

Efficient & Effective Use of the Intraoral Camera

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This course is no longer offered for Continuing Education credit.

This continuing education course is intended for the entire dental team: dentists, hygienists, dental assistants, business employees, dental students, dental hygiene students, and dental assistant students. This course will provide a broad range of techniques and parameters with which to best utilize an intraoral camera within the dental practice. Intraoral cameras provide easy-to-use, high definition magnification and are one of the most powerful diagnosis and teaching tools within dentistry. Knowing the advantages and limitations of the intraoral camera will empower you to be an outstanding, cutting-edge clinician in this age of innovation.

Conflict of Interest Disclosure Statement

- The author reports no conflicts of interest associated with this work.

Overview

Intraoral cameras (IOCs) had their debut in dentistry in 1987. Since then, their evolution has been profound. They have transformed from oversized mobile units to pocket-sized lightweight wands; from time consuming to use, to time efficient sensations; from crude, analog to high-definition, digital images. This course will help you embrace and excel in the art of IOC usage by demonstrating techniques that will make it easy to use, resulting in dramatically increased patient understanding and treatment acceptance.

One of the biggest advancements of present day IOC technology is the ability to interface with most practice management software, thus allowing storage and transmission of magnified, high-definition oral images and video. As a result, this advancement has catapulted dentistry into a new information integration era.

While the dentist and hygienist will be the most apt to use the IOC routinely, the dental assistant can have a significant role in using the IOC chairside. This is especially applicable when the dentist is performing a hygiene exam. The dental assistant should utilize this time to review future potential work with her patient using the IOC. Business team members must become “hands-on” with the IOC images themselves and should know precisely how to use *and share* each custom image with patients, referring doctors and insurance companies to ensure optimal understanding and care, in “larger-than-life” detail!

Learning Objectives

Upon the completion of this course, the dental professional should be able to:

- Understand the history of photography in relation to the practice of dentistry.
- Ascertain the evolution of the IOC.
- Be familiar with how to manipulate an IOC wand to focus and capture intraoral images.
- Understand how IOC images can be stored and referenced within dental practice software.
- Distinguish proper and improper disinfection techniques for IOC wands.
- Explain the advantages of color image magnification to the patient.
- Explain relevant dental conditions as they relate to each patient’s status.
- Describe various uses for IOC images (post-patient examination).
- Identify landmarks that may indicate various breakdown or disease conditions within a tooth.
- Understand how to use IOC images to monitor and track changes in oral soft tissues.
- Distinguish between fractures or craze lines within an IOC image and how each should be treated.
- Discuss with patient various conditions that may be present on intraoral images and optimal treatment options.
- Explain at least 5 different educational applications for using the IOC.
- Understand how each dental team member can best utilize the IOC or IOC images on the patients’ behalf.
- Distinguish legal parameters for utilizing patient IOC images outside the scope of the dental practice (i.e. internet, advertizing, etc.).

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History of the Intraoral Camera (IOC)

If a picture is “worth a thousand words” then modern dentistry has proven over the past several decades that imagery conveys an understanding of critical conditions. First accounts of intraoral

photographs can be traced back to 1839. That was the year the first process of photography was presented to the world by Louis J. M. Daguerre at the Paris Academy of Sciences on January 7th. Later that same year, Alexander S. Wolcott, a manufacturer of dental instruments from New York, designed and patented the first camera from the Daguerre concept.¹ These early photographs were called “daguerreotype” after their inventor and were a one-of-a-kind image on a silver-coated copper plate.² Until this time, all visual representations and descriptions of dental conditions and procedures were subjective interpretations expressed through drawings or models. The “photographic phenomena” introduced a new era of objectively reproducing and recording visual dental images. This new era observed the inception of the world’s first dental journal, the American Journal of Dental Science,³ and for the first time in literature preoperative and postoperative photographs were published by Thompson and Ide.⁴

Since that time Dentists have used extraoral cameras with precision to capture images within the oral cavity. Photographs could capture and monitor oral conditions to be used in ways that allowed a dentist to predictably create the most aesthetic outcomes when fabricating restorative and cosmetic cases (Figures 1 & 2).

The debut of the first true IOC that captured images from inside the mouth came with the launch of the first Analog IOC System in the late 1980s. Fuji Optical Systems of Los Gatos, CA acquired the first registered trademark of an intraoral camera on July 7, 1987. Fuji

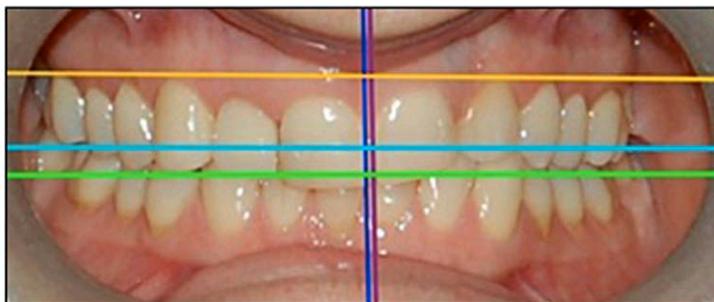


Figure 1. Secondary reference planes for determining positioning

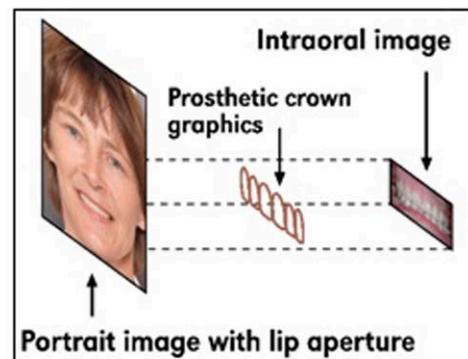


Figure 2. Teeth & Lip aperture cosmetic measures for use in photographs
Photos courtesy of Dr. Davor Hribar



Figure 3. DentaCam™, original intraoral camera system
Photo courtesy of Patterson Dental

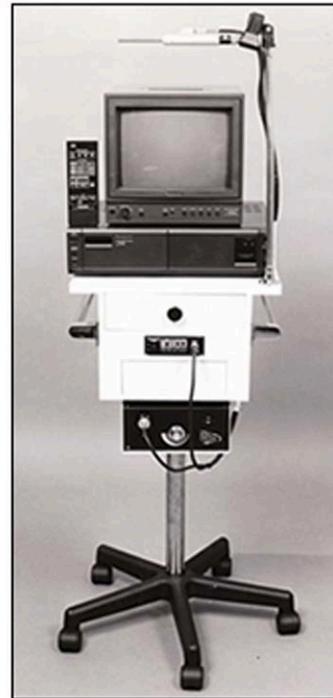


Figure 4. Oral Video Scope (OVS) from 1989

then released their IOC technology as the DentaCam™ under Patterson Dental Supplies later that same year (Figure 3).⁵

The Fuji DentaCam™ IOC was a derivative of a medical grade unit and sold for \$35,000 as a cart system with a monitor and printer. About that same time, Video Dental Concepts™ also launched an intraoral camera (1989), using a dental endoscopic handpiece. The design was revolutionary and included components from Panasonic Industrial Camera Division (NJ) and ETS Groux Optical Corp (France). This was the first component based IOC using a light source, a remote head micro camera and a dental endoscope. It inspired and set the standard for over a decade. The Oral Video Scope (OVS), cart and printer sold for approximately \$12,000 (Figures 4 & 5).⁶

In different areas of medicine, particularly in gastroenterology, endoscopes had been used for many years. The potential of miniature intraoral cameras improved as manufacturers improved them. Simultaneously, so called imaging systems were being used in many areas of medicine and industry with which digital photographs were



Figure 5. Original design dental endoscope handpiece
Photos courtesy of Video Dental Concepts.

taken (home, clothing, face) and then enhanced with the aid of software and computer. This re-imaging concept was introduced to dentistry in the late 1980s and was used to change anatomical oral outlines to be used to aid in treatment planning and patient education.⁷

According to the March 2009 Dental Products Reports Technology Survey, 68% of practices have an intraoral camera, and 69% of practices with computers in the operatory have an IOC camera connected to their computers.⁸ Extraoral and intraoral images are used for patient education and clinician erudition. While the images are not considered diagnostic, they play a role to augment and enhance diagnoses when paired with other diagnostic measures like radiographs.⁹ Typically IOCs magnify teeth 40 to 60 times their original size. This allows discovery of certain types of details and defects instantly in bigger, better format than ever before possible.

Types of Images

Original IOCs were analog in nature. The word analog means to measure or represent data by means of one or more physical properties that can express any value along a continuous scale.

For example, the position of the hands of a clock is an analog representation of time.¹⁰ Original analog IOCs plugged into a monitor and printer. The images could be viewed and printed. The early form of storage was a VCR. Movies of the patients mouth were recorded on VHS tape. In 1991, Panasonic introduced a video floppy recorder using a 2" disk that cost \$10 and could only hold 50 pictures. Hence, storage of analog was costly and cumbersome at that time (Figure 6).

Printing was through dye sublimation printers and printed copies would degrade over time.¹¹ This limited the practical use of analog images to real-time viewing and paper printing. As digital imaging improved through the late 1990s, it slowly replaced analog imaging as the optimal choice for most dental offices because digital representations were smaller to store, could integrate with dental practice management software and produced a high quality picture.

Early digital imaging systems utilized video capture cards to convert an analog image to a computerized digital image. There are many ways to convert an analog image, but many dental offices will use a video capture card installed in the



Figure 6. IOC video floppy disc recorder & printer (circa 1991)
Photo courtesy of Video Dental Concepts

treatment room computer. To do the conversion, the video output (either composite RCA or S-Video) from an IOC is connected to the capture card, which then converts the analog video to a digital format. Once you freeze the video image, computer electronics can capture, store, enhance, or print that image. In other words, the computer replaces the analog-printer which was considered the memory of the old analog IOC system. Still today, some IOCs with analog composite output can be used with video capture cards, others have direct USB output. For these, it is not the camera that makes it a digital system; it is what you plug it into.¹²

Today, IOCs can be either corded or cordless direct USB to the PC or through a small docking station. The cords of direct USB cameras house both power and interface data transmission to dental software. Cordless units are set on a power docking station or may contain batteries for power. Wireless receivers transmit the data to the computer or video networks. Cordless IOC units are very convenient to use and transport from operator to operator. However, original designs were known to pick up occasional interferences with radiography emitting devices or other technology such as cell phones, landlines and internet connections. Also, internal batteries had difficulty staying charged. Newer cordless/wireless IOC units use lithium ion rechargeable batteries which eliminated this problem, and drastically increased the duration of the charge and life of the battery.¹³ Contemporary corded models are electric powered and have a quick disconnection so that only the IOC handpiece need be transported from room to room. They are lightweight, easy to transport and do not rely on batteries.

