Report from ADA's Tech Day
DICOM interoperability demo

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Dr. Emmott offers regular hands-on programs to selected dentists in his Phoenix office. At these seminars, you will receive personalized advice on setting up your office to maximize your high-tech future. To find out more, check Dr. Emmott's Web site, www.drylarryemmott.com, or call 602-279-1641.

The Digital Imaging and Communications in Medicine (DICOM) standard will allow dentists to transfer and view identified digital radiographs hassle-free on digital systems that are DICOM conformant. Dr. Larry Emmott explains how DICOM interoperability will work and why it will benefit dentists.

By Dr. Larry Emmott

The high-tech buzz at the 2002 American Dental Association annual meeting in New Orleans centered around a digital-image transfer demonstration program on Oct. 18 at Technology Day. The demo is the result of a revolutionary project that brought to the demo 10 vendors from the more than 30 companies working with the ADA toward interoperability within dentistry. Digital interoperability is the ability of different components from different manufacturers to work together.

For the first time, the participating vendors demonstrated how the international Digital Imaging and Communications in Medicine (DICOM) standard makes it possible to do the following in dentistry on digital systems that are DICOM compliant: transfer digital radiographs from one machine to another, from one application to another, and on a variety of memory devices, such as CDs and SmartMedia cards. (For photographs of participating vendors and speakers at the DICOM demo, see page 79.)

DICOM and essential data transfer

What makes the ability to transfer digital images so important is not just the transfer of an x-ray image, which can be done simply and in a variety of ways. It's important because the DICOM standard calls for the transfer of essential data along with the image.

Essential data can include the following information:

- Patient name
- Date image was acquired
- Tooth number

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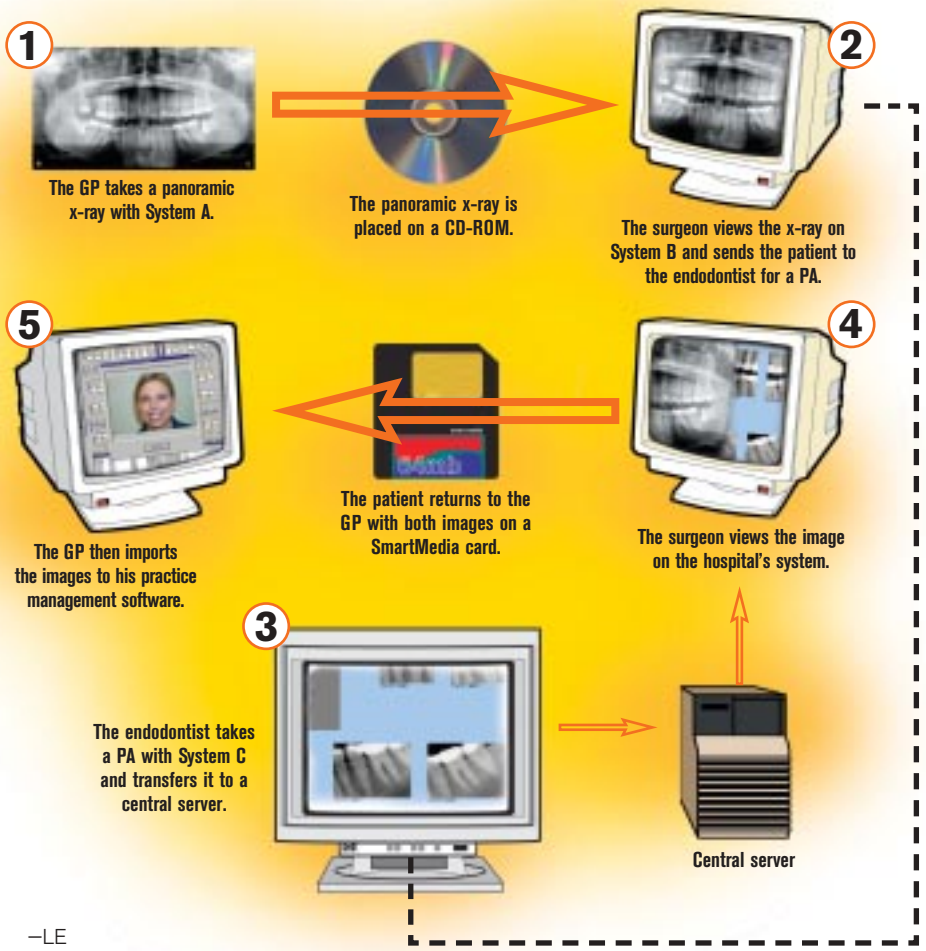
DICOM scenario: A demonstration of interoperability



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About this scenario

The scenario (below), illustrated in the flow chart (left), demonstrates the following:

- The transfer of images between four DICOM-conformant systems: Systems A, B, C, and a practice management program
- The ability to cross from dental to medial systems
- The use of removable media (such as a memory card) and a client-server transfer using a central server.

