger computer monitor rather than using the standard #2 size film. The ability to enhance the images makes for easier and more accurate diagnosis. In addition, the long-term stability of the image will be appreciated by dentists who have charts of old film radiographs that may have deteriorated over time. The digital radiographs taken today will be just as viewable years from now as they were the day they were taken. Also, instant access to all radiographs makes doing comparisons quicker and easier.

There are two types of digital radiography to consider—phosphor plates and sensors. Phosphor plates consist of a thin plate and are very similar to film; an office can use its existing RINN kit holders. The image is acquired from the radiograph head and the plate absorbs the energy. The image is then placed into a scanner, which can be considered the digital developer. The image is scanned and transferred to a computer monitor. While this process is slower then a sensor, it is still faster than film. Sensors, which produce the image directly via a USB or wireless computer connection, are faster then phosphor plates and produce a sharper, more detailed image. While both systems will produce a diagnostic image, at the maximum resolution settings phosphor plates can produce 15 to 20 line pairs per mm (lp/mm); sensors can produce 25 lp/mm. The quality of the phosphor plate images is lower than that of a sensor, but the human eye cannot distinguish above 12 lp/mm.

The price of sensors has come down slightly; some are now available in the $4,000 price range. The cost for a phosphor plate system is in the $8,000 to $10,000 range. The phosphor plates can become scratched and degrade over time. The cost for a new plate is in the $20 range. For those who take analog panoramic films, a larger phosphor plate may be used to replace the panoramic film—in essence, converting an analog to a digital panoramic machine. The cost of a phosphor plate scanner that takes panoramic size films is closer to $20,000. Because it is important to have a redundant system, having two sensors or a sensor and phosphor plate system enables work to continue in the event of a hardware failure.

AVAILABLE TECHNOLOGY
Cone beam volumetric tomography (CBVT) is one of the hottest topics in dental imaging. This imaging modality is no longer just for dental specialists as many general dentists are seeing the value of 3-D images. The newer cone beam machines can produce different size volumes, allowing the clinician to select the correct size for the image while reducing radiation exposure. A low-volume scan is good for implant planning, endodontics, and surgeries. A larger-volume scan assists with temporomandibular joint (TMJ) evaluation and airway analysis. Cone beam machines can now be obtained for less then $80,000, helping make the use of this technology more commonplace.

These 3-D images allow for very accurate diagnostics for many of the most challenging issues in dentistry. CBVT assists in treatment planning for implant placement, searching for missed canals, and issues with failing endodontics. Third molar removal has always been a challenge when attempting to determine the location of the tooth and the inferior alveolar nerve in efforts to prevent nerve damage. Planning the exposure of impacted teeth during orthodontic treatment is now easier. The information gleaned from seeing “everything” in full 3-D can dramatically alter treatment plans by providing information that wasn’t previously available.

For example, the Planmeca ProMax 3D ProFace (Planmeca Oy, www.planmeca.com) can produce volume ranges to view a single tooth or the whole skull region. One imaging session can generate both a realistic 3-D photo (no radiation) and a CBVT volume. Lasers scan the face while a digital camera captures the facial images. The soft-tissue images can be overlaid on top of the cone beam images (Figure 1 and Figure 2), enabling the clinician to
visualize the soft tissue in relation to the facial bones and teeth, making treatment planning easier and improving esthetic results. This imaging is available in Europe but has not yet received FDA clearance for use in the United States.

Siromon's new GALAXIS 1.8 software (Siromon, www.siromon.com) combines CEREC data with 3-D radiograph data from GALILEOS. Dentists import the virtual CEREC model and their restoration design to the 3-D radiograph volume and can consider all prosthetic consequences. The combination of CEREC and GALILEOS 3D data gives dentists the ability to ideally plan implant treatment based not only on bone availability, but also on prosthetic realities, and to better control implant treatment from start to finish—from planning ideal placement, to temporization (when appropriate), to custom abutments, to final restoration. Precise and economic surgical guides are easier to produce.

For those not yet ready to make the leap to 3-D CBVT imaging, there are panoramic machines that can be upgraded. Users can start with a digital panoramic, then upgrade when they decide 3-D images are needed. The new Genex GXP-700™ (Genex, www.genex.com) is an example of a modular imaging system that is upgradeable from 2-D panoramic to cephalometrics or 3-D cone beam with expandable fields-of-view, or both. So it is possible for one machine to image bitewings to TMD.

INTEGRATION AND COLLABORATION

One of the benefits of digital radiography is the ability to share and collaborate on images with colleagues. Many images are being e-mailed every day, but this is an insecure method of sharing and in most cases is a HIPAA violation. Such companies as Sesame Communications, (www.sesamecommunications.com) DentalShare (http://dentalshare.net), eDosse (www.edosse.com), and BrightSquid (www.brightsquid.com) allow secure HIPAA-compliant collaboration. Images are acquired and saved locally and can then be encrypted and uploaded to a secure server. An e-mail with a link can be sent to a specialist, who can then log into a password-protected account and view or download the images.

Determining the software to use in a practice may be more difficult than determining the best hardware. Clinicians must decide whether they want tight integration with their practice management software or a separate database. However, going outside the tight integration should not be a matter of great concern, as all imaging software bridges to existing practice management software. Clinicians should make this decision based on the features that are best for them and whether they want to be locked to a specific vendor. Most vendors will try to integrate a clinician's existing hardware, but it may become more difficult to add new hardware from other vendors. Many imaging devices are now using TWAIN drivers, which makes integration with existing imaging software easier.

There are advantages and disadvantages to all digital radiography. Clinicians must make purchasing decisions based on their individual practice needs, budget, and compatibility with their existing practice management software.

REFERENCES