Quality & Illumination

Visual illumination also plays an important role in the quality of an IOC image. The rule is “the more light, the more depth of field”. Original systems typically used very high-end optics to produce the best image quality possible. The light source was in a separate “box” and there were fiber optic cables running from that box to the IOC handpiece. Until very recently, these were the only types of IOC systems available. These camera and light systems were quite heavy and difficult to move from operator



Figure 7. First mobile IOC (circa early 1990s)
Photo courtesy of Video Dental Concepts

to operator. Some of the original camera systems were so heavy that a cart containing all components (camera, light source, monitor, and printer) was the best way to transport and utilize the IOC system. This made fiber optic IOC systems troublesome to use. These large, portable cart systems were very impractical (Figure 7).

Many dental clinicians found this inconvenient and the IOC units began to sit and collect dust instead of being actively used. One of the solutions offered was to put a docking station in each operator. While this made carrying the camera much easier, it added on around \$500 - \$1500 per operator to the overall cost.¹⁴

The inconvenience and bulkiness of the 1990s design of IOC systems motivated manufacturers to develop LED and USB camera systems. USB stands for "Universal Serial Bus." USB is the most common type of computer “port” or “plug-in device” used in today's computers. USB-IOC cameras are typically very lightweight, easy to carry from operator to operator and convenient to use unlike their predecessors. The USB light source is built into the IOC handpiece, usually as a ring of LED lights around the lens. Like all systems, there are pros and cons. Inferior quality LED lights can sometimes produce a reflection on

wet objects distorting a picture. Also, USB devices require a small piece of software called “a driver” be recognized for the USB camera to “bridge” and work with specific software. This again adds cost (per-operatory) to operate a USB-IOC system.¹⁵

As of 2010, there are seamless software solutions available from IOC manufacturers that provide software drivers or “smart drivers” allowing the USB-IOC to directly integrate with most dental imaging capture software. These designs can be a less expensive software compatible solution for most dental offices. Most use a proprietary interface from the IOC to dental software (Figure 8).¹⁶

Choosing an Intraoral Camera

There are many factors to consider when choosing an IOC System. Present day IOC systems are generally digital in nature. When choosing an IOC for your clinical setting it is important to consider these factors:

- Intent of Use
- Compatibility & Integration with Practice Software/Specifications
- Space or Bulk of IOC Unit
- Ease in Handling



Figure 8. DiscoveryULTRA with USB
Photo courtesy of Videodental.com

- Image Quality
- IOC Features
- Cost

Researching various IOC options for your practice can be done easily, using the internet or having various manufacturers bring IOC units to your office for demonstration and discussion. During your research you can create a list of “must have” and “have not” options that will influence your final purchase. Experienced dental equipment professionals can assist with ensuring that your IOC system integrates and performs for your intended use.

IOC images have many practical uses within the clinical setting. While the images are primarily used for chairside patient education, they can also be stored within the patients records to be shared with insurance claims reports, other dental specialists or even to be printed/disc copied for reference within the patient’s proposed treatment plans. Image enhancement or video capture capability, are also options for the dentist to consider. Deciding if storage of the images is important and particular use of the images will help influence the type of IOC system you purchase and what type of computer imaging interface you will need. These specifications are best discussed and decided with the help of a dental technology equipment specialist since they can vary from manufacturer to manufacturer. In its simplest form, image management is like an electronic photo album. It allows you to capture, store, retrieve and display an image. However, unlike a paper photo album, with digital image management you can also transmit or enhance an image,¹⁷ which is useful to present “before-and-after” restorative treatment outcomes to patients.

An IOC will be most utilized within the clinical dental setting if it is easy to use. If there are clinicians in multiple treatment rooms, plan to use the most convenient, portable IOC equipment designs. Small, lightweight models are ideal and less cumbersome to store and transport. IOC handpieces and docking stations need to have easy access to software “plug-in” ports. This means reaching into an operatory without disturbing another clinician and patient, needs to be precisely thought out when designing your IOCs functionality.

How easy your IOC is to handle is another important consideration. Contemporary focus options are most commonly designed as “auto-focus” or by a “twist or tap” setting within the IOC handpiece. Image capture options have evolved from remote control (which required a second operator to assist with image capture) to foot pedal or handpiece button capture. The foot pedal method can be challenging as it requires more body movement from the clinician and can cause distortion during the actual image acquisition. Handpiece buttons with sensitive tap controls seem to be the easiest to use.

Image quality of an IOC depends on many factors: sharpness, noise (variations in density), dynamic range of color capture, tone reproduction, contrast, distortion, vignetting (light fall-off), exposure accuracy, color fringing (which causes the lens to focus at varied distances), lens flare (glare of stray light), artificial color banding and artifacts (low-contrast detail or over-sharpening that can occur during software conversion). All of these factors affect digital image quality.¹⁸

Every digital image consists of a fundamental unit called “a pixel”. The pixel, invented by combining the words “PICTure and ELEment”, represents a single color dot, combined with millions of other color dots, to seemingly create a detailed, continuous image. Each pixel contains a series of numbers which describe its color or intensity to the computer’s software. The terms pixels per inch (PPI) or dots per inch (DPI) were both introduced to relate this theoretical pixel unit to real-world visual resolution.¹⁹ IOC images are measured by these terms in combination with the above listed factors to indicate the quality of an IOC image.

It is apparent that many features associated with IOCs play a role in selecting one for clinical use. The options include:

- Macro-to-infinity focusing
- Anti-fog lens
- USB interface
- Corded / Cordless
- Lithium battery powered / Direct power
- Etc.

The options are complex and seem endless! Ted Takahashi, noted intraoral camera expert, suggests following a more simplified approach when choosing an IOC system.

Key Feature Areas to Consider

Quality of construction: make sure the camera docking station and power connection plugs can withstand the punishing 2,000 insertions and detachments it will have to endure per year. If corded, inspect that the cord has “strain relief” or will it ultimately fray, leak and create “water spots” on image displays and printouts.

Depth of field: with the IOC wand inside of the mouth, note the amount of viewing area that is in focus. Superior IOCs require little or no focusing inside of the mouth.

Artifacts & Optics: compare what you see in the mouth to the monitor. Lighting will play a role in this, so it is important to have an in-office demonstration under typical operatory lighting conditions. The optics distinguishes a good IOC from a more inferior one. The best optic systems are created by placement of the CCD chip at the end of the wand next to the lens. This is more expensive than placing the CCD chip in the middle of the wand. When the CCD chip is in the middle of the wand an additional prism is used to direct the incoming image farther down the wand to the CCD chip. The addition of the prism degrades image quality and produces more artifacts (Figure 9).²⁰

Artifacts can appear as either low-contrast detail or over-sharpening. They can occur during software conversion resulting in an unreliable representation of present conditions. Avoid purchasing an IOC with high artifact quotient.

Evolving Market

Through the years well over 150 companies have developed intraoral video cameras (IOVCs). IOVCs had component-based cameras that required little engineering as they emerged from 1988-1995. IOVCs are considered Class I devices which are not regulated by the FDA and do not require FDA 510-k certification. As LED and special optics were introduced and as the

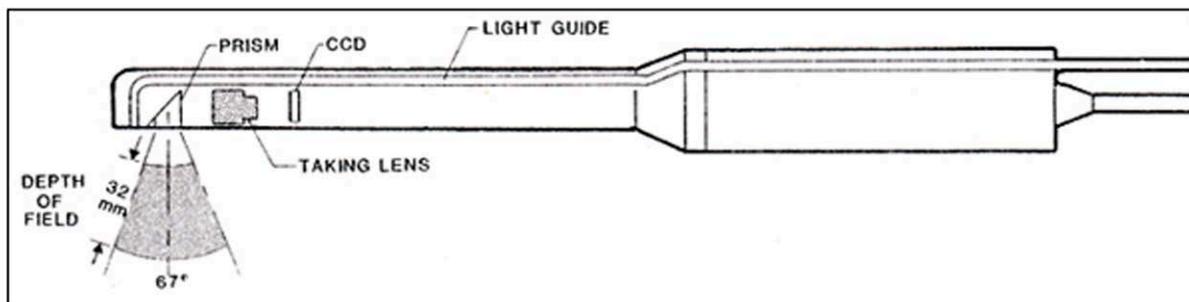


Figure 9. Mid-wand placement of CCD chip and prism degrades IOC image quality
 Photo courtesy of Videodental.com

market demanded better engineered handpieces, over 80% of these companies went out of business between 1994 and 2004.²¹

Presently IOC camera sales are dominated by three major companies: Patterson & Henry Schein Dental Suppliers and Kodak Dental (a.k.a. CareStream Health of Canada) Kodak is selling direct to dental practices and is a distributor of imaging systems only. These companies offer practice management software that integrates with imaging software but, the IOC capture is tied to a foot pedal operation. Secondary vendors offer button capture function that is an ease-of-use preference and typically less costly. Integrating with practice imaging programs by use of bridging software may drive costs up further.

While IOCs & IOVCs were first produced mainly in the United States and later in Europe, Asia is now mass producing IOVCs and flooding the U.S. market. The trend started in Japan (RF System Lab, 1998), Korea (Somotech Corp 2005) and now Taiwan and the Republic of China. These IOVCs are being mass produced using a new “on the chip technology” (CMOS) which originated for the web-cam industry. Dentists have commented on the DentalTown.com website of IOVC purchases as low as \$149.00. E-bay lists IOVCs as low as \$49.00! Claude Berthoin, founder of Video Dental Concepts and co-inventor of the IOVC technology comments, “On my recent flight to a dental tradeshow I was stunned to see one of these Chinese IOVCs offered in the Sky Mall Magazine. Clearly more professional companies will go out of business as a result”. Berthoin also added, “While purchasing a “cut-rate cam” will satisfy the need to show a tooth image, the combination of cheap plastic lenses and low quality imagers (640 x 480) like CMOS chips and

low cost LED’s will only render average images. Loaner use and service is not available for repairs on these low-cost dental cams”. Superior image quality can only be achieved by the ideal combination of superior glass optical lenses paired with high resolution CCD chips. Durability, longevity and maintainability are derived from reliable manufacturers. While these newer low-cost cameras may be inexpensive to purchase, they may have a life span of 3-6 months. Most quality cameras are made to last 10-20 years. To quote an old adage, “You get what you pay for”, still rings true with regards to IOC or IOVC investments. A clinician should carefully research all aspects of current IOC technology, including compatibility with potential or existing dental software and quality of images, before committing to any IOC purchase.

Handling Techniques for the Intraoral Camera (IOC)

It is of fundamental importance to handle your IOC with the utmost of care. The number one reason for repair is careless or mishandling of the IOC wand. If your IOC is portable from operator to operator, be sure you understand the proper connection and disconnection of your IOC wand or unit, as it relates other ports or plug-in sources. When working with corded models, be sure to differentiate if disconnection is of “snap” or “twist” release. Forcing or jamming the connection will result in serious damage to the IOC wand. Read the IOC Instruction Manual and ask for proper guidance from experienced peers when learning to operate any IOC.

When not in use, be sure to store the IOC wand properly. *Corded models* should be stored within docking cradles. *Portable-wand units* are smaller, less stable and can have a tendency to drop or

fall when not in use. Store cordless IOC wands in their docking cradle or securely in a storage case to avoid accidental damage.



