

Benefits of Digital Imaging in the Endodontic Practice

For an efficient and effective endodontic practice, equipment and technology choices seem to be endless.

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One aspect of dental technology, digital radiography, is extremely important for any dental practice. In the year 2000, when Dr. Scott Norton began his practice, he was determined to take the time to implement such technologies that would benefit both him and his patients. After researching and consulting with other practitioners, Dr. Norton decided on a digital radiography system that offered tools targeted toward endodontics so that he could plan for the best possible results.

Choosing a System

Over the years, Dr. Norton has had the opportunity to see many x-rays from colleagues and referring dentists. He chose a digital radiography system (DEXIS™) for its excellent image clarity, resolution, and contrast, all of which give him the opportunity to see key anatomical

anomalies that may not show up on traditional film radiographs or certain digital systems with lower resolution. One reason for this is that this sensor can capture 16,000 shades of gray, which enables a clinician to view even the subtle densities that are so important in endodontics.¹

Compared to traditional film x-rays, which are small and unchangeable, digital radiography offers more flexibility. It is imperative for endodontists to see anatomical aspects—such as the sinus, trabeculation of the bone, or the extent of dental resorption—very clearly. With digital x-rays, the clinician can lighten, darken, enlarge, change color, or invert an image in just one click of a computer mouse. Contained within DEXIS' software are the ClearVu™ image enhancement tool, which sharpens the details even more, the Spotlight magnifying tool, which can magnify very small areas of the tooth, and the Zoom tool, which can enlarge an image for a closer look.

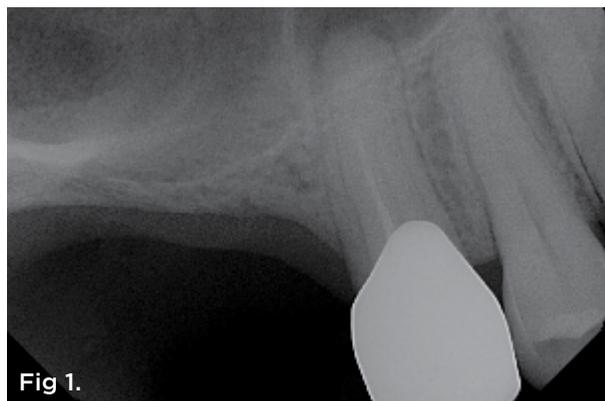


Fig 1.

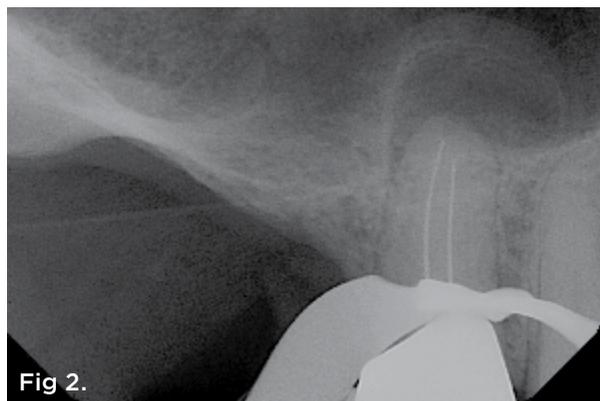


Fig 2.

Fig 1. During re-treatment with a second calcified canal shown, note how the root canal filling material is incomplete, and the original canal was off center, suggesting the presence of an additional calcified canal.
Fig 2. Working-length x-ray with files in place during the same procedure.

