



## The Big Push to Clinical Microscopes for Esthetic Dentistry



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**D**entists, manufacturers, and educators are wondering if clinical microscopes are the future platform of mainstream dentistry or just a sideshow. This concept is both intriguing and perplexing. To reliably predict the clinical microscope's future we should examine the history of magnification in dentistry and consider the influence of technology on our culture (Figure 1).

The following is a timeline for the use of clinical microscopes in dentistry:

- Early 1990s—the first dental microscopes were used.
- 1994—The first microscopes were routinely used for restorative dentistry.
- 1999—The American Association of Endodontists required all endodontic graduate students to be microscope proficient.

■ 2002—The Academy of Microscope Enhanced Dentistry is formed.

■ 2005—Several dental schools integrate microscopes into undergraduate programs.

Twenty years ago, if a poll was administered to general dentists the results would probably show that only 5% were using magnification.

the bar is raised to allow a better level of diagnostic and restorative sensitivity it is unlikely that a regression to a lesser capability will happen.<sup>2</sup>

Many articles have been published touting the benefits of clinical microscopes in dentistry.<sup>3-5</sup> The purpose of this article is to explore the specific applications and chal-

### The microscope patient-video is dentistry's best kept secret.

At our recent Clinical Research Associates update course I polled the dentists and over 80% now use loupes. Although less than 1% had a microscope, interest in all forms of magnification has become very high.<sup>1</sup> Therefore, it is unlikely that a lesser capability will occur. When

lenges of the microscope when used for comprehensive esthetic reconstruction.

### Integration of the Microscope for Patient Examination

The concept of building a microscope centered practice is

new. Imagine if patients saw their mouth through the dentist's eyes. It is now possible to videotape the microscope examination and present it at the consultation in conjunction with traditional photographs, models, and our own digital before and after "possibility" cases. A powerful message is conveyed after the patient sees a video of open margins, inflamed tissues, micropurulence from overhangs, rough porcelain and open contacts. Shortly after, the patient stops complaining about the cost or time of esthetic microscope enhanced dentistry. The microscope-patient-video is dentistry's best kept secret.

### Benefits of Clinical Magnification

The operating microscope not only has a higher magnification than oculars (loupes) but a better magnification. Oculars may always be used in restorative dentistry, but the optics are crude when compared to the infinity corrected optics of a stereoscopic microscope (Figures 2 through 5). The clinician's potential for accuracy in almost every discipline in dentistry is transformed when the stereoscopic microscope is combined with the shadowless coaxial light source. The microscope has a squared, not linear visual relationship to the eye; and depending on the amount of magnification used the retina will acquire 100 times to 400 times more visual data.

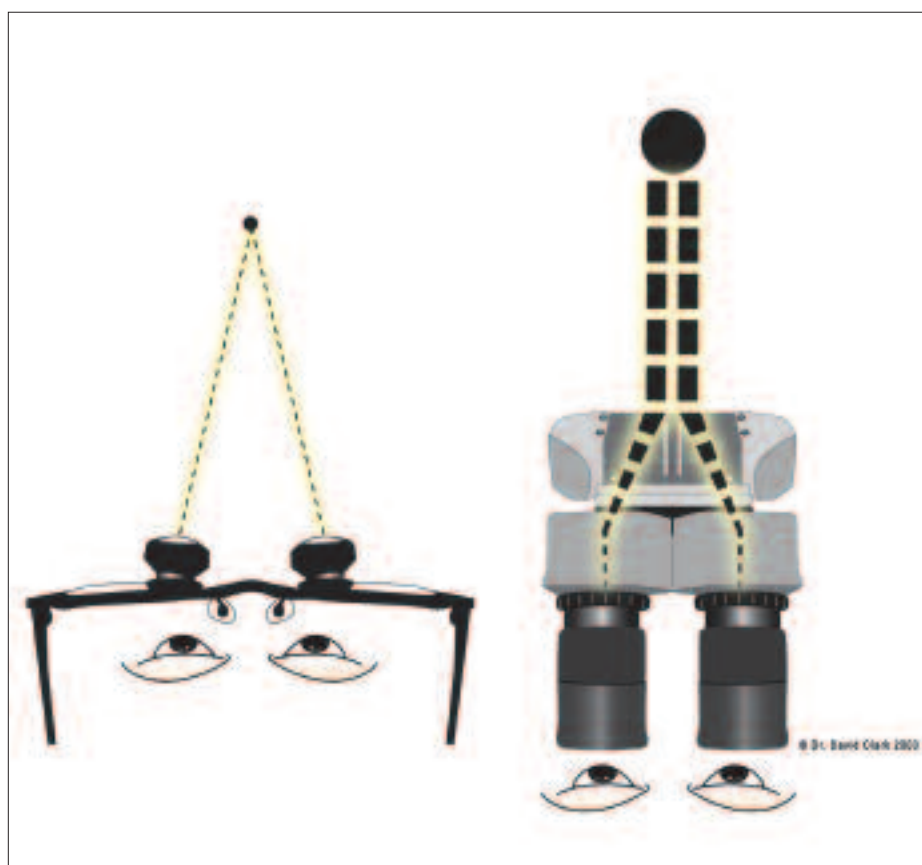
### Visual Acuity for High Tech Dental Esthetics