Video 1. Handling Techniques for the Intraoral Camera

To view this video, please go to www.dentalcare.com and find this course in the Continuing Education section.

Navigation of your intraoral camera may take some practice. Typically you will need to maneuver your IOC wand while viewing your navigation on a monitor. Begin by making sure your equipment is properly set up. Position a computer monitor within effortless view of operator. Have the IOC wand inside of its docking station engaged to the “on” position and ready to use. Finally, ensure that the “capture method” of your IOC system is within reach. IOC systems come with various methods to capture images. A remote-controller, foot-pedal or a button on the IOC wand are most common.

Set-Up & Capture

Proficient navigation of the IOC wand, while watching a computer monitor, may prove challenging at first. Maneuvering the IOC wand inside the oral cavity without stability and purpose can prove to be very frustrating. Follow these “ease of use” recommendations to make IOC handling easy and efficient:

1. Pre-focus your IOC lens for the type of images you will be capturing. Common Options include: full-face, smile, close-up, or super close-up. Setting the focus option before you enter the oral cavity will ensure less fumbling. Auto-focus lenses will adjust automatically.
2. Remember to set your IOC to either “video” or “still image” mode so that you can effectively save and use your images.

Ease of Use in Mouth

The following video will demonstrate a very efficient method that will enable you to “tour the mouth” and capture IOC images on patients proficiently. By practicing these techniques, your IOC skills will increase rapidly.



Video 2. Proper Use of the Intraoral Camera

To view this video, please go to www.dentalcare.com and find this course in the Continuing Education section.

1. Using the patient’s teeth as a fulcrum for the IOC wand, start at the distal most aspect of the lower arch.
2. Lay the camera wand “flat and parallel” on the occlusal plane.
3. Find orientation to the tooth above.
4. Slide or drag the IOC wand forward to see the consecutive teeth on the upper arch.
5. Have the patient “open & close” to enhance focus.
6. Use a “finger roll technique”, between thumb, index & middle fingers, to see lateral aspects of teeth.
7. Lift the wand from lower arch then extend wand towards left or right to gain full lateral view, then capture the image.
8. Return to original occlusal plane position IOC wand parallel and continue sliding the wand forward to view consecutive teeth.
9. Repeat process for other side of mouth.
10. Reverse it for upper arch to view lower arch.

Remember, staying disciplined in practicing these techniques will rapidly increase your IOC proficiency and skill. You may want to take notes on these videos and post a small “reminder” near your work station to promote exceptional IOC handling techniques and habits.

Creating a Dry Field

Once you feel adept at moving the IOC wand around the mouth while watching your monitor and capturing images simultaneously, you can then add an additional step that will enhance the quality of your IOC images immensely.

Creating a “dry field of view” just prior to capturing your IOC images will dramatically increase what you and your patients can see. Saliva and a “wet field” will hide or skew what actually exists on the tooth’s surface. Look at the wet and dry comparisons in these next examples (Figures 10 & 11). Defects and diseased areas will seem to “jump off the monitor” when you master how to keep your field-of-vision dry for IOC photography.

Establishing a dry field is much easier with two clinicians. When only one clinician is taking IOC images, add the following steps to the previous “ease of use” suggestions for dramatically improved images. You may need to retake images that do get obscured with saliva. Even



Figure 10. Wet view of amalgam filling



Figure 11. Dry view of same amalgam filling

the most proficient IOC photographer has to consistently contend with managing excess saliva flow.

Steps to Create an Intraoral - Dry Field of View

1. Simultaneously hold IOC wand and air/water syringe.
2. Have patient hold saliva ejector in mouth.
3. Air dry each tooth just prior to capturing an image.
4. Help the patient to move the saliva ejector to the next appropriate place as you tour their mouth capturing images.
5. Ask patient to “breathe through their nose” to avoid lens fogging.
6. Some clinicians may use a dry angle or cotton gauze 2 x 2 to aid in creating a dry field.



Video 3. Creating a Dry Field for the Intraoral Camera

To view this video, please go to www.dentalcare.com and find this course in the Continuing Education section.

While a dry field IOC photo is most desirable for educational purposes, be aware that managing saliva to create a dry field can take up a significant amount of time. Remain cognizant to stay on schedule and diligent with the other clinical duties you will have to perform. IOC imaging can be rewarding but also frustrating and initially very time-consuming. You may even suggest rescheduling a patient for a more comprehensive IOC and tactile examination if you see the need for a more extensive evaluation. Keep yourself on-schedule and advise the patient if more time is required for all necessary diagnostics.

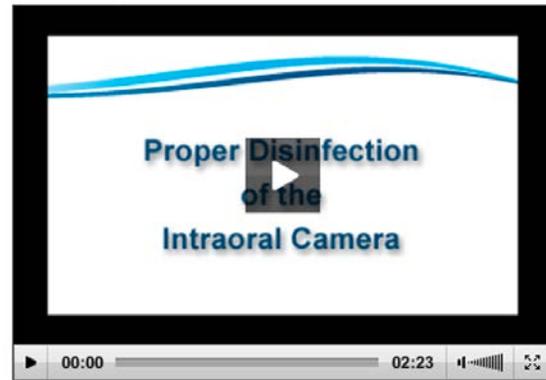
Proper Disinfection

As with all dental equipment, proper and consistent disinfection or sterilization is mandatory. Most IOC wands cannot be sterilized in a heat sterilizer because the fragile workings of the internal lens will not hold up to the intense heat. Delicate disinfection is in order with most IOC wands. Immersion in sterilizing solutions or spray disinfectants are also most always contraindicated. Instead, gently wipe wand area with either a sterile cloth moistened with water and a gentle antibacterial soap (avoiding the lens) or according to the manufacturer's specific disinfection guidelines.

Most IOC manufacturers advise against wiping the delicate IOC lens directly, while others may advise a light alcohol wipe. Dry-wiping can also scratch and damage the delicate lens. Check manufacturer recommendations and do what is best for your IOC's longevity. To protect your IOC lens and adhere to universal infection control guidelines, use the IOC manufacturer's specified barrier sleeve. Typically an IOC barrier sleeve has an inner and an outer sheath. The outer sheath ensures that the inner sheath remains fresh, clean and ready for intra oral use. Single-layer sheaths are available but, provide less infection control. To use, gently slide the IOC wand into the inner sheath and carefully peel away the outer sheath. Avoid touching or handling the clean inner sheath. Your IOC wand and recommended sheath may demand specific interface. For instance, you may have to insert the camera wand "face-down" or "face-up" so that the clearest side of the plastic interfaces with the lens. This will yield a clear field of view. Many times the sheaths are marked with a stamp to designate proper insertion for clearest viewing. Improper sheath application may produce a blurred lens and images.

Introducing the IOC to Your Patients

Two of the biggest obstacles for patients to accept needed treatment are that they often do not understand their condition and they just do not enjoy the experience of dental treatment. Even routine examinations can invoke within the patient's mind thoughts of pain, fear, buzzing handpieces or pointed instruments. None of these have pleasant association or make the clinician's tasks easy. A great way to introduce



Video 4. Proper Disinfection of the Intraoral Camera

To view this video, please go to www.dentalcare.com and find this course in the Continuing Education section.

the IOC to your patients will be to describe this as a patient education tool that will improve both patient comfort and understanding of their current dental conditions in a gentle, touchless manner. Since the IOC wand is smooth, slender and contained, it will be unobtrusive in the oral cavity. A great introduction of the IOC could be worded like this: "Mrs. Smith, today included in your periodic dental examination, we will be using a state-of-the-art dental technology called the intraoral camera. It is a comfortable miniature camera wand that will allow us to tour and capture magnified pictures of your current dental conditions, then display them on a monitor. The images will allow us to see fractures, leaks in fillings and deteriorating areas close-up, so we can discuss potential problems together. We will pair these visual findings with other traditional diagnostic tools to plan any necessary treatment."

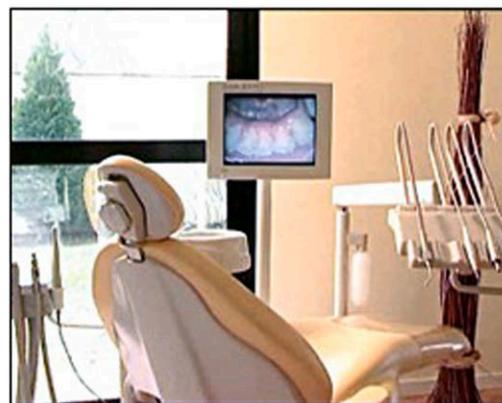


Figure 12.
Photo courtesy of AbsoluteDentalImage.com

It is important to point out to patients that IOC images do not replace conventional diagnostic tools like radiographs, study models or tactile examinations, but they will enhance understanding of the findings by providing a magnified, clear, close-up look at current conditions. Point out too that these findings can be stored, shared with specialists, emailed with insurance claims, reprinted and cosmetically enhanced. Patients will quickly understand the far-reaching value and use that IOC images will lend to support their long-term oral health.

Some patients may be resistant or squeamish to look at their IOC images. Reassure them that it is not compulsory that they view the monitors but, it is necessary for the dentist to view them. Most patients will reenroll themselves in the viewing process as the clinician is capturing and discussing the findings.

Each dentist uses different methods to modify patient behavior and acceptance of treatment proposed. The IOC allows patients to directly observe their intraoral conditions. Thus the

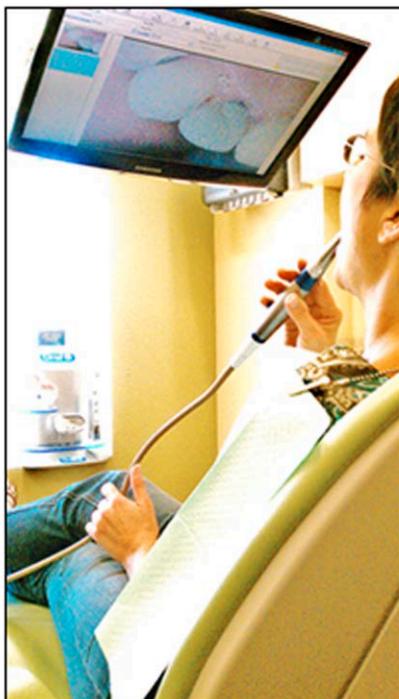


Figure 13. Patient touring their own mouth with IOC
Photo courtesy of Osprey Dental, FL

patient can participate directly in the decision making process as far as preferred treatment is concerned.²² Some dentists even hand the IOC wand directly to their patients and allow them to tour their mouth themselves for inspection and discovery prior to a clinical IOC exam. Clinicians should try varied approaches to ascertain what methodology works best to enroll patients in their IOC image discovery and education.

Patient Learning Styles

Dental patients enter a dental setting with a varied degree of understanding about their present oral conditions, need for treatment and treatment options. This level of understanding is said to be a patient's "dental IQ". As dental professionals, we are constantly striving to improve our communication skills, increase our patients' dental IQs and proceed with necessary dental care. Patient education has long been a challenge for dental professionals to master and deliver chairside.

