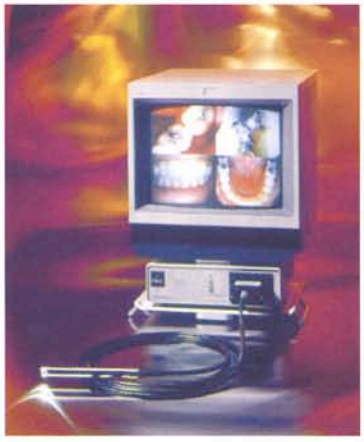
Intraoral Camera Technology

by Michael C. DiTolla, DDS

The field of dentistry was forever changed in 1987 when the first intraoral camera (IOC) was introduced. Essentially a miniature video camera that is inserted into the mouth to take sharp, up-close images of the teeth and mouth, the IOC has become a powerful diagnostic, educational and documentation device for the dental practitioner.

The IOC enables the dentist to see details inside the mouth that were not visible before and provides a powerful medium to visually demonstrate to a patient their dental health. As a result, dentists can perform better dentistry and patients can take a more educated, active role in their dental treatment decisions.



An intraoral camera system, consisting of a monitor, light source, and camera, with the camera and image processing components integrated into the mobile cord, module and handpiece.

Intraoral Camera Basics

An intraoral camera operates on the same principal as a standard home video camera system: an image is captured by a tiny microchip-sized camera (called a Charged Coupled Device or CCD) and sent through image processing electronics to produce full-motion video images on a monitor.

Five key components comprise an intraoral camera system. Ranging from manufacturer to manufacturer, these components are sometimes integrated together or combined for a more compact, efficient package.

- Light Source. For an intraoral camera to function, the mouth must be adequately illuminated so that the light-sensitive camera chip can effectively gather images. This light, provided by either a halogen or arc lamp, is focused into the fiber optic cord to the handpiece. Light emanating from the tip of the handpiece illuminates the subject for the camera.
- Optics. The images must be focused onto the tiny CCD. Some cameras use an endoscopic lens chain and/or an adjustable focus lens assembly. Other cameras have a fixed lens with specific optical characteristics for imaging teeth.
- Camera and processing electronics. The images captured by the CCD are sent to special image processing electronics that manipulate the information into an image.
- Handpiece. The intraoral camera's handpiece emits light to illuminate the viewing area while a lens at the tip focuses and captures the images for the CCD. Different intraoral cameras have their own unique handpiece feel and design, but should be easily maneuvered inside the mouth and feel as natural as any other instrument used for dental procedures.
- Monitor. The video output is corrected to a color monitor for viewing by the patient and dental staff.

In addition, other peripheral equipment can be incorporated into the intraoral camera system. This includes a foot switch to operate the camera, a video printer for color print-outs of selected captured images and interchangeable lenses for different focal lengths.

How To Choose an Intraoral Camera System

When researching intraoral camera systems, a good place to start is right in your own practice. You should fully understand your practice's needs and goals and how an intraoral camera can play an important role in your practice's growth.

Some basic things you should know prior to contacting manufacturers and scheduling demonstrations are: How many rooms are you going to equip with an IOC? Is the ability to integrate the camera with a computer system important? How easily will the camera grow with your practice? How readily available is service and replacement equipment?

One of the best ways to learn about intraoral cameras is by speaking with your colleagues. Find out who has an intraoral camera and what their experience has been, their likes and dislikes and what they would change.

Today, there are several manufacturers with cameras on the market, ranging from basic single-operatory models to

Intraoral images can be captured and displayed on screen in multiples for viewing and comparison for the patient. The screen can be printed out on a color printer and given to the patient or filed for future reference.

portable multiple-operatory arrangements. Upon trying various cameras, you may find subtle differences between models.

Although image quality, ease-of-use and price are important factors, the long-term stability of the manufacturer/distributor and the services they provide is most important when making any major capital purchase. You have to feel comfortable with your suppliers and their ability to service their product – in addition to feeling comfortable with the image itself. You may be drawn to all the high-tech gadgetry, but what you should be buying is the manufacturer.

How To Integrate an Intraoral Camera into the Practice

Once you have an intraoral camera in your practice, learning to use it may take some practice, but overall it is not very hard to learn how to operate the instrument. The bigger challenge is incorporating the camera into your exams and procedures so that both you and the patient realize its full benefits.

