MICROSCOPE & Sedation Dentistry:

A Common Origin

by Dale Travis, DDS, FAGD, FDOCS

In this article I would like to share a brief history of microscope dentistry and look at different types of magnification including the new 3D microscope.

A Brief History of Microscope Dentistry

The teaching and development of sedation dentistry and microscope dentistry has come from the same common training ground: the operating room. My introduction to microscope and sedation dentistry began in 1976 when I was one of the dental anesthesia residents at Harborview Trauma and Medical Center in Seattle, WA. This is the site where the Medic 911 system was first developed. At the time, Harborview was participating with several other trauma centers around the country in the research and development of microsurgery. Our teams regularly made headlines on the evening news with dramatic breakthroughs in the reattaching of severed limbs, fingers, toes, etc. One of the keys to this success was the stereo binocular microscope (Figure 1). With extension tubes allowing for two observers, surgeons and residents could do research and teach together during surgery.

I had the opportunity to observe orthopedic surgeons through these microscopes and I was surprised by the power of magnification they used. It was the perfect magnification for dentistry. I had to wait, however, before I could try such a microscope in my own work. The medical microscopes available at the time were not like the research models. They were very bulky and expensive. In 1976 a new microscope could run around $65,000 while a new Toyota could be purchased for $2,500!

Also in 1976, Harvey Apotheker, DMD, and Gezo Jako, MD, pioneers in otolaryngology microsurgery, started working on the development of a dental microscope (Figure 2). They were full-time faculty at the Harvard Medical and Dental Schools and in 1982 they released for sale the first microscope for dentistry, the Dentiscope (Figure 3).

Figure 1: Experimental Microsurgery Microscope 1976

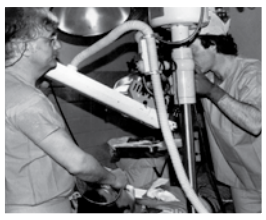

Figure 2: 1979 The first use of a CO_2 laser with a dental microscope

Figure 3: 1982 Dentiscope

Figure 4: 2007 Global 6 Step with HD video and SLR

Figure 5: The author in a comfortable ergonomic position

I installed my Dentiscope in the spring of 1982 and attended the first hands-on course in microscope dentistry by Drs. Apotheker and Jako at the Harvard Dental School in the summer of 1982.[1] My Dentiscope (Figure 3) is still in regular use in my private practice.[2]

The first dental microscopes had three major shortcomings: problems with still photography, video, and ergonomics. The original light source was tungsten, which resulted in poor still photography on costly film. The early video cameras worked well but were expensive. The ergonomics of the Dentiscope was an improvement over the early loops but with the development of the articulating eye piece the ergonomics of the dental operating microscope was dramatically improved (Figures 4 and 5).

The person most responsible for solving these problems was Gary Carr, DDS, often called the father of modern microscopic endodontics. He holds numerous patents and was instrumental in bringing the microscope to endodontic teaching, research, and clinical practice. For today's endodontists, the microscope is the standard of care and all accredited endodontic programs in North America teach microscope dentistry.

Microscope technology has revolutionized so many areas of medicine. To help bring the microscope to a wider segment of dentistry Dr. David Clark founded the Academy of Microscope Enhanced Dentistry (AMED) in 2002. Microscope dentistry has been growing in North America and is now worldwide. The AMED academy had attendees from 18 different countries at the last annual meeting where microscope dentists from around the world showed some amazing dentistry. They are also working together to share ideas and develop new techniques.

Examples of Magnification Instruments

1. Eye glasses to improve vision e.g. readers
2. Magnifying safety glasses (Figures 6 and 7)
3. Binocular Loops (Figure 8)
4. Monocular Loop for photographs and x-ray films (Figure 9)
5. Binocular Stereo Microscopes (Figure 4)
6. 3D Microscopes

I use all these types of magnification in my dentistry except for the 3D microscopes, which are just coming on the market. In the clinic I start with the magnifying safety glasses with a 2.5 power insert (Figures 7 and 8) then step up to a microscope. I use 2.5 or 5 power loops for hands on courses and in operatories that do not have a microscope. The binocular stereomicroscopes come in a variety of configurations. The Dentiscope is a fixed 6-power device. My Global microscope has six steps between 2.1 and 19.2 power. Dental microscopes can be ordered in continuous zoom configurations but are more expensive. Global, Zeiss, and Seiler are leading sellers of microscopes in North America at this time.


Figure 6


Figure 7


Figure 8


Figure 9

Types of Lighting Used with Magnifying Devices

1. Room lighting usually "color corrected"
2. Dental operatory lights
3. External fiber optic lights often mounted as headlamps or as used with the Dentiscope (Figure 3)
4. Internal through the lens lighting as used on modern microscopes

Light sources used by the microscope and loop manufactures include Halogen, Xenon, and Metal Halide. Loops are also now available with LED.