A common belief among teachers is that most people favor a particular method of information processing/learning. Based on this concept, teaching by the use of individualized "learning styles" originated in the 1970s, and has been used by educators ever since. One of the most common and widely-used categorizations of the various types of learning styles is Fleming's VARK model (sometimes VAK) which has its origins in neuro-linguistic programming. The VARK model is represented as follows:

1. Visual Learners
2. Auditory Learners
3. Reading/Writing=Preference Learners
4. Kinesthetic Learners or Tactile Learners²³

In dentistry, Fleming's VAK model, helps to accelerate patient understanding when all three styles (visual, auditory and kinesthetic) are combined during the chairside examination appointment. Since time is limited during a dental appointment, combining the VAK model ensures that all learning styles are addressed. The IOC provides clear, magnified images in monitor-view (visual learners) that can be easily discussed and described (auditory learners). The clinician can also easily perform tactile examination, or have the patient handle the camera wand for

self-examination (kinesthetic learners). Greatest impact of understanding results when IOC technology is utilized in this manner.

High-tech guru Dr. John Jameson passes along this information to us: "For doctors who capture IOC or digital images of the patient, we have seen an increase between 10% - 25% in case acceptance."²⁴

The IOC is an educational tool that will enlighten patients in a way that description alone cannot accomplish, confirming the old adage, "A picture is worth a thousand words." In this case, a picture is worth acceptance of necessary treatment and years of optimum dental health!

Patient Education Beyond Chairside Use

Contemporary digital IOC systems have improved to allow better integration with dental software. This offers the ability to store and manipulate digital images with imaging software and provides a very broad scope of use for patient IOC images. A dentist can choose which options best suit his/her needs. The following table illustrates common IOC image communications:

Use of IOC Images:	Communication with:
Printed Copy	Patient – for at-home reference. Specialist Doctor – for referral / for patient file Insurance Carrier – for visual claim support
E-Mailed Transmission	Patient – for at-home reference Specialist Doctor – for referral / for patient file Insurance Carrier – for visual claim support
Copy of Video	Patient – for at-home reference
E-Mail Video	Specialist Doctor – for referral / for patient file
Letters / Post Cards	Existing Patients or Potential Patients
E-Mail Blasts	Existing Patients or Potential Patients

While the use for IOC images multiplies, it is important to adhere to federally mandated restrictions. IOC images are considered "personal health information" (PHI). Under dental HIPAA mandates, IOC images cannot be utilized

outside of the scope of patient/doctor care unless additional consent forms are signed by concerned patients. If you intend to use IOC images for marketing or internet posting, you must get proper clearance and with supporting legal consent documentation from your patients.

Detecting Defects & Landmarks on Restorations within IOC Images

It is certain that IOC imaging is a powerful utility for finding, viewing and explaining dental conditions to patients, as well as, supporting the dental clinician in diagnostic decision making. However, IOC Systems are not regarded as diagnostic means or measures. Most professionally recognized entities categorize IOCs as educational devices. The American Dental Association does not take a hardened stance on the diagnostic and clinical use of IOC systems. ADA representatives encourage individuals to check with their respective State Dental Board or Department of Professional Regulations concerning recommended practices as they apply to IOCs and dental professionals.²⁵ In checking several State Dental Practice Guidelines it is consistently stated that the use of IOCs is recommended for educational purposes. While photographs and images may support diagnoses, IOC images are in no way a definitive means of analysis for disease prognosis or treatment.

That being said, a hybrid of an IOC and a light scanning fluorescence device is in development for the detection of carious dentin. It is a novel therapeutic concept using a light-induced fluorescence evaluator for the detection and treatment of dental caries, referred to as LIFEDT. LIFEDT uses variations of measured brightness of light to evaluate healthy vs. actively carious dentin when illuminated. Active caries will appear red under the fluorescence. This device may be helpful in daily practice to discriminate between carious or healthy dentin.²⁶ As technology advances, acceptable diagnostic practices will follow suit.

For the remainder of this course we will be looking at IOC images and explaining some commonly recurring markers, anomalies and conditions that are considered familiar "landmarks" within IOC photography. These are for educational use with patients and should always be accompanied

by a tactile examination and complimentary radiographs for formal diagnosis.

Amalgams

Corrosion

As dental professionals, we know that amalgam fillings age and show signs of a breakdown process. Fillings will begin to corrode, which is the equivalent to an object becoming “rusty”. This becomes very obvious with the magnification of IOC images. Aging amalgam fillings appear dull-gray or even black in color.



Figure 14. Shiny amalgam filling with no signs of corrosion



Figure 15. Corroding amalgam filling

Corrosion in and of itself does not warrant filling replacement and can most times be polished back to a high luster.

Landmarks

Leaks, Cracks, the “Black Halo Effect”, Patches & Percolation

Amalgam fillings most often can begin to separate from the tooth over time, creating a crevice that can harbor bacteria. This void can be referred to as an open margin or a leak in the restoration. Amalgams can also expand and contract in response to the varying temperatures of food. Cold foods will cause the amalgam to contract, while hot foods will cause expansion. Continual expansion and contraction may place undue pressure against the surrounding tooth structure and create cracks in the walls of the tooth. These cracks can also allow bacteria and acids to penetrate the tooth causing damage (Figures 16 & 16A).



Figure 16. IOC image

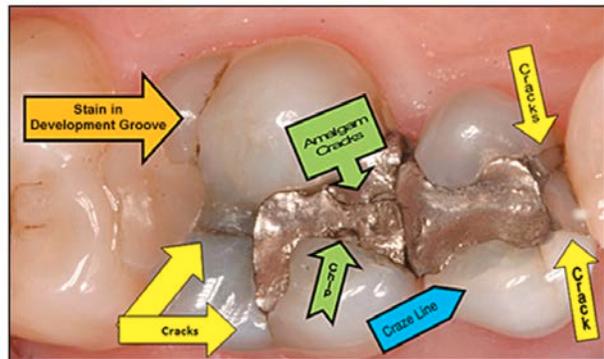


Figure 16A. IOC image with corresponding landmarks

Changes in temperature can also lead to “amalgam percolation”, a separation and popping effect of the amalgam from its original position. This can occur due to the micro-gap between tooth structure and the filling material.²⁷ Within this micro-gap oral fluids enter, are effected by body heat and the result is percolation which allows the filling to move, rise or separate from its original position. While the amalgam filling may stay secure within the prep, the separation creates continual micro leakage and should be evaluated with other diagnostic measures such as tactile exam and radiographs.

It is important to look for certain IOC landmarks around the margins of all amalgam fillings. As you inspect the circumference of an amalgam



Figure 17. Percolation of an amalgam filling (Notice the edges separated and “popped-out” from its original position in the prep.)

on the IOC image, look for dark corrosion areas, actual separation of the filling from the tooth (leaks/open margins), cracks in the tooth, cracks in the amalgam and “black halos” surrounding the amalgam itself (Figure 18).

A “black halo” is the appearance of a blackened area emanating from the amalgam and spreading through the tooth’s image. This will typically merit further diagnostic inspection with radiographs of the corresponding tooth to determine the presence and extent of decay. The “black halo” appearance is a landmark for cavity detection.

Amalgam fillings can also crack, which indicates that the filling is weak or defective. Another common landmark visible on IOC images is the presence of “patched amalgams”. In an effort to restore cracks within amalgams, some dentists have added additional amalgam to patch and repair the restoration. It is important to look carefully and closely at amalgam fillings to differentiate between cracks and patched outlines.

Typically it is difficult for a clinician to see these defects with the naked eye and patients may not see or feel discomfort from this breakdown at all. IOC photos bring this erosion into magnified view. Remember the importance of air-drying each tooth, as saliva will coat over and “camouflage”

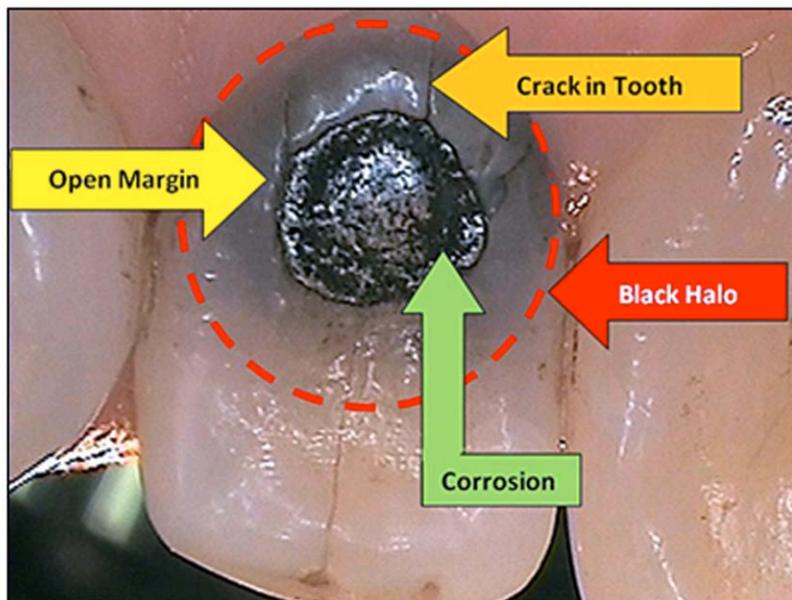


Figure 18. Landmarks on IOC photo



Figure 19. Look closely at the center of this amalgam to detect small circular patch.



Figure 19A. Two separate amalgam fillings (MO +DO). Interface of filling creates an open margin.



Figure 19B. Close tactile examination reveals these to be just scratches in the amalgam.

fine defects especially at the margins of fillings. Dry teeth will yield enhanced IOC images.

Composites

As composite fillings improve in compressive strength, bond strength, luster and color compatibility, they gain popularity within the professional dental community. Many dental offices only offer non-mercury fillings made of resin or porcelain. Studying composite landmarks and potential defects is an essential skill in mastering the art of IOC photography. Let's take a look at some composites conditions under IOC magnification:

Deep Stain vs. Caries on Occlusal Surfaces

IOC capture of stain in occlusal pits is a very powerful visual for the patient, but do not let them be fooled. In this example, the more significantly stained margins proved to be decay-free, while the lesser stained pits had incipient caries.

This could only be determined by following up the IOC exam with a traditional mirror-and-explorer tactile examination. IOC photography never replaces dependable diagnostics, but is maximized when the clinician knows when and how to combine diagnostics with educational tools like IOC images.

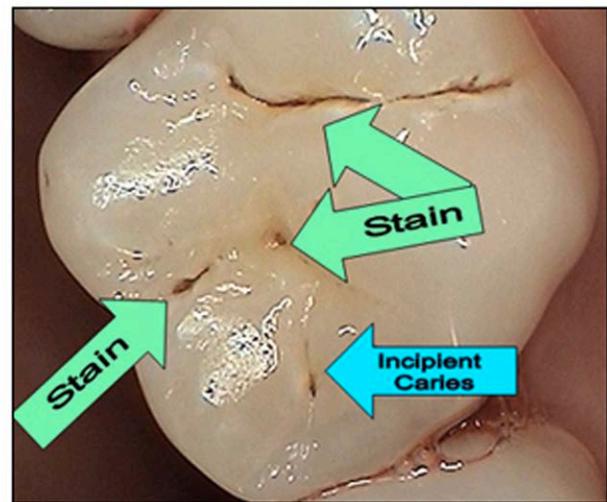


Figure 20. Upon tactile and radiographic examination most stained areas were sound. Distal pit was found to be carious.

