Microinvasive Dentistry

Clinical Strategies and Tools




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Diagnosis

4 Intraoral video cameras

John J Graeber

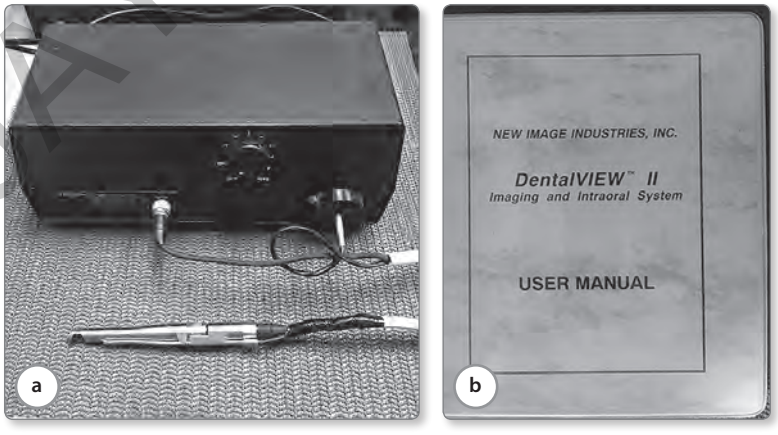
Introduction

Intraoral video cameras (IOVC) were developed for dental practice in the late 1980s and their use was the first instance of the application of video camera imaging in caries diagnosis. Early models, such as those produced by Accucam and Fuji, were extremely expensive (costing approximately $15,000), difficult to use, and were usually sold as part of rudimentary systems (by today's standards). The introduction of this technology served to heighten interest in cosmetic dentistry treatment at the time when highly invasive treatments (veneers, full coverage crowns and bridges) were very popular within the profession. IOVC preceded both tooth whitening and other more sophisticated devices (such as CariVu, DIAGNOdent) for use in the early diagnosis of caries.

One of the immediate benefits of these first generation video cameras was the ability to show patients live footage of the condition of their teeth, improving their awareness and enhancing the likelihood that they would follow advice relating to oral hygiene provided by their dentist. The increased magnification and better illumination also allowed dentists to more effectively monitor the changing nature of the decay process due mainly to the positive effects of fluoridation. Since fluoride had begun to be added to the US water supplies, it became less common for decay to present as deep and well-defined cavitations, but instead appeared more subtly as discoloration, dark pits and fissures, and hypocalcifications on the surface of teeth. The introduction of IOVC has allowed dentists to detect these subtle signs and implement preventative treatments. Conventional diagnostic tools of the time (radiographs and mirror/explorer) were far less accurate and much less effective at identifying evidence of decay.[1]

Development of the IOVC

Early IOV cameras were bulky due to the attached control box, which contained the light source. From the 'box', the light beam was carried to the intraoral camera via fiber optic cable. These cameras were usually included in cosmetic dentistry systems and were highly priced. The IOVC ensemble system often included a digital printer to produce color photographs, which either were given to the patient or saved in the patient record. One negative flaw present in these early cameras was the wear and tear causing premature failure of the fiber optic cable (see **Figures 1a** and **b**).



Figures 1a and b Early Accucam unit and instructions for use of software for cosmetic dentistry case presentations.

The development of the USB camera has allowed miniaturization of the camera device. Powered by the USB port of a computer, (usually from a laptop or tablet) the light emanates from the head of the camera wand. The LED light is brighter and whiter than previous fiber optic light sources providing a more accurate image. These devices are much lighter than older cameras.

Today's IOV cameras have improved the images immeasurably:

- LED illumination is far brighter than original fiber optic incandescent or halogen illumination
- LED's have improved color rendering due to the optimum color temperature of the LED
- Digital cameras have much higher resolution
- Digital cameras are usually automatically focused
- Some models are cordless reducing wear and tear on the cables

One disadvantage of the USB types is the smaller lens and relatively lower resolution when compared to smart phone mounted cameras or SLR Dental photographic equipment.[2]

Method

The IOVC employment should be the first step in the examination process. Using the camera to quickly scan the dentition in this way allows the dental examiner to obtain an overview of every tooth, and any suspicious or questionable areas can be frozen and saved as a still image and can be reviewed later for closer scrutiny. Most patients can be IOVC scanned in less than a minute. Best practices are as follows:

- Cover the camera with a transparent "shield" to avoid cross-contamination between patients. Most cameras will have a shield specific to each model
- Clean teeth to remove plaque or debris, and place cotton rolls and/or dry angles to help with access and salivary control
- Further salivary control can be achieved by air-drying each quadrant prior to examination, using a dental air syringe. Drying immediately prior to examining each quadrant will help reduce light reflection and increase accuracy
- If a patient has salivates excessively, you may need to remove the camera after completing your examination of each quadrant to allow the patient to swallow
- Always start examination in the same quadrant and complete one arch at a time
- As an aid in focusing, rest the camera on tooth surfaces either in the same quadrant or on the opposing teeth
- Use lip and tongue retractors to help manipulate soft tissue. This will reduce the likelihood of poor image quality due to restricted access
- Freeze any image where decay or any anomaly is suspected. Remember to further check for caries or marginal defects in existing restorations (see **Figures 2** to **7**)

Figure 2 Typical frozen frame from a quality IOVC to be shown to a patient while presenting treatment.

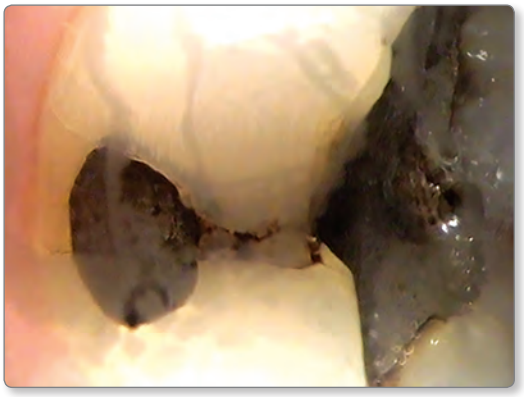


Figure 3 IOVC image clearly showing fracture between 2 separate amalgam restorations through transverse ridge on maxillary molar.

Figure 4a and b IOVC images of hypocalcification.

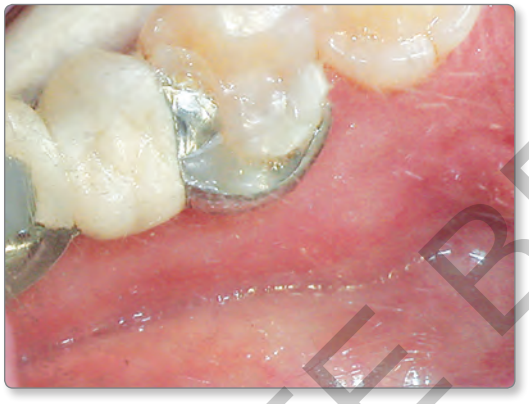


Figure 5 IOVC image of recurrent decay adjacent to bonded retainer arm.

Figure 7 IOVC image of suspected decay under existing restoration.

Figure 6 IOVC image of a fractured porcelain veneer.

- Complete exam with conventional steps as appropriate
- Clean the camera after each use to prevent possible cross contamination

Many intraoral cameras are kept in the hygiene room. While this affords the motivated hygienist an opportunity to show patients biofilm accumulations, home care deficiencies and compare healthy and inflamed gingival tissue, the diagnosis of caries is not the hygienist's responsibility.

Consideration of the location of the IOVC is also important because every procedure done in the office setting requires it to become an efficient

part of the "flowchart". Examining a patient in the hygiene room has significant disadvantages:

- Often there is too little space for diagnostic equipment
- The exam time wastes too much of the hygienist's chair time
- Current infection control and sanitization tasks create enough chair "down time" thus negatively impacting on room use efficiency

This will require every exam patient moved to it for the Doctor's examination. An adjacent operatory if available can be used as the "Exam/Consultation Room". Minimum equipment is required for a dedicated exam room (see **Figures 8** to **10**):

- Chair and light
- Air syringe
- Intraoral video camera/monitor/computer
- Mirror/explorer/periodontal probe
- X-ray viewer/computer for digital radiographs

Use of IOVC in case presentation

Identifying dental pathology is just one part of the diagnostic process; presenting the need for treatment and acceptance is the far more difficult task. Lesions, which require a treatment recommendation, can now be shown immediately to a patient. Few patients had ever been shown what a small carious lesion actually looked like. Patients showed utter amazement when viewing the pathology "up close".

Suffice it to say, the intraoral video camera has ushered in a new era of patient education. Patients are able to more easily understand and visualize a color image than they ever could do with X-rays. Patients now understand what and where their dental problems are and tend to show a far greater acceptance of treatment options.

When ready to present findings to the patient, an image of each recommendation can be queued-up so the presentation can be efficiently made to the patient.

The intraoral camera images save chair time in explaining pathology to patients – remember the old adage: one picture = 1,000 words!

