

Magnification in dentistry

Useful tool or another gimmick?

You may remember the first time you saw a dentist wearing magnifying loupes; you probably thought the person must have a severe vision defect. That certainly was my opinion as I observed an elderly dentist wearing single-lens loupes and leaning almost into a patient's mouth to accomplish an oral treatment procedure. I had that naive opinion for the first few years of my dental career, since magnification was not a popular aid to dental practice until later.

Although I was blessed with nearly perfect vision until approximately 55 years of age, I always felt the need to see more clearly some of the aspects of dental practice. After a few years of watching excellent dentists routinely using magnification, I finally became inquisitive enough to try the concept myself. I found the extra appendage to my head to be objectionable and in the way. The lenses of the loupes soon became dirty and scratched. My posture degenerated as I leaned

in too close to the patients. The loupes were uncomfortable to wear on my nose. They were an infection control challenge. However, after a few days of forcing myself to use loupes, I was convinced that my restorative treatment was being accomplished at a higher level of quality because of the magnification. My laboratory technician asked me if I had started to use a new technique, because the tooth preparations were better. I became a routine user of magnification, but then many questions came into my mind.

This article poses some of those questions about magnification and answers them from scientific information, personal experiences and my work with many dentists in study clubs and hands-on clinical courses.

DOES USE OF MAGNIFICATION WEAKEN YOUR EYES?

After consulting with an ophthalmologist about magnification (oral communication, L. Noble, M.D., Sept. 25, 2003), I was informed that he and his

colleagues agree that use of magnifying loupes does not harm or weaken the eyes, nor does it cause the user to become compromised in any way. However, after wearing loupes for a period, the user becomes accustomed to seeing more detail than that apparent with natural vision, and a psychological feeling develops that something is being missed if depending solely on natural vision. This is an