Caries vs. Stain Under Composite

It takes some training of the eye to distinguish subtle color differences in IOC photography. The “black halo” landmark is a very helpful tool but can be tricky when seen around a composite filling. Black halos under composite fillings can merely represent stain left behind from a previous amalgam that takes on a dark translucent value through the composite material. How do you tell the difference? Always cross check for caries with a tactile exam and radiographs (Figure 21).

Natural Dentition

Cracks vs. Craze lines

Visible crack lines on teeth (within IOC images) can be misleading. A savvy clinician must become very aware of the differences in cracks/fractures vs. craze lines. Use of the IOCs fiber optic light will help you make the distinction. If a tooth is truly cracked, light will not transilluminate through the tooth. It will instead bury itself in the floor of the crack. Conversely, if the light source does transilluminate through the tooth, the apparent crack is merely a surface craze line. In illustrations (22 & 22A), you can see the difference.

Craze lines are for the most part inconsequential and do not need to be corrected with dental treatment except for cosmetic improvement. True cracks on the other hand, can be very serious! Vertical cracks that travel to the gumline may require a full-coverage crown restoration. If the vertical crack travels below the gumline, the tooth may require endodontic treatment with crown lengthening or extraction. Additional diagnostic measures would be needed to determine appropriate treatment options. It is important to understand the distinctions between cracks and craze lines.

Bruxism

Bruxism, clenching or grinding teeth can have a profound mix of effects on the dentition, temporomandibular joint, head and neck musculature and even sleep patterns. The cause of bruxism is not completely agreed upon, but daily stress may be the trigger in many people. Bruxism can cause severe pain to none at all. Many patients will be unaware or asymptomatic to their bruxing habit. IOC images will capture

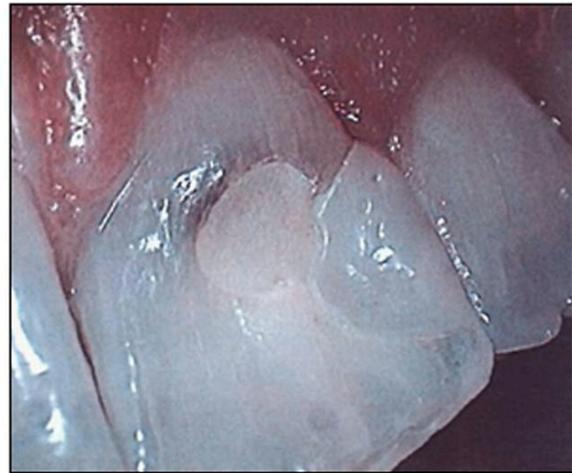


Figure 21. Composite filling with Black Halo



Figure 22. Illuminated light gets buried into a tooth fracture

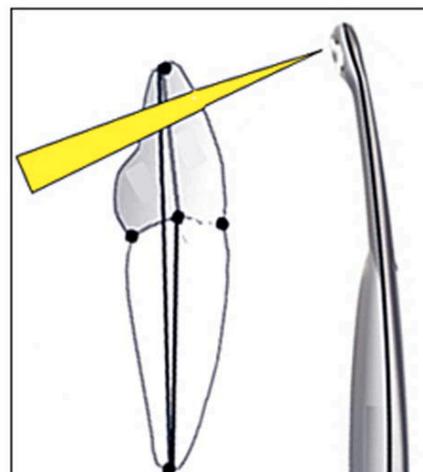


Figure 22A. Illumination travels through a craze line



Figure 23. Craze lines in central incisor



Figure 24.



Figure 23A. True fracture in tooth at upper third of incisor



Figure 24A.

surface wear facets on occlusal and incisal edges of teeth (Figures 24 & 24A). These visual landmarks should alert the dental clinician to examine the patient more thoroughly for bruxism symptoms and measures to arrest its ill effects over time.

Abfractions, Cervical Erosion & Recession

Through the years the dental profession has held a variety of theories about the causes of abfractions, including the chemical wasting of teeth, the effects of tooth brushing or tooth pastes and lateral forces.²⁸

In the early 1990's, Dentist, J. O. Grippo concluded that cervical erosions were the result of flexing of the teeth at the gum line due to heavy bruxing (grinding). This flexure produced damage to the enamel rods at the gum line resulting in their loosening and consequently flaking away of the tooth structure. He named

this type of damage abfraction in a paper published in 1991 (Figures 25 & 26).²⁹

While there are varied opinions on whether or not to treat cervical tooth wear with composite restoration or prosthetic mouth guards, the incident of such wear is prevalent. Dental clinicians can view and capture cervical wear on teeth with the IOC and review treatment recommendations with each patient.

Gingival recession is characterized by the displacement of the gingival margin apically from the cemento-enamel junction, or CEJ, or from the former location of the CEJ in which restorations have distorted the location or appearance of the CEJ. Many people may exhibit gingival recession without having any awareness of the condition.³⁰ Using IOC images to record and discuss the implication of gingival recession with patients can be critical, especially when such conditions are

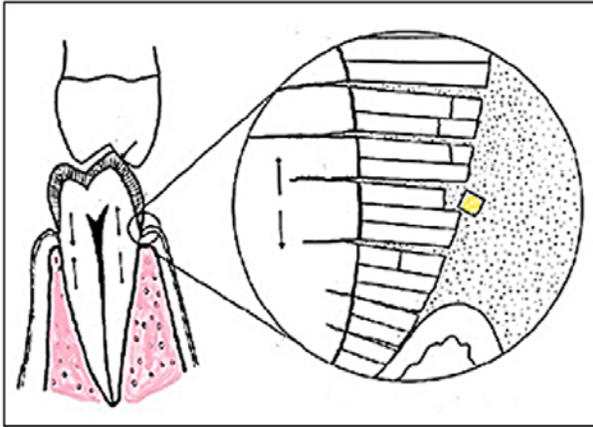


Figure 25.



Figure 26.
Images courtesy of Dr. Brian Palmer



Figure 27. Gingival Recession

advancing asymptotically. Images are also valuable to share with referring dental specialists or within insurance documentation (Figure 27).

Enamel Hypocalcification, Hypoplasia & Fluorosis

The appearance of white spot defects on IOC images is quite common. White spot lesions may occur as a result of an injury to, or a large cavity in the primary tooth. When the permanent tooth erupts it may have a roughened, pitted area in the enamel, corresponding to the defect. This is sometimes referred to as a "Turner's tooth", or "Turner's hypoplasia". It is most common in (permanent) bicuspid teeth (secondary to infected primary molars) and permanent central incisors (secondary to injury to the primary incisors).

An event such as fever, malnutrition, or hypocalcemia during teeth formation can occur during fetal development or early childhood. This is a related condition in which the ameloblast cells affect the tooth enamel. When the front teeth and six-year molars are affected, the event most likely occurred in the first year of life. When the bicuspids and second molars are affected, the event likely occurred around age three. Disruption can appear as white or brown spots on the teeth (Figure 28).³¹

Mild fluorosis is the appearance of small white opaque flecks, which can be magnified with the IOC and are more visible near the incisal edges. The pattern becomes more obvious when the teeth are dried prior to image capture. This



Figure 28. Enamel hypoplasia exhibiting both white and brown lesions in enamel

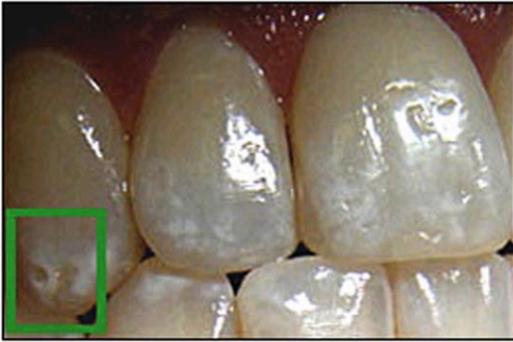


Figure 29.
Photo courtesy of Cosmetic Dentistry Center

condition has been linked to over use of fluoride. It can be corrected with a course of professional treatments that combine in-office etchants, tri-calcium phosphate paste infusion and whitening products (Figure 29).

Occlusal Pit Defects

While IOC images alone cannot diagnostically determine if a tooth lesion is carious, the magnification can provide clinicians and patients dramatically close-up views which can aid in the early detection and treatment when combined with other diagnostic measures. Figures 30 & 31 are ideal examples.

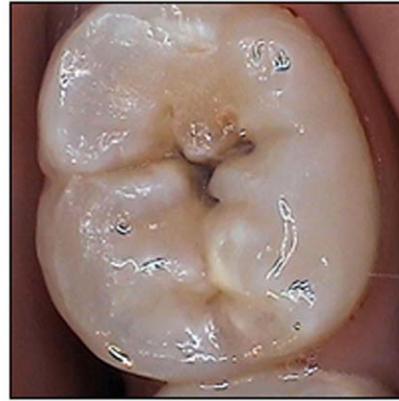


Figure 30.



Figure 31.

Crowns, Bridges & Implants

IOC photography can be useful when inspecting margins of existing crown and bridgework. Many times difficult to see or reach areas come to full view with the IOC wand and capture. Defects not discernable by plain view, tactile or even radiographic inspection can be revealed with IOC magnification. The dentist can then discuss with patients possible treatment options to correct such defects. Figures (32 - 34C) are some examples.

Soft Tissues

Soft Tissue Lesions

IOC images can be helpful in detecting and monitoring soft tissue abnormalities as well as tracking them for changes. Since capture,



Figure 32. Mesial fracture in this filling prep reveals need to discuss benefits of crowning this tooth with patient.

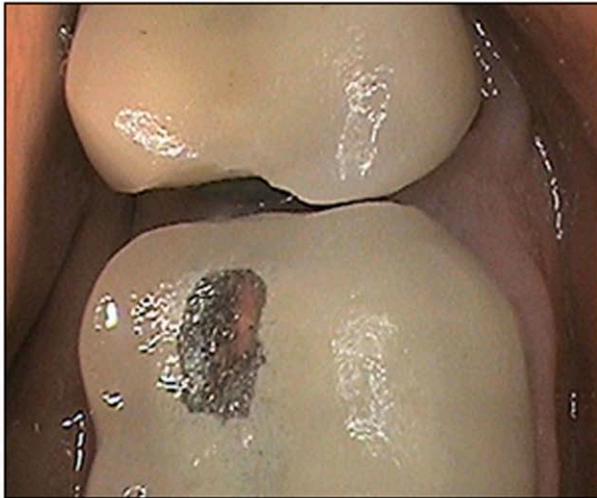


Figure 33.
Varying views of this fractured crown reveals an intact mesial margin but open contact.