Many dentists and manufacturers have proclaimed that advanced technologies in resin cements, bonding, computer-assisted porcelain fabrication, etc, have made esthetic dentistry a slam dunk. The reality is that the inflexible nature of porcelain and the technique sensitivity of resin cements require more, not less magnification. Yet, most restorations are still performed today with little or no magnification.

However, critical analysis of some esthetic compromises will show the progressive decline of gingival color from ideal salmon-pink to bluish-purple which is typical of chronic mild inflammation. It is



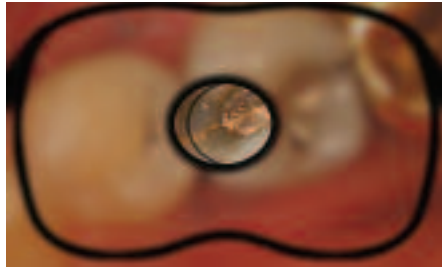
**Figure 1**—What would G.V. Black think of the modern microscope centered operator? The operating microscope is a simple technology that transforms other complex technologies. When a patient watches live-time treatment, trust, value for precision, and fear of the unknown are all dramatically impacted.



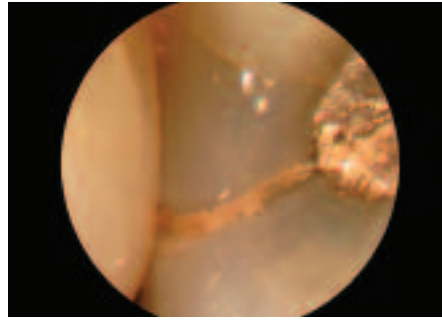
**Figure 2**—Oculars (loupes) rely on convergent vision that essentially requires a crossing over of images. This form of magnification creates increasing problems and eye strain as magnification increases.



**Figure 3**—Convergent magnification at 8X and a representation of the 2 images that your brain receives as you begin to focus.



**Figure 4**—Incomplete merging of images, which is a common occurrence. Both images also demonstrate the visual noise in the background of loupes.



**Figure 5**—Microscopes feature infinity corrected (parallel) optics. There is no eye strain.



**Figure 6**—When this patient reported for esthetic treatment, I first assumed that she disliked the shape of the maxillary central incisors.

evident that nonideal tissue responses impact patient acceptance of treatment more than dentists realize. In our practice, we are surprised at the number of patients who report for retreatment because of mildly red or purple gingiva (Figure 6). Thus, practitioners may be underestimating the importance of “pink” esthetics for the success of treatment.