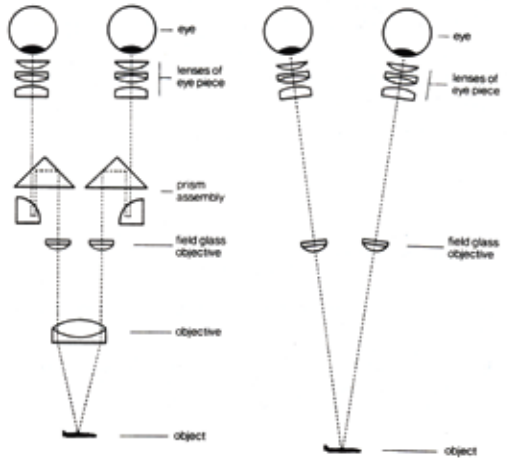

Figure 10

Microscope vs. Loops

Advantages of a Microscope

Loops bring the image from the subject directly to each eye. The eyes have to converge the images to focus on an object. This limits the magnification that can be used to around 8 power. Few people work at this level because of the eyestrain and short focal length. Most dentists use 2-3 power loops but I do know dentists using 5-6 power loops.

A stereomicroscope takes the incoming images and divides it into separate images for each eye. The two incoming images are offset slightly which gives a stereo view and eliminates convergence eyestrain. More lenses can be added in the light path, which allows greater magnification, depth of field, and a convenient working distance.[1]

Two big advantages of a microscope are the in line photography and video. The microscope can be set up to take video or still photography while you work. This is handy for insurance and legal documentation, patient and staff education, communicating with colleagues, study club presentations, teaching and research, etc. Imaging can also be done at a higher magnification than a clinical camera. Patient education and trust building is very powerful when a still or video image is sent to a monitor mounted right in front of them. They can easily see their own worn fillings, bleeding gums, cracks in teeth, etc[3] (Figure 11).

Figure 11:
Dr. David Clark showing a patient an area of concern

Two other convenient features of a microscope are the composite and laser filters. Operatory lights often start to set up composite materials reducing their working time. The microscope lights are so bright they will rapidly set up composite. A light filter blocks the setting frequencies before they enter the microscope so you now have a greatly increased working time. I find the in-line laser filters give a much better view than wearing the laser safety glasses and it's nice to have the option of using the laser at higher powers of magnification.

Advantages of Loops

Loops do have some advantages over a microscope. Loops are portable so one can use the same pair throughout the office, take them to classes, or use them for home projects. Most microscopes are mounted so they can swing between two rooms but are not easy to move beyond that. Loops are considerably less expensive than a microscope, even with the headlamp, and the learning curve with loops is usually much shorter.

Is Magnification Power Really Important?

Assad Mora showed us that the information received from magnification goes up exponentially not linearly. An object viewed with the naked eye will be seen four times as well at two power (2x2). At three and five power you will see 9 and 25 times as much information. Those working with a microscope at 7, 15, and 20 power will gain an additional 49, 225, and 400 times the information. That means a 7, 15, and 20 power microscope will give 40, 200, and 375 times more information than three power loops.[4] Besides seeing more detail at higher powers one also starts to see structures that are not visible at lower powers. An extra canal is often unseen until 10-15 power. Before you cement a post for a bridge abutment wouldn't it be nice to look down the canal to see if the internal of the root is cracked or fractured?

3D Microscopes

I first saw a 3D microscope several years ago at the AMED annual scientific session. Instead of stereovision, which is enhanced 2D imagery, 3D microscopes give a true and amazing 3D image. Besides width and height, objects rise up out of the view coming toward you. If there is an object in front, you can move your head and see what is behind it without moving the microscope. With the 3D technology you focus the microscope on the object and then do your work while watching a monitor or video headset. Arthroscopic surgery has used this surgical concept for years with 2D screens. The Morovision System is a leader in this field.

The Future of Microscope Dentistry

A microscope is an imaging instrument using the visible light spectrum. Oral surgeons and periodontists are starting to use cone beam 3D imaging in their practices. What will we be adding to x-ray and visible light technology in the future? Keep an eye on the medical technology coming out of the operating room and other arenas of medicine.

Conclusion

Anyone treating high fear patients with sedation dentistry quickly realizes the importance of accomplishing the highest possible quality under difficult conditions. Nobody wants a remake, especially on a sedation patient! Neurosurgeons sometimes work at 240 power. What limits our ability is not our hands but our eyes. Our hands will follow the eyes with good ergonomic posture and support down to incredibly small dimensions. The daily feedback from magnification along with the video and still imaging makes the microscope a great instrument for improving our dentistry and educating our patients and staff.

Dr. Dale Travis *graduated from the University of Washington Dental School in 1977. He has a full time sedation and microscope practice in Woodinville, WA. He has received Fellowships with the Academy of General Dentistry (AGD) and DOCS Education. In 1982 Dr. Travis was the first dentist in full-time private practice to implement microscope dentistry and is the historian for the Academy of Microscope Enhanced Dentistry (AMED).*

Sources for learning Microscope Dentistry

1. Academy of Microscope Dentistry (AMED) | MicroscopeDentistry.com
2. Dr. David Clark | LifetimeDentistry.net
3. Drs. Sheets & Paquette Newport Coast Oral Facial Institute | Ncofi.com
4. Scottsdale Center for Dental Excellence, Dr. Gordon Christensen (Dean) ScottsdaleCenter.com

Sources for Dental Operating Microscopes

1. Global Surgical Microscopes | Globalsurgical.com
2. Zeiss Dental Microscopes | Meditec.zeiss.com
3. Seiler Microscopes | Seilerinst.com/micro/
4. Mora Vision 3D Microscopes | Moramicro.com

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Pictures 2 & 10 courtesy Dr. Harvey Apotheker. Picture 11 courtesy Dr. David Clark.