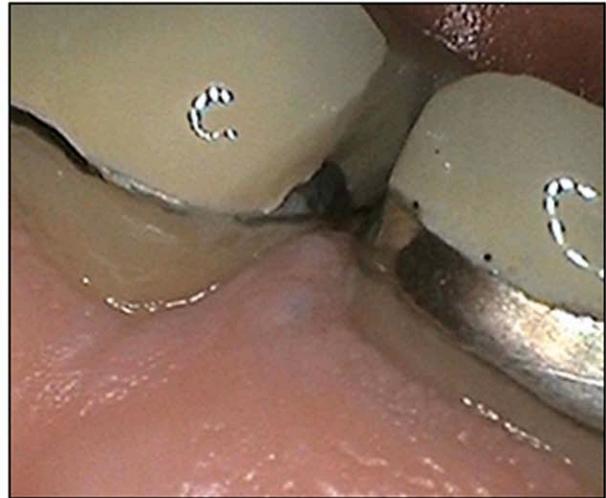


Figure 33A.



Figure 34.

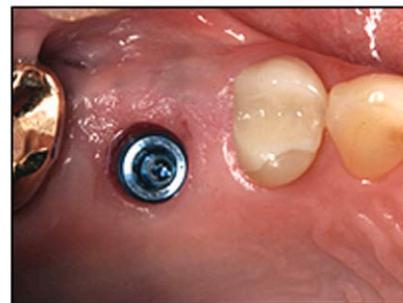


Figure 34A.



Figure 34B.
Working IOC photos of implant healing progression. Useful for correspondence between specialist and general dentist.



Figure 34C.

storage and transmission is so convenient, IOC images can easily be shared with dental specialists and insurance carriers. While IOC images provide a magnified view, questionable soft tissue abnormalities need to be evaluated with more advanced diagnostic testing. IOC images are an enhancement to monitoring tissues, never a substitute for precautionary diagnostic measures (Figures 35 & 36).

Periodontal Examinations

A foundational aspect of being a good dental professional is the detection or assisted detection of disease and patient education regarding conditions. As professionals, we must also be discerning and judge if a technology or approach is suitable for our patient education needs. Using a periodontal probe simultaneously in IOC photography may not translate into a



Figure 35. Capturing lesions for comparison



Figure 36. Tissue sloughing

comprehensible representation for your patient. Notice how the probe is buried in this IOC photo. The patient has no concept of how deep the probe actually reaches. Unassisted probe-photography efforts are often futile and time consuming for very little patient educational result. It may be better to apply another approach when educating the patients on their periodontal probe measurements (Figure 37).

Periodontal/Gingivitis Images and Insurance Submission

In certain instances it is very beneficial to utilize IOC photography for periodontal education and documentation. Figure 38 illustrates a non-painful case of pregnancy gingivitis graphically. Although the patient does not feel pain from her condition, by viewing this photo she can now gain understanding of her current condition, especially when accompanied with explanation and discussion from her dental healthcare provider. Printing this photo and using it as documented proof of the condition may enhance dental insurance claims coverage for gingivitis therapies. Traditional x-rays would not provide this color graphic representation and radiographic bone loss may not represent the need for additional treatment. Narratives need to accompany such

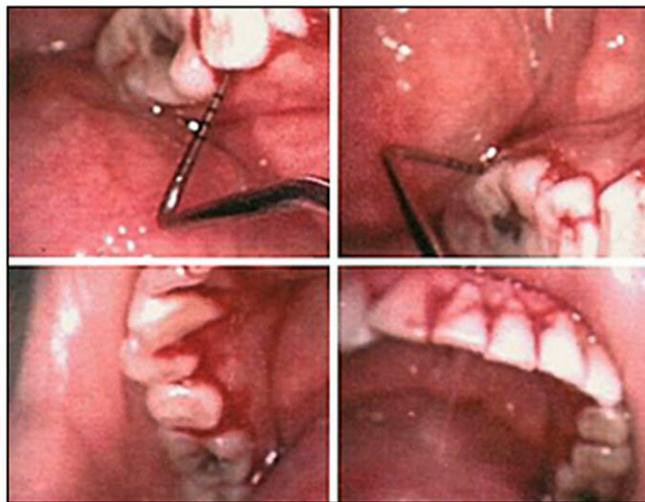


Figure 37. Difficult to comprehend probe depth with IOC images



Figure 38. Non-painful Pregnancy Gingivitis



Figure 38A. Same patient, 4 weeks after in-office and homecare therapies.



Figure 39. Maxillary anterior IOC image of gum tissue changes.

submissions but magnified color photos are an exceptional correspondence tool.

Periodontal abscesses are best diagnosed with symptomatic review plus tactile and radiographic evaluation, but IOC images help provide an enhanced view to referring specialists, insurance carriers and for monitoring future changes of the condition (Figure 39).

Combine this with probing depths and radiographs for treatment planning and insurance claim.

Tongue Health & Halitosis Education

Tongue hygiene and health can also be addressed using the IOC. Many patients are not aware of the value and benefits of proper tongue hygiene. By using your IOC, you can capture photos of the tongue and discuss overgrowth of bacteria, yeast, and grooming tongue papilla with proper tongue brushing or tongue scraping techniques to improve periodontal conditions and halitosis. This is another creative example of how the IOC can be a valuable tool for establishing and conveying healthy guidelines to patients. Visual magnification can deliver a powerful message that auditory education alone may not accomplish. Track and compare tongue health by capturing comparative IOC photos at routine hygiene visits. This is a good practice to incorporate in a new or existing halitosis or tongue hygiene program for your office (Figures 40 & 40A).



Figure 40. Initial photo of coated tongue before tongue hygiene.

Photo courtesy of Tom Oechslin of Peak Enterprises, FL

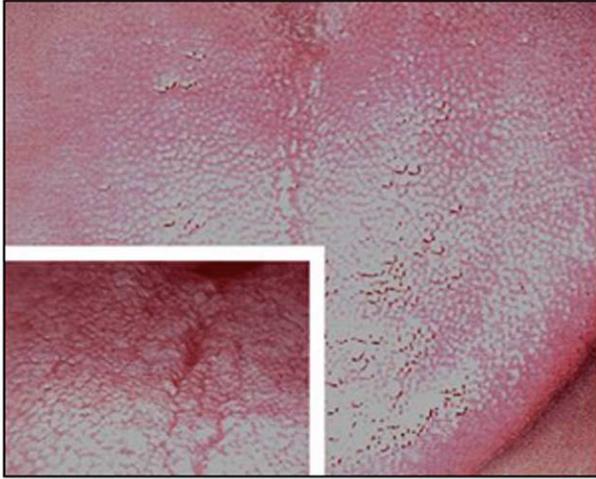


Figure 40A. Comparison image of tongue at a later healthier stage.



Figure 41. Disclosed plaque image taken in-office. Print and post on home mirror to remind patient to disclose and brush better at home.

Oral Cancer Examinations

IOC images can be used to monitor oral lesions for changes in size, color and consistency. They are also an informative complement when provided via email or in-print to a referring specialist like an oral surgeon. It has been emphasized throughout this writing that IOC images serve to enhance communication and educate. They are in no way definitive or comprehensive enough to serve as more than an adjunct to a referral or an additional reference tool when monitoring lesions. Dental clinicians should ultimately rely on medically acceptable diagnostic standards in making the final assessment of lesions for malignancy.

Plaque Control & Plaque Disclosing Images

Using the IOC for plaque control education is an exceptional idea. Using the IOC with children who need to learn better plaque control creates a unique opportunity to combine the serious side of dental hygiene with an element of fun. Plaque control images can also be used for adult education. Older IOC systems allowed capture of a 4-plex within one viewing screen. Newer systems allow side-by-side, 2-plex viewing on the same screen. You may also choose to print out several images for patient reference as a take home learning tool. Patients can post these images on a bathroom mirror to remind them to disclose, brush a specific length of time, brush with a specific product or focus on a specific area of the mouth. Newer IOC systems will also allow you to print captions/directions below or within the image. Being creative with your IOC system will enable you to combine magnified, custom, color printed images with specific homecare directives for your patients. The use of disclosing tablets and mini sand-timers provide an inspirational and professional touch to your plaque control education program. The key with IOC images for take home reference is that they can continue to engage and motivate the patient. Figures (41 & 41A) are examples of how IOC technology can bridge the gap between in-office learning and home motivation.

IOC Images for Parent Education & Specialist Referral

Another appropriate and effective use of IOC photography is to use it to illustrate various dental syndromes to the parent of the patient. In this example, it is much easier to show in magnified terms this deciduous tooth that has delayed exfoliation. In some cases, it may be easier to show an IOC image on a monitor than to expect a child to sit still while parents and doctor can discuss the implications. Images can also be printed out for parents and can accompany specialist referral slips (Figure 42).

Orthodontists, Endodontists, Periodontists, etc., can all use and share IOC images to transmit via email or print for reference to interested parties. Color magnified images compliment treatment planning in a way that was not possible before the advent of advanced integration for printing and internet transmission.

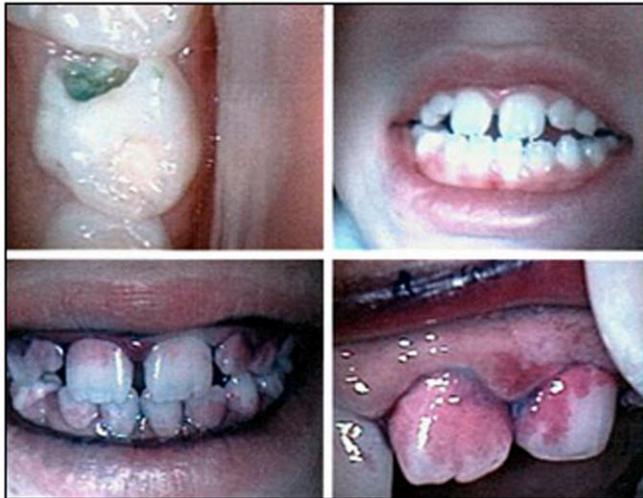


Figure 41A. Use of 4-plex imaging can show trouble areas plus, before-and-after use of plaque disclosants.



Figure 42.

General Practitioners can also integrate them into follow-up letters to encourage homecare recommendations, specialist referrals or to follow through on treatment recommendations. Include supportive brochures or reference articles to further educate and encourage patients to seek recommended care.

IOC Photography at Various Patient Examinations

Today, IOC photography is an integral part of the dental examination and patient education process. Understanding all of the popular methods for IOC use will inspire practical and creative IOC photography in your daily practice.

The following are useful examples you may want to consider:

New Patient Examinations & Comprehensive Examinations

Since a New Patient Examination (NPE) involves total discovery about the patient, IOC photography brings to life notable conditions within the mouth for the dentist and patient to see and discuss together. This process is commonly referred to as co-diagnosis and it is ultimately enhanced with the aid of IOC photography. While the dentist will have to reference other diagnostic means, IOC magnification allows the patient to see intricate details of specific conditions

that would otherwise not be visible or easily understood using more sophisticated diagnostic aids. Many potentially pathologic conditions may be asymptomatic for the patient. The magnified color views on IOC images will allow the patient and doctor to view and discuss the conditions and reasonable treatment options. The images provide an advantage both technologically and educationally for building rapport with the new patient. Photos can be stored and references at subsequent appointments.