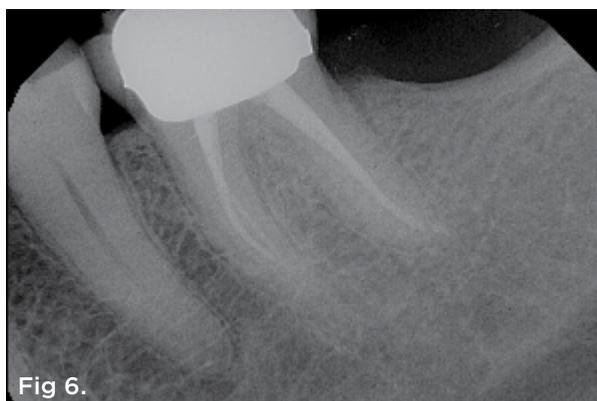
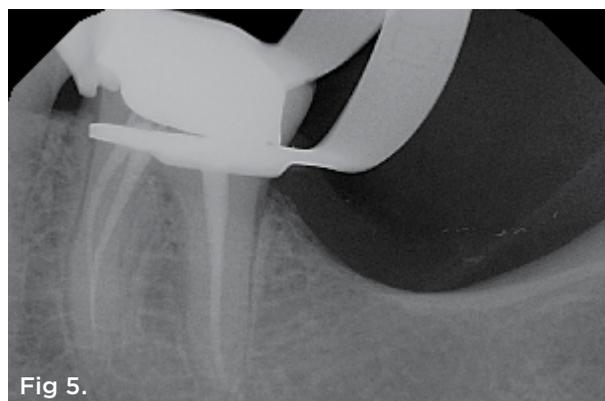
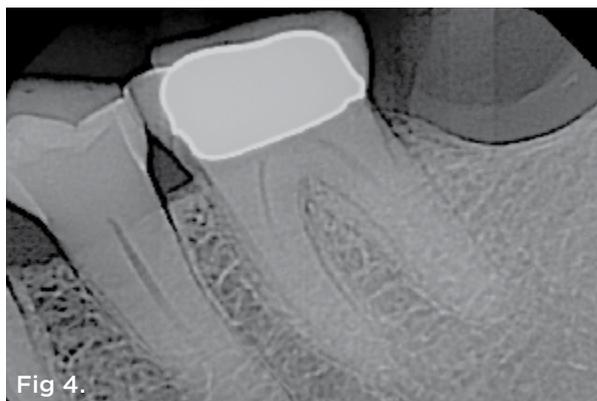
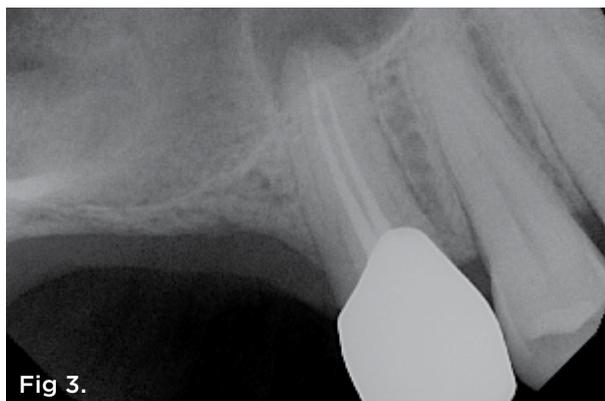


Fig 3. Final root canal fill with apical communication of the two canals during the same procedure. Note a small amount of apical resorption. **Fig 4.** The postoperative image. Note the apical dilaceration of the mesial canals. **Fig 5.** The digital x-ray clearly shows that all portals of exit are sealed. **Fig 6.** Digital imaging allowed the clinician to check the final fill before the endodontic temporary access was placed, and the rubber dam was removed.

Because of the need to take additional images under certain conditions, clinicians should appreciate that digital radiographs expose patients to less radiation than traditional film. It has been established that “under some circumstances, digital dental x-ray techniques can achieve 80% to 90% less radiation exposure than conventional x-rays when taking periapical films.”² Here again, it is important to research digital brands to find the one with the lowest radiation without sacrificing image quality. A study has shown that the radiographs from DEXIS “are more consistent and clinically usable at a wider range of exposure settings than other brands.”^{3,4}

Endodontic Applications

For specific endodontic needs, the DEXIS system is equipped with an endodontic module that Dr. Norton finds indispensable to his practice. For determining the length of files, the software has a helpful measuring tool. He always uses an electronic apex locator to determine the length of the canal, followed by a radiograph to confirm that measurement.