Numerous studies have shown that gingival and subgingival marginal discrepancies greater than 50  $\mu\text{m}$  cause problematic tissue response with increased crevicular fluid flow, altered bacterial flora, and poor esthetics.<sup>6-10</sup>

**The reality is that the inflexible nature of porcelain and the technique sensitivity of resin cements require more, not less magnification.**

The shortcomings with relying on composite cements to close large marginal gaps that are common with many of today’s outcomes are demonstrated in Figures 7A through 7D. Manufacturers recommend removing composite cements in the green stage. However, a microscope reveals huge “chunks” of composite that pull away when this technique is followed. If the clinician waits until composite cement is fully set, the removal of excess is a nightmare. In short, there is not any substitute for microscopically adapted, polished, and seated porcelain.




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Figure 7A—Low magnification of the microscope 2.5X.

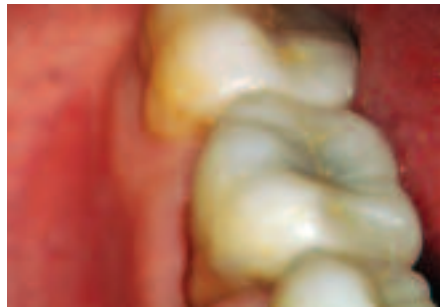


Figure 7B—Magnification at 4X.

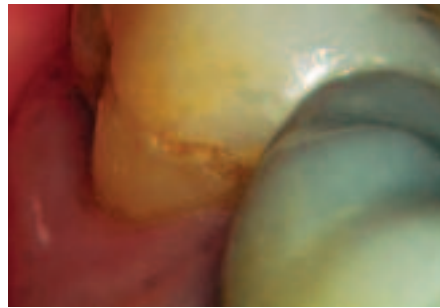


Figure 7C—Magnification at 12X. The drawbacks of the new "composite margins" become painfully obvious.

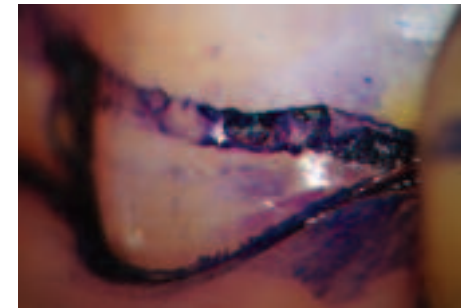


Figure 7D—View of the new "composite margin" with methylene blue stain at 24X.

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### Full Seating

Some days it feels as if the longer I practice the more difficult it gets. The new porcelains are beautiful and strong but sometimes mercilessly difficult to seat. Gold and porcelain-fused-to-metal crowns seat snugly and uniformly (Figures 8 through 10). All porcelain crowns seem to bounce back or rock on the tooth. High level magnification identifies 7 distinct obstacles to full seating and how to overcome these.

**If the Clinician waits until composite cement is fully set, the removal of excess is a nightmare.**

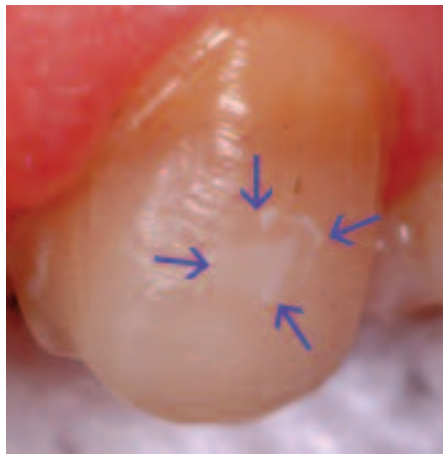
### A Microscope Centered Approach

Mainstream dentistry is moving toward the creation of 2 margins, porcelain and a composite margin. Porcelain that is several hundred micrometers off in both horizontal and vertical axis are theoretically sealed by the new super viscous composite cements. Margins that are accessible are sometimes dressed down with finishing burs. These protocols are the standard of care, but when viewed under the microscope the following is apparent:

- The high luster of porcelain cannot be fully reestablished near the sulcus when "dressing down" porcelain margins.
- The cement margin portion is chalky and becomes bumpy after time.
- The composite margins are prone to microleakage.