In using IOC images within your NPE, it is important to establish a pattern of images that you will routinely want to take and store within your patient software files. The images will be a great reference for patient care and professional correspondence. Having a set list of images you routinely take will ensure that you can refer to those images at anytime in the future should you need them for treatment planning, comparison, referral sharing and insurance claim support. The following is a list of useful images to consider capturing routinely:

- Full-face photo
- Smile photo
- Slightly opened-bite smile (to check for bruxism)
- Individual occlusal photos of teeth
- Mandibular lingual anterior photo
- Buccal views
- Lingual views
- Tongue image
- Soft tissue areas of interest

After all diagnostics are compiled, the dentist can combine them to formulate formal diagnosis. Most patients will understand a picture easily. Having the patient's IOC images on the chairside monitor will save time and make comprehension of conditions with proposed treatments straightforward and interesting. Some doctors like to keep their IOC system in video mode to create a live video of the NPE. This can be copied and sent home with the patient but may prove to be more time consuming to view than embedding images into a printed treatment plan. Depending on your preference, video or printed images can complement your NPE and treatment recommendations, when provided to the patient post-appointment.

Periodic Examination at Hygiene Visits

Patient treatment visits with the hygienist typically out number dentist/patient visits 4:1. This means that the hygienist will have more chair time treating the patient, more time to establish rapport and more time to monitor conditions with IOC images. While dentists, by state law must provide periodic dental examinations either every 6 months or at least once per year,³² many times the hygienist invites the dentist into their operatory, more often than the minimum requires, to view and evaluate patient conditions. IOC images allow for fast, magnified capture of questionable conditions and can greatly aid the dentist upon his arrival. Magnified images can help the dentist to assimilate weather more predictable diagnostic measures, such as a tactile exam, comprehensive exam or radiographs, need to be performed.

Aside from this convenience, keeping IOC images up and visible during hygiene treatment can serve to be beneficial in educating the patient about their most critical conditions. Once the dentist has diagnosed and presented treatment options, the hygienist can help to clarify or answer patient questions. This can lead to treatment acceptance using the hygiene appointment in a very constructive manner (Figure 43).

During Treatment Evaluation & Discovery



Figure 43. During hygiene treatment, patient and hygienist can converse about the dentist's recommendation to crown molar #30.

IOC image capture can provide valuable visual evaluation of tooth preparations for a dentist. Many clinicians routinely scan their work in progress with the IOC wand prior to moving forward through the restoration process. Images may reveal where a crown margin needs to have more definitive preparation or where decay needs to be more adequately removed. If pulp exposure

is eminent, a dentist can capture an IOC image before completing current treatment and discuss endodontic implications with the patient. Figure 44 shows a vertical fracture remaining apically at the distal of the prepped tooth. This photo could have been captured mid-prep for the dentist to check his work or it could be used to educate the patient that a vertical fracture runs apically and that prognosis of this tooth is guarded (Figures 44 – 45B).



Figure 44. Vertical fracture remains at the distal of this prepped tooth.

Before & After Comparison

Before and after images are an asset to use in both restorative and hygiene situations. They can be used to monitor the progress of whitening patients, capture healing and changes of tissue, show differences in restorative quality and illustrate aesthetic improvements. Sharing before and after images with your patients can reaffirm their good choices to treat and invest in their dental health (Figures 46 & 46A).

IOC Images & Each Professional's Role



Figure 45. Working photos that can illustrate to patient need for a full coverage crown restoration due to cusp fracture during initial stages of preparation.



Figure 45A.



Figure 45B.



Figure 46. These images are part of a before-and-after series of photos taken from this patient's Smoking Cessation Program.



Figure 46A.

Dentist Use of IOC

Doctors may rely on IOC images to help them check difficult angles and access areas while preparing a tooth to receive restoration. Margins can also be meticulously inspected. Near pulp exposures and vertical fractures are other situations where IOC images can help both the dentist and patient review and keep treatment plans on a healthy course. Tracking changes of questionable areas is another common practice. Keeping progress photos of a patient's treatment can help as a reference to the doctor, specialists and insurance carriers and may be supportive in legal matters.

Hygienist Use of IOC

Hygienists should routinely use the IOC during patient visits to inspect teeth and tissues. Upon discovering any questionable areas, the hygienist should promptly alert the dentist and request his attention to the concern. Many dental software systems will allow IOC image to be viewed at different workstations. So the dentist can preview the area of concern prior to entering the hygiene operatory. The dentist should always provide a tactile exam and recommendations for additional diagnostics plus treatment recommendations for all questionable IOC images. Discussion of treatment recommendations can be supported by the hygienist after the dentist makes his diagnosis to the patient.

IOC images can be supportive for recommended gingivitis and periodontal therapies as well. These images can be referenced on monitors for patient education, printed/emailed and shared with the patient, referring specialist or insurance carrier. Hygienists can also use the IOC images creatively by utilizing before and after or progressive images to reference health changes. Incorporate them into a plaque control protocol, healthy tongue & breath protocol other hygiene motivation protocols.

Dental Assistants Use of IOC

There are many opportune times for the dental assistant to use the IOC, perhaps even more than the dentist or hygienist. Dental assistants can take advantage of times when the dentist is out of the operatory (i.e. hygiene exams, working in another operatory, working in the lab, etc.)

to take IOC patient photos. The dental assistant may need to capture working photos from the patient's current appointment or tour the mouth to reference and discuss the next phase of the patient's treatment plan. Dedication to habitual use of the IOC will maximize the impact of this technology and provide the highest quality time with the patient, increasing their dental knowledge and treatment opportunities.

Clerical Use of IOC

While IOC images create understanding and awareness chairside, they serve a far reaching and greater value within the business aspect of the dental practice. Insurance coordinator, treatment plan coordinator receptionist and office manager can all utilize these images in ways that will enhance the patient's dental experience. Insurance coordinators should learn to attach IOC images with narratives to provide maximum support when submitting insurance claims. Treatment coordinators need to study the integration protocols that allow IOC images to be imported and displayed within treatment plans. All business team members should understand proper protocol for printing and email sharing IOC images.

Patient Motivation and the IOC

IOCs provide visual insight for patients that was not possible before the introduction of magnified, full-color digital in-operatory monitor displays. Prior to this technology, verbal explanation paired with chairside drawings or models were considered the state-of-the-art standard in patient education. In many cases, this inanimate method fell short of enlightening patients to fully understand or take ownership of worsening dental conditions. Deeper explanation could have left a patient feeling confused, deflated, ashamed or belittled. This was the antithesis of what the dental educator sought as an outcome, but many times patient education efforts were grossly inadequate.

In the late 1980s, with the advent of IOC photography visual magnification could more often inspire patients to see and take ownership of their declining dental conditions. With this came the concept of chairside patient collaboration (co-diagnosis), in which the patient could now take an active role in viewing and understanding their own body. Their own dental conditions were magnified in full view. The IOC has since changed

the way many patients interpret their dental visits as well as how clinicians need to comment on the clinical findings. Patients can now see firsthand, defects in their own mouth and understand the implication of such conditions. Dental personal at this point can interact with the patient on a level that educates and elevates the patient to seek optimum dental care.

It is important to note that many times a patient may not be ready or able to move forward with treatments. Saving and using IOC images at subsequent dental visits can be helpful.

Again, the old adage, “a picture is worth a thousand words” is applicable. When a patient can see for the first time what the dentist conceptualizes, this can broaden understanding of critical dental conditions for the patient and can add a whole new dimension to compliance and motivation.

Insurance Company Interface

Dental insurance claim reimbursements can be maximized by submission with IOC images. For example, many times dental radiographs will not show a broken cusp on a posterior tooth, but an IOC image will depict this clearly. Periodontal charts and supportive radiographs may not indicate bone loss for periodontal claims. But in many periodontal cases, supplementing the claim with an IOC image will show inflamed tissues, bleeding gums and abscessing areas to increase coverage approval. When applicable, submit IOC images routinely to save from having to resubmit denied claims that were not previously accompanied by an IOC image.

Submitting IOC images with supportive narratives on dental claims will help communicate conditions to the insurer with clarity. You should routinely include a narrative with an IOC image. For efficiency, save commonly recurring narratives to a library and reference them on future submissions by adjusting these narratives to fit your current claim.

Keep in mind that many dental insurers separate file attachments from e-mailed claims. IOC images may go to one email address (to scan the attachment for viruses), while the actual claim goes to another. This would detach your

supportive IOC image and in many situations they may remain separated. You may want to check with respective insurers to determine their eClaim filing practices. A safer approach would be to print claims with IOC image support and mail them in mutually for submission. This would ensure that claim and image arrive for review together.

Sharing IOC Photos & Legal Confines

Approved use of IOC systems in the United States, are classified and governed by the Food and Drug Administration (FDA) in conjunction with various other agencies. FDA approved IOCs intend them for chairside use by dentists and dental personal during oral health examinations. By definition IOCs provide magnified, digital, color images of intraoral or extraoral anatomy via a viewing monitor. Both still and video images can be captured and stored. The device allows practitioners and patient to view areas of concern together, before, during and after procedures.³³ There are no special certifications or licensure protocols necessary to own or operate an IOC but a clinician needs to follow the manufacturer's directions for use and safety. Caution should however be taken in how the images are used, shared and transmitted over the internet and in public use situations.

Some IOC images are considered Personal Health Information (PHI) and governed by the U.S. Department of Health & Human Services, Health Insurance Portability and Accountability Act of 1996 (HIPAA) Privacy and Security Rules. Restricted from public use would be full-face photos or any related identifiable characteristics of patients (Sec. 164.514(b)(2)(i)(Q)). These are considered "individually identifiable health information" which relate to the individual's past, present or future physical health or condition that identifies the individual for which there is a reasonable basis to believe it can be used to identify the individual (45 CFR Sec. 164.514 --Code of Federal Regulations).³⁴ These images would most certainly have restricted use outside of each respective patient's specific care. Use of any pictures within advertisements or public viewing would need special patient permission by signed consent.

Attorney Brian T. Hatch who publishes a

periodic legal update for dental practitioners, interprets HIPAA laws as they pertain to IOC images as follows, “HIPAA does not restrict the use of “de-identified health information” which neither identifies nor provides a reasonable basis to identify an individual.”³⁵ This would include intraoral dental pictures which cannot be reasonably used to identify a patient; and without showing things like eyes, ears, noses, hair, etc.; and not using any things like names, addresses, account numbers, etc. (Sec. 164.514(a)). “But, the dentist or dental practice owner should check specific state laws which very well may be more restrictive. If more restrictive state laws apply regarding advertising to the public, i.e., web sites, magazine ads, etc., then special written permission from such patients is justifiably required.”