Because of the ease with which the sensor can be moved inside the mouth, he can use it to view the details that are imperative for a positive endodontic outcome. Precise digital imaging helps ensure a smooth and efficient root canal procedure. He can see if a tooth has four, five, or even (an unusual) six canals, or he

can take an image to see if there are lateral or accessory canals. There may be two or three mesial–buccal canals in a molar; if a radiograph indicates that the mesial file is off center, he can be fairly certain that the tooth has an additional canal (Figure 1 through Figure 3). Also, he can see internal or external resorption, and if that is the case, he can capture a CBCT scan to gather even more information. Further, while he uses his surgical microscope on every patient, he can also use the digital x-ray during the procedure to ensure that all the canals and anatomy are addressed.

After the root canal is completed, but while the rubber dam is still in place, Dr. Norton prefers to take a “check picture” of the root canal to make sure it is perfect and there are no gaps or voids before he puts the temporary in the endodontic access (Figure 4 through Figure 6). This is far easier with a digital system, which provides instant imaging results, compared with a traditional film x-ray, which must first be developed so the clinician can determine whether the area of interest was captured or if a retake is needed. This can prolong the appointment unnecessarily and is neither beneficial to the dentist nor the patient. The image can be taken with holders that can be used specifically with the rubber dam in place. This is an example of equipment that endodontists can use every day.

Patient Communication

In the digital age, communicating and educating patients on their condition is vital. Patients accustomed to using Google for information may have already researched online and determined what they *think* their condition is before arriving at the endodontic office. Sometimes an antibiotic prescribed by the referring dentist can lessen the patient’s pain when the infection that caused it remains. When the patient reports feeling better and believes that no treatment is needed, it is very helpful to take and enlarge a digital x-ray of



Fig 7.

Fig 7. A preoperative image of tooth No. 19 with partial calcification was securely e-mailed by the referring dentist, who also uses the DEXIS system.



Fig 8.



Fig 9.

Fig 8 and Fig 9. Pre- and postoperative images show the apical accessory canals and a portal of exit (POE) at the center of the endodontic apical lesion. Digital imaging helped the clinician to see this lateral lesion in the apical one third, which facilitated sealing the accessory canal/POE.

the infected tooth, and point out the infection at the end of the root. With a digital drawing tool, the infection can be circled or an arrow can be drawn pointing to it to help the patient understand why a root canal is necessary. The ability to magnify the entire image to fill the screen is already invaluable, and the Magnification tool takes understanding to the next level. Patients do not need to be trained in reading x-rays to understand these large, clear images. The Magnification tool is very helpful in other situations, as well; for example, when patients seeking emergency treatment forget their reading glasses.

Digital Workflow

Besides the images themselves, digital radiography facilitates efficient workflow. As noted above, digital x-rays do not need to be developed; they are up on the monitor almost instantly. Also, unlike film x-rays, they do not need to be mounted and numbered. With the software that comes with the system, the teeth are automatically numbered and put in a specified order. There are no file folders, no filing, and no searching for lost x-rays. That saves time and increases efficiency.

Yet another advantage of digital radiography is file storage. Digital files do not take up office space like paper files do. All of the x-rays that Dr. Norton has taken since 2000 are stored on his server and are frequently backed up. (He has several backups as a precaution.) If he has seen patients in 2000, 2004, and 2008, he can easily access those historical images and display them on the screen simultaneously. If he needs to obtain a 3D image, he can even import his CBCT images into the software so he can look at his 2D and 3D images at the same time. It is all done with the click of an import/export button. His digital system's video feature gives him the ability to document the details discovered

from the high-definition digital images and video from the camera attached to his surgical microscope.

Besides the clinical benefits, a digital system simplifies insurance claim filing. For example, for the re-treatment of certain root canals, Dr. Norton needs to show the extra canal that he was able to treat. For a case such as that, he can print out the digital image on high-quality paper and submit it to insurance, or he can send the images electronically.

A digital workflow also simplifies communication with Dr. Norton's colleagues. All referring dentists with whom he works receive reports on their patients. He can securely send all of those images regarding his treatment by HIPAA-compliant e-mail or by sending a printed copy by mail on high-quality glossy paper (Figure 7).

Conclusion

The details that an endodontist sees on x-rays have a profound effect on treatment (Figure 8 and Figure 9). Therefore, it makes sense to prioritize imaging and to research to find the unit with the lowest radiation possible that offers effective software tools targeted to the individual specialty.

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