For many dentists and hygienists, the camera becomes the very first instrument they pick up when examining a patient, and is often used again and again during procedures and consultations.

One scenario is to have the hygienist perform the initial exam with the camera and have a few relevant images on the screen when you come into the room to check the patient. Then during your consultation, refer to the captured images and use the camera to illustrate greater detail.

As I mentioned, this is just one way to bring the camera into your routine. Each dentist will find an optimum method that fits his or her style and practice philosophy.

Benefits of an Intraoral Camera System

Unlike other equipment, the intraoral camera directly benefits the dental professionals who use the camera, the patients who are examined with the camera and the dental practice itself. The following is a brief description of what benefits an intraoral camera can deliver if used consistently and properly.

Patient Education and Interaction

Using an intraoral camera as part of every dental exam is very beneficial in developing a strong dentist/patient rapport, as well as improving the patient's understanding of their dental health.

The images are not a replacement for interaction with your patient. Instead, they are a truly compelling visual aide when outlining a treatment procedure or illustrating ways to improve their dental health. The dentist must learn to effectively communicate with the images, not solely rely on them.

For example, many patients have not seen their back teeth and the discoloration or build-up of tartar often found on them. The images can clearly illustrate this problem to patients and is particularly persuasive if you are going to recommend extensive treatment. If you have a color printer connected to your camera, you can print out relevant shots and give to the patient to remind them of the condition of their teeth.

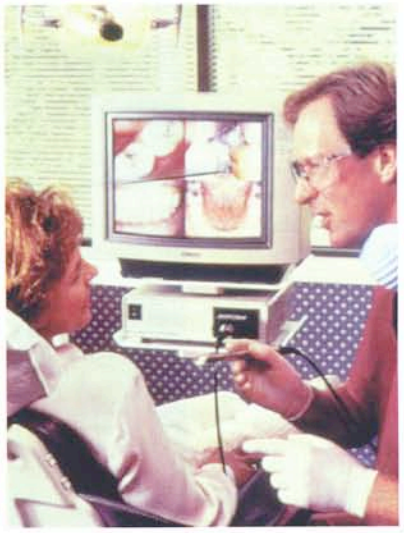
Increase Treatment Acceptance

Getting patients to complete the treatments you recommend in a timely fashion is not that easy. What an intraoral camera can do is reinforce the value in the recommended treatments and make the completion of the treatment more of a priority.

For example, you may see that two teeth need crowns, but the patient doesn't schedule the procedure because they are in no immediate pain or discomfort. With the camera, the images can make the need more apparent (they can easily see the condition of their teeth with their own eyes) and create value for its need. For greater reinforcement, you can use a previous patient's before and after intraoral images to illustrate how the same treatment benefited another patient.

Practice Building

The result of increased treatment acceptance is not only more healthy patients, but a source of revenue to further build your practice. The correlation between a greater percentage of patients completing recommended procedures



In this operatory, the patient and dentist can view the intraoral camera images on the video monitor and discuss treatment options or compare before and after images.

and the growth in revenue can be made once a camera system is incorporated into a practice. You can do your own comparisons and see the difference.

In addition, the camera can be used to build your practice in another, less thought of way — building loyalty with your patients and word-of-mouth knowledge about your practice.

Intraoral images can be a strong marketing tool that can reinforce a patient's decision and help them feel better about their dental health. Images can be incorporated into direct mail

pieces or placed in inexpensive frames and sent to their homes or work.

These unique practices, and the use of high-tech equipment in general, can get your patients talking about your practice to their friends, co-workers, etc. Just imagine the conversation generated by sending a framed photograph of their most recent dental work to a patient's workplace.

Before-and-after Documentation

Intraoral cameras give the practitioner an immediate medium to create a before-and-after comparison for the patient. Showing the patient the results of your work can boost their confidence and make them more appreciative when they pay the bill.

Thus, 35 mm cameras that are commonly used for before-and-after documentation can be replaced with quicker intraoral imaging. Intraoral cameras can capture full smiles just as a 35mm camera but can also provide magnified images for more detailed documentation.

During restorative dentistry, images captured by the camera can help the patient see the progress of their treatment and give them tangible proof of their procedure – as well as more appreciation of what has been done.