Dental offices should also have a written protocol in place that follows the 2010 federal mandate for HIPAA High Tech Law guidelines. IOC images and how they are managed within the office (in printed and internet transmittable form) fall into this mandated protocol. High Tech Law pertains to your office procedure for:

Doctor to Patient Sharing

With a signed HIPAA consent form, dental offices can share PHI with other health entities that relate to that patient’s specific treatment, i.e., specialists, insurance claims, dental labs, etc. Always follow federal HIPAA guidelines and state laws as they pertain to the use of PHI which can certainly mean IOC images. Internal use and direct patient use of images is permissible with professional and ethical conduct.

Printed images can best be used within patient treatment plan proposals and letters, correspondence with dental specialists or for insurance claims. E-mailed images may be included as motivational reminders to help encourage patients to schedule recommended treatment but, use caution and be sure to have HIPAA consent forms signed to use specific email addresses and use care in matching images with email addresses.

IOC Image Library

Dental offices may want to compile comparison photos of “before-and-after photos” or “restored” vs. “deteriorating” dentistry and organize them in

a continuous loop slide presentation for chairside viewing or a reference book for patient education. This is a common practice but, make sure to check your state dental practice act to comply with specific laws that pertain to patient images.

Compiling an IOC image library may be ideal and practical for your office. When you see a good example with day to day clinical IOC use, keep a reference file, labeling each type of condition. Save it to a slide presentation or label it for printable use. It is worth the small effort it will take. You can then reference these comparison photos to instantly view and educate patients as to differences in quality vs. failing dental situations. These photos will serve as a very valuable learning tool in so many chairside situations.

Patient HIPAA / Patient Signature & Waivers

In conclusion, with regard to the use of IOC images, each practitioner should abide by federal HIPAA guidelines in conjunction with their specific state protocols. When desiring to utilize IOC photos outside of the scope of direct patient-doctor correspondence, consult a legal expert and/or retain patient signed permission to waiver auxiliary use.

Conclusion

While most patients have difficulty with understanding “dental-speak” and viewing x-rays, use of the IOC allows the clinician to translate the language of clinical diagnostics to an understandable, visually enhanced experience for the patient. Simply stated, the clinician can replace professional jargon and complex diagnostic concepts with layman’s terms and enhanced photo images to bridge the communication gap between them. IOC images and the advancements to store and share images help not only the patient in understanding and accepting their dental treatment needs, they provide enhanced communication with other associated parties like specialists and insurance entities.

Use of the IOC as a chairside educational tool within the scope of dental practice provides an advantage that brings patient understanding in line with dental diagnosis. This technology brings to dentistry a conduit for optimizing patient health.

To receive Continuing Education credit for this course, you must complete the online test. Please go to www.dentalcare.com and find this course in the Continuing Education section.

Course Test Preview

1. **Alexander S. Wolcott designed and patented the first camera from the Daguerre concept. He was _____.**
 - a. a manufacturer of dental instruments from New York
 - b. a photographer from Paris
 - c. a dentist who was also an inventor

2. **The debut of the first true intraoral camera, that captured images from inside the mouth, came with the launch of the first analog IOC system in _____.**
 - a. the same year Fuji launched high-speed x-ray film
 - b. the early 1960's
 - c. the late 1980's

3. **DentaCam™, original intraoral camera system _____.**
 - a. has its trademark registration under Fuji Optical Systems
 - b. was distributed and sold under Patterson Dental
 - c. was analog in nature
 - d. All of the above.
 - e. None of the above.

4. **Analog intraoral images were problematic because _____.**
 - a. they were difficult to integrate to printer and difficult to print
 - b. they could only be viewed for a short time then would disintegrate
 - c. they took up significant computer storage space and printed copies would degrade over time.

5. **USB _____.**
 - a. stands for "Universal Serial Bus"
 - b. is the most common type of computer "port" or "plug-in device" used in today's computers
 - c. proved inefficient at sharing digital images with dental software
 - d. A & B
 - e. A & C

6. **A pixel _____.**
 - a. represents a single color dot
 - b. is the port that connects the USB to the dental software
 - c. contains a series of numbers which describe color or intensity to the computer's software
 - d. is measured in (PPI) or (DPI)
 - e. A, B & C
 - f. A, C & D

7. **Artifacts in a digital IOC image can appear as _____.**
 - a. pixels that distort and move apart
 - b. oral morphology tooth landmarks
 - c. either low-contrast detail or over-sharpening

8. **The number one reason for IOC wand repair is _____.**
 - a. leaving the light-source "on"
 - b. careless or mishandling of the IOC wand
 - c. USB port connections getting bent

9. **IOC systems come with various methods to capture images. The most common being _____.**
- a remote-controller, foot-pedal or a button on the IOC wand
 - a cord, a battery or a USB plug
 - a keyboard and mouse
10. **When using an IOC, you should always remember to _____.**
- pre-focus your IOC lens for the type of images you will be capturing
 - enter the ADA code for IOC images in the patient's record
 - tell your coworkers not to disturb you while you are imaging
11. **When using an IOC in a patient's mouth, _____.**
- use the patient's teeth as a fulcrum for the IOC wand
 - lay the camera wand "flat and parallel" on the occlusal plane
 - slide or drag the IOC wand forward to see the consecutive teeth on the opposing arch
 - have the patient "open & close" to enhance focus
 - A & B
 - A & D
 - All of the above.
12. **Saliva and a "wet field" will hide or skew what actually exists on the tooth's surface with regards to IOC images.**
- True
 - False
13. **To create a "dry field of view" during IOC imaging, _____.**
- simultaneously hold the IOC Wand and mouth mirror
 - air dry each tooth just prior to capturing an image
 - ask the patient to "breathe through their nose" to avoid lens fogging
 - All of the above.
 - B & C only
14. **Proper disinfection of an IOC lens includes _____.**
- submersion in sterilizing solution
 - spray disinfecting
 - gently wiping wand area - avoiding lens - according to the manufacturer's specific disinfection guidelines
 - gently disassembling IOC wand, hand polishing with diamond paste and heat sterilizing the pieces
15. **Two of the biggest obstacles for patients to accept needed treatment, is that they often do not understand their _____.**
- brush and floss and how to properly use them
 - occlusal bite relationship and how it effects their dental health
 - condition and they just do not enjoy the experience of dental treatment
16. **The VARK model of learning is represented as follows:**
- Visual, Auditory, Reading/writing & Kinesthetic learners
 - Valuable, Affluent, Realistic & Kick-start learners
 - Vintage, Antique, Retro & Keepsake learners

17. **Printed copies of IOC images are best used for _____.**
- patient chart entry only
 - patients, specialist doctors and insurance carriers
 - framing, then viewing within the dental office
18. **Most professionally recognized entities categorize IOC's as _____.**
- a diagnostic device
 - an educational device
 - a clerical device
19. **Commonly recurring markers, anomalies and conditions are considered familiar _____ within the IOC photography.**
- pathology
 - landmarks
 - flaws
20. **Black halos under composite fillings can represent _____.**
- stain left behind from a previous amalgam
 - a leak in the composite and decay
 - a dark liner-base under the composite
 - A & B
 - B & C
21. **Illuminated light gets buried into a tooth crack and travels through a craze line.**
- The above statement is true.
 - The above statement is false.
22. **Fractures in teeth not discernable by plain view, tactile or even radiographic inspection can be revealed with _____.**
- Light Scanning Robotics
 - IOC magnification
 - Light Emitting Diodes
23. **IOC images are not helpful in detecting and monitoring soft tissue abnormalities or tracking them for changes.**
- The above statement is true.
 - The above statement is false.
24. **The key with IOC images for take home reference is that they can continue to engage and _____ the patient.**
- enrage
 - instruct
 - motivate
25. **New Patient Examinations should have a set list of IOC images that are routinely taken to ensure those images can be used for _____.**
- future treatment planning, comparison, referral sharing and insurance claim support
 - software integration and paperless chart building
 - advertising campaigns

26. **Dental Assistants _____.**
- a. should never use the IOC
 - b. may have even more opportunity than the dentist and hygienist to use the IOC
 - c. should only assist the hygienist or dentist in using the IOC
27. **Dedication to _____ use of the IOC will maximize the impact of this technology and provide the highest quality time with the patient, increasing their dental knowledge and treatment opportunities.**
- a. systematic
 - b. habitual
 - c. periodic
28. **Many times dental insurance claims and IOC image attachments can get _____ upon electronic submission.**
- a. approved
 - b. infected
 - c. separated
29. **Under federal HIPAA law, does not restrict the use of “de-identified health information”.**
- a. True
 - b. False
30. **Use of the IOC as a chairside educational tool within the scope of dental practice provides an advantage that brings patient understanding in line with _____.**
- a. better dental treatment options
 - b. dental diagnosis
 - c. having a dental degree

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Special Thanks To:

Claude Berthoin at Videodental.com
Ted Takahashi at T2consulting.com
Jim Clark at AbsoluteDentalImage.com
Tom Oechslein of Peak Enterprises and Tung Brush
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Jill Obrochta received her Bachelor's of Science Degree at Loyola University in 1985 and her Certificate in Tissue and Anesthesia at UCLA in 1991. Initially practicing Dental Hygiene in the Chicago area, she polished the "business edge" to her career. Establishing herself in a niche area of dental research, Jill developed easy-to-follow dental practice protocol for Infection Control Compliance within the insurance industry in accordance with OSHA and the Center for Disease Control.

She expanded her career into the field of academics. By securing a position with a highly dynamic dental education company, she was part of a national team of dental hygienists that were dedicated to research and lecturing the current trends to other dental professionals.

In 1999, she co-founded the Ft. Lauderdale-based dental continuing education foundation, transcDENTALStudyGroup.org. This unique continuing education venue, offers dental professionals an opportunity to stay clinically current with a special focus on Stress Relief, Psychological Balance and Self! TranscendENTAL's success gained notoriety in RDH magazine for offering continuing education credits with a unique motivational flair. Jill also co-writes and has co-hosted several Health-Channel Television Shows for Today's Health/CNBC, and local Cable & You-Tube™ Television.

Jill went on to establish a professional education company, Dental Enhancements.com, providing a unique blend of dental education, motivation, practice growth solutions, and 5-star customer services philosophies that culminate into the most exquisite & unique dental patient experience!

Over the past 2 decades she has researched and developed innovative dental team workshops, such as: OSHA made Easy™, Perio Fitness, Dental Branding & Internet Marketing, Winning Influences in the Now Economy (W.I.N.E.™), and many other powerful practice growth solution seminars.

She is a charismatic dental speaker, with an approachable style that makes learning uniquely memorable and fun! Jill has coached dental teams from coast-to-coast, as well as presented inspirational

workshops at many National Dental Conferences and to the Dental Hygiene Society of Switzerland.

Jill has represented well-known companies like: Pro-Dentec, Collagenex (Periostat), Capital One, Water Pik Technologies & Patterson Dental.

She currently serves as Dental Enhancements Senior Director. She is dedicated to helping dental professionals enjoy and excel at the art of dentistry. Her enthusiasm is contagious.

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