**Figure 8**—Porcelain laminate is 700  $\mu\text{m}$  short from full seating.



**Figure 9**—Desiccated and magnified tooth reveal residual composite cement that was used to spot bond the interim laminate. This problem was not identified when initial cleanup was done at 4X magnification, but was readily apparent at 8X.



**Figure 10**—Fully seated laminate (within 50  $\mu\text{m}$ ) after composite removal. Laminate is now ready to be bonded to place. No margination will be necessary.

- The fear of marginal esthetics has driven clinicians to bury these margins creating new problems.
- Gingiva, cementum, and porcelain are rarely the same afterwards.
- At our microscope-centered hands-on porcelain laminate courses at Precision Esthetics Northwest and Newport Coast Oral Facial Institute, gingival finishing burs are not used.

With microscope precision the excess luting cement is “scissored” away cleanly as the ultra-precise laminate is seated. There is only 1 margin—a laboratory or chairside presculpted, pre-polished porcelain margin.

### Three Myths of the Microscope

#### Myth 1: Microscopes Are Not Practical in a “Normal” Restorative Practice

Restorative dentists are broadening their vision to include “microscope-centered practices” throughout the world. In our courses, we are seeing clinicians become comfortable using a microscope in just one day. Now some of these doctors are using microscopes and not the loupes.

#### Myth 2: Microscopes are Rigid, Cumbersome, and Impossible to Use for Routine Dentistry

Few clinicians realize that higher quality microscopes include low magnification such as 2.5X with the depth and breadth of field comparable to loupes. Although, it is true that many endodontists have rigid microscopes laden with heavy peripherals; but in my restorative practice I have found that microscopes can be set up for easy mobility.

#### Myth 3—Microscopes are Expensive

Unlike most “cutting-edge” “high-tech” dental gadgets, microscopes have reached an increased state of evolution and may never wear out or become obsolete like a computer or a curing unit. Some microscopes have lifetime guarantees and the amortized cost is quite low. In addition, a microscope can replace intraoral cameras and operator lights, and can allow the practitioner to forgo instruments and materials that are unnecessary in the microscope-centered setting saving money and time.

### Challenges of a Microscope in Daily Practice

Frankly, there are not any disadvantages for a clinician that seeks

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true excellence, but there are challenges that merit discussion. Practitioners often wonder if learning to use a microscope will interfere with the dentist’s practice. First, I recommend enrolling in a course before using a microscope in the office. Second, use a logical approach when incorporating the use of a microscope during the clinical day using small deliberate steps. For example, only use the microscope *after* packing cord for indirect restorations. Then, inspect, refine, impress with each patient’s case. Soon you will be proficient and ready to tackle the next step.

The practitioner will often make the mistake of using unrealistic levels of magnification for gross reduction or other less nuanced tasks. When I work on a quadrant, half of the time is spent at 2.5X, 4X, and 8X. Although I am able to use loupes during this time, the microscope is just as practical, more enjoyable and ergonomically superior.

When a practitioner is constantly leaving the mouth to use polishing strips or change instruments there is a risk of poking the patient’s face or pinching a lip. This is the moment the practitioner and assistant should return to the use of loupes until they are more adept at their tasks.

Also, it is important to remember that for manufacturers to keep costs down some microscopes are sold with weak, inexpensive light sources. In addition, some microscopes are too stiff. A practitioner should be able to gently move a microscope with their nose. Other disadvantages include: some microscopes do not have inclinable binoculars or only partially inclinable binoculars; and training is scant, and clinicians do not know how to adjust the microscope which is intimidating for the clinician and staff.

### Conclusion

The United States may not be keeping pace with other countries in the magnification and clinical-accuracy race. For example, dentists in third world countries are clamoring for microscopes where the financial commitment is proportionately much higher. Dr. Dennis Shanelec, a founding father of microscope enhanced dentistry said, “It is always difficult to try something for the first time. It is more difficult to try what *no one* has ever tried.” Thus, the Academy of Microscope Enhanced Dentistry was formed to help practitioners overcome obstacles and continue to the promised land of complete visual information. ■

### Acknowledgements

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