A few years ago, this scenario would not have been possible. With DICOM and the development of conformant programs, it is possible to do everything described here, right now.

The scenario

1 At the dental office (Taking a panoramic on System A)
A general dentist takes a digital panoramic x-ray of a patient's teeth with System A. He sees a possible lesion in the bone, and he refers the patient to a surgeon at a nearby hospital practice. The patient takes the x-ray to the hospital on a removable CD-ROM supplied by the general dentist.

2 At the hospital/with a surgeon (Viewing a panoramic on System B)
The surgeon views the panoramic x-ray with the hospital System B. (Note: DICOM is a healthcare-wide standard, which allows both physicians and dentists to view conformant images and the attached data.) The surgeon wants more information and needs a dental periapical (PA). The hospital system can't take a PA, so the surgeon sends the patient to an endodontist in the same building.

3 At the hospital/the endodontist's office (Taking a PA on System C and transferring it to a central server)
The endodontist takes a PA with System C. The image (and the attached data) is transferred to a central server in the building and then to the surgeon's office.

4 At the hospital/with the surgeon (Viewing panoramic and PA images on System B)
The surgeon views and enhances the panoramic x-ray from System A and the PA image from System C on the hospital System B and completes her diagnosis of the patient.

5 At the dentist's office (Viewing panoramic and PA images on practice management software)
The patient returns to his general dentist with a removable SmartMedia card from the surgeon. This card has both the original panoramic (from System A) and the PA (from System C) on it. The general dentist loads the images into his practice management software where they become part of the patient's digital record for storage and documentation.

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- Tooth orientation
- And more.

The benefit of arranging these critical data or information elements in a standard format is that the information can now be transferred, along with the image, in a reliable manner, and from one system to another, as well.

The old photo system

To understand the concept of essential data transfer, relate it to our old photographic system. A radiograph is just an image. Data elements—in the form of the patient's name, the date, and tooth numbers—are attached to the image by writing them on a mount or on an envelope that holds the x-ray. As long as the mount and the image stay together, we know all the details about the film.

However, sometimes the image and the identifying data are separated. Virtually every dental office has found an orphaned x-ray stuck behind the file cabinet at some time. With the data elements removed (in other words, with the mount missing), there is no way to ever determine whose x-ray it is and when it was taken.

DICOM standards are the equivalent of permanently attaching to a digital image an x-ray mount and all the data it contains.

Image transfer– without data elements

To appreciate how significant the transfer of essential data is, the Tech Day demonstration project started out with vendors showing an example of what might happen when the DICOM standard is not used and an image is transferred **without** its essential data elements attached

Here's the scenario:

A woman shows up at an oral surgeon's office with a disk that contains a simple digital photo of a radiograph with a possible odontoma.

The doctor receiving the image views the digital photo, but its orientation is not clear.

"Was it the right or left?" he wonders. (There is no way to tell.)

"When was the x-ray taken?" he wonders. (There is no way to tell.)

After additional conversation, it seems the patient isn't even sure if it is her x-ray.

Image transfer– with data elements

The demonstration project went on to show four other scenarios that transferred images between all 10 vendors with DICOM-conformant systems using a variety of media and network settings. As opposed to the failed scenario above, the scenarios worked flawlessly because the data elements were intact.

For an example of a successful scenario using systems that are DICOM conformant, see "DICOM scenario: a demonstration of interoperability" on page 76.

About the DICOM project

The DICOM project is a two-year effort led by Allan G. Farman, PhD, DSc, and the ADA's DICOM Working Group, which is part of the ADA's Standards Committee on Dental Informatics (electronic information).

Farman is professor and head of the Division of Radiology and Imaging Sciences at the University of Louisville School of Dentistry in Kentucky.

The DICOM project is in response to an ADA board resolution to accept DICOM standards for dentistry and demonstrate their effectiveness.

DICOM is an international standard that covers everything from hospital CAT scans to dental periapicals. It is the DICOM standard that determines the reliable transfer of information.

Note: In dentistry, there is a confusing situation revolving around the word "DICOM."

In addition to the international DICOM standard, there also is imaging software that uses the name "DICOM," namely,

DICOM Demo: Participating vendors
Vendors join together at a technical support desk to help demonstrate how DICOM interoperability works during a workshop on the standard given at the ADA's Tech Day on Oct. 18. The vendors participating at the demo represent the following companies:
- **Dentsply Gendex**
- **Dexis**
- **EagleSoft/Patterson Dental Supply Inc.**
- **Instrumentarium Imaging Inc.**
- **Medicor Imaging/Lead Technologies Inc.**
- **Planmeca**
- **PracticeWorks Inc.**
- **Schick Technologies Inc./ Patterson Dental Supply Inc.**
- **Sirona Dental Systems GmbH**
- **Trophy**

DICOM Demo: Key speakers
The key speakers at the DICOM Tech Day presentation are, as follows (left to right): Allan G. Farman, PhD, DSc; Larry Emmott, DDS; Claudio Levato, DDS; Dale Miles, DDS, MS, and Barry K. Freydberg, DDS (not pictured). All are members of the DICOM Working Group, which is a part of the ADA's Standards Committee on Dental Informatics.

PracticeWorks DICOM Imaging. The DICOM standard and the software are not the same. There are many DICOM-conformant programs, including one from Dexis, Planmeca, Schick Technologies, Trophy, and others. The software named DICOM is not the only conformant program.

DICOM's benefits

The DICOM standard will have many benefits for dentists, including the following:

Fewer steps. The addition of DICOM to a digital radiography system does not make it more complex for a user. All DICOM functions are invisible to a user, and using the standard does not require any additional steps. In fact, the user's number of steps will be reduced when transferring or importing images, as the user will not have to type in any patient data.

Interoperability. What's most important about a standard such as DICOM is that it is essential to achieving digital interoperability, which is extremely beneficial to consumers as well as doctors.

To understand how interoperability works to benefit consumers, let's examine a familiar, well-established, non-technical system for videocassettes. After going through a standards battle, videocassettes now use a VHS standard.

Here's what this means for you, the consumer, when you rent a movie on a cassette tape with the VHS trademark. The tape you rent could be made by Sony, while the movie's content could be made

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by Paramount. You take the tape home and play it on a Hitachi VCR, and you watch it on a Philips television. You deal with four different vendors from four different countries, and it all works together seamlessly.

The opposite of interoperability is proprietary. Proprietary systems attempt to confine users to a single brand. Many new products, especially in technology, start as proprietary but eventually the market forces the adoption of standards and interoperability.

In the past, all digital radiography systems were proprietary. As a user you were locked into one brand. For example, if you used a Trophy system you needed to use a Trophy sensor, with a Trophy capture board and Trophy software. If you wanted to change to another brand you would have to start all over again with a whole new system.

Investment protection. Another benefit of interoperability is that it protects the dentist's investment. To go back to the videocassette example, some consumers chose a Beta-type videocassette recorder (VCR). When Beta left the market, these consumers were eventually forced to abandon their old systems and invest in a whole new product. They had been *Betamaxed*!

A benefit of complete interoperability is that if you want to change or upgrade a system component, you can choose from many brands. If your brand leaves the market, you can replace components as needed with other brands.

The next step

The next step with the DICOM project is one that dentist's have been longing for: that is, the easy transfer of images on the Internet to colleagues and third-party payers.

It is now possible to send a digital x-ray to an Internet server. The server will store the x-ray and allow others—such as insurance companies or specialists with the proper access codes—to view the image. However, at this time, the images are a little like the old radiography films with a missing mount. There is no way to confirm the data elements, such as a patient's name or a tooth number.

Once the DICOM standards are applied, though, Internet transfer of images will become much more secure and acceptable to third parties. The DICOM working committee is drafting a standard for dental Internet transfers with data elements; the standard could be ready as soon as 2003.

'Are you DICOM conformant?'

The 10 vendors who participated in this project for Tech Day have put a tremendous amount of work into it. They have put aside their usual competitive caution, and their work has set the stage to help the dental profession more than it helps any of them. They deserve our thanks.

The best way to reward these vendors and others who develop DICOM-compliant systems is to buy their products. As consumers of digital-image products, especially digital x-rays, we need to ask vendors, "Are you DICOM conformant?"

If they aren't, do you really want to buy that product? It is in our interest as consumers to have standards and interoperability. Some vendors would rather not do it. However, if we expect a standard for interoperability as a condition of purchase, the market will quickly change.

The future of dentistry will be digital images. DICOM will make that future better; after all, the future is coming and it will be amazing! DPR

Photo credits

- Photos of panoramic x-rays and PA images on page 76 courtesy of Schick Technologies Inc.
- Photos of practice management system on page 76 courtesy of EagleSoft/Patterson Dental Supply Inc.
- Photos of vendors and speakers at the DICOM demo on page 79 courtesy of Allan G. Farman, PhD, DSc., University of Louisville School of Dentistry.