A Diagnostic Tool

The biggest beneficiary of an intraoral camera is the dentist. Due to the camera's ability to provide close-up images of teeth and gums, the dentist will be able to see details that were being missed with either the naked eye or loupes. Some cameras provide up to 40x magnification, a vast difference than what you can see using conventional tools.

For example, what if a patient comes into the office complaining of a tooth ache, but isn't exactly sure which tooth? With close scrutiny, the camera can help you find a small crack or pit that was not visible either on an X-ray or with the naked eye.

Root canals are another procedure that can benefit from an IOC. The camera can be helpful in searching for and locating a fourth root. The increased magnification from the camera gives the practitioner a closer view of the root.

Patient Education

One of the best ways to educate a patient to improve their dental hygiene habits or proper hygiene techniques is to show them and to reinforce with information about the consequences of not following your or your hygienists direction. The intraoral camera is an effective aid in this area due to the quality images of the patient's mouth.

The hygenist uses the intraoral camera to identify potential problem areas for the dentist and show a patient specific occurrences, such as their gums hemorrhaging blood during a cleaning.

On the monitor, the patient can see (in some instances at great magnification) exactly what you see much more clearly than in a mirror. For example, during a routine cleaning, the hygienist can show the patient their bleeding gums and explain why this is happening (tartar build-up) and what they should do to correct it (proper dental hygiene techniques).

Insurance Claims

Intraoral image print-outs can be submitted with insurance claims as documentation and proof for all types of procedures. The image clarity and variety of focal lengths can help build a visual case for a treatment and can be more persuasive than written explanations.

For example, an X-ray image does not visually illustrate how wide a filling is. This information is important in determining if a tooth is weakened by the need for a filling and requires a crown to keep from falling apart. Typically, a written report would be sent with the claim describing the procedure and its need. Some insurance companies may not clearly see that need. An intraoral image, sent with the claim, would clearly demonstrate the necessity of the procedure.

The next step with intraoral images and insurance is the development of electronic claims. With a computer modem, intraoral camera images can be sent electronically to an insurance company equipped with a modem.

Integration with Practice/Image Management Software

Recently, practice management software has increased significantly in acceptance. Many intraoral cameras can be integrated with software programs to provide electronic files of images. These files can serve many purposes, including safe, convenient storage and quick access to a patient's images. The compatibility of intraoral cameras varies from system to system, but be sure to inquire about this ability if you use or plan to adopt a practice management software program.

The Future of Intraoral Technology

Intraoral camera technology will continue to grow in the coming years as the systems begin to expand in functionality. In addition, new peripherals are being introduced that can be easily incorporated into intraoral camera systems. One exciting development is the integration of intraoral camera systems and digital filmless X-ray technology, otherwise known as digital radiography. By the end of the year, there will be intraoral camera systems available that not only provide intraoral camera imaging but the ability to incorporate filmless X-ray into the same light source and monitor. The result will be X-rays that are displayed direct to a video monitor instantly, without waiting for them to be developed and without the need of a computer system.

Digital filmless X-ray brings several unique advantages, including significantly reduced radiation exposure and no chemicals. By incorporating this technology with an intraoral system, the benefits of owning an IOC grows.

Another option available soon is the ability to capture an image of the mouth

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and, with the aide of a software program, manipulate the image to show the "after" results before a patient starts a procedure. This is of special interest to the cosmetic dentistry practitioners where they can capture a smile, modify it and show it corrected.

Intraoral cameras can evoke all kinds of responses from you, your staff and your patients. While your patients might remark that "I've never seen my teeth before" after an intraoral exam, you may be thinking the same thing at first. It is obvious that the intraoral camera can be a very beneficial investment for your practice and your patients. ■

ABOUT *the author*

Michael C. DiTolla, DDS did his undergraduate work at Occidental College in Los Angeles and received his Doctor of Dental Surgery degree from the University of the Pacific in San Francisco. Dr. DiTolla is a fellow in the Academy of General Dentistry and is also a graduate of the FORCE Orthodontic Institute, the Las Vegas Institute for Cosmetic Dentistry and several Clinical Research Associates participation clinics. He is also the author of numerous articles for several dental journals and is a monthly columnist for the nation's fastest growing practice management newsletter. Dr. DiTolla has spoken in over 50 cities since 1994, and as one of the nation's defenders of fee for service dentistry, has shown dentists how to build and maintain the practice of their dreams.

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