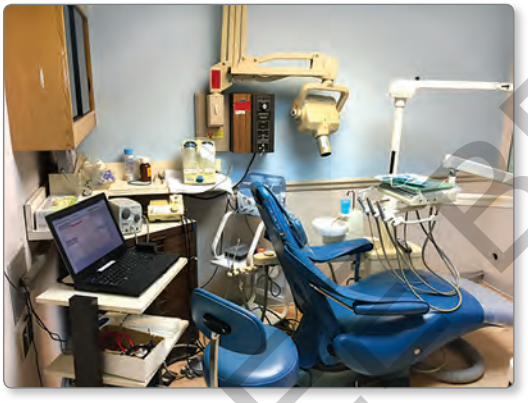


Figure 8 Typical hygienist operatory.

Figure 9 Using the IOVC with patient.

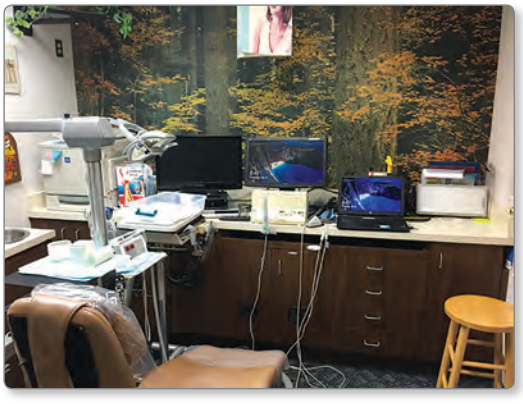


Figure 10 Exam room.

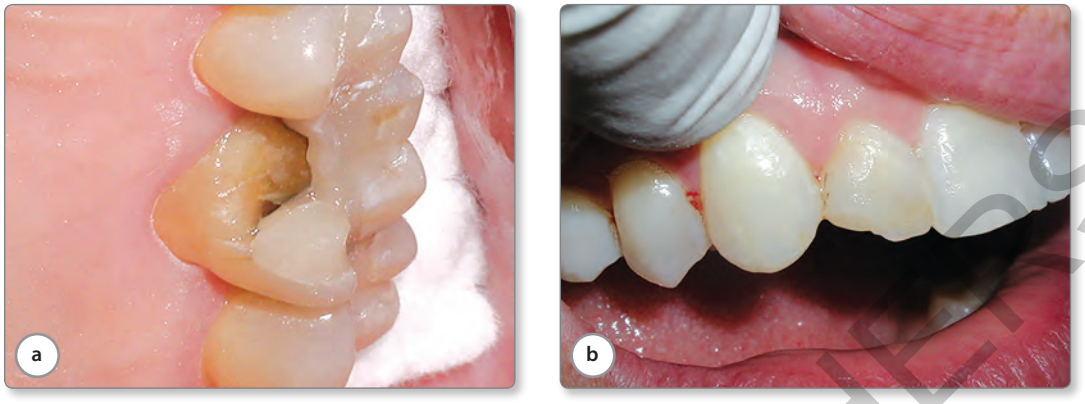


Figure 11a and b Fractured teeth.

Advantages

- Enlarged view of teeth and oral pathology
- Creates a permanent record of preoperative condition
- Show coronal fractures for support of necessary indirect restorations (see **Figures 11a** and **b**)
- Made part of the patient's permanent record
- Are easily sent via email to insurance provider for pre-estimates or claim payment

Disadvantages

- Cost of IO camera units
- Cost of integrating software and maintenance
- Time to integrate into examination routine
- Cost of training Staff/Doctor

Units in the dental marketplace

- Claris i4D, Sota Imaging
- SoproLife, Acteon
- Schick, Sirona-Dentsply
- Discovery 360, RF America
- Mouthwatch, Mouthwatch, LLC
- CS 1500, Carestream Dental
- EZcam wireless, Ashtel Dental
- Firecam HD, 3 disc Americas
- DEXcam 4, DEXIS (KaVo-Kerr)
- LED IC 200, LED Dental
- CAMX Triton HD, Air Techniques

Source: Dentalproductsshopper.com (Accessed 7/6/18)

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2. Lavine L. Comparing Intraoral Camera Systems. Dental Economics; 2005.

Microinvasive Dentistry
Clinical Strategies and Tools

The clinical appearance of caries has changed since the widespread use of fluoride in most populations. Diagnostic instrumentation and treatment protocols have not kept pace.

Technology developed in the past 30 years has made evidence-based diagnosis simple and objective. The advent of Adhesive Dentistry requires traditional technique changes.

Caries management and treatment need an overhaul to make early diagnosis and microinvasive treatment a reality.

The contents of this book will challenge and enlighten Dental Professionals as to many of these new developments which preserve dental tissues to the maximum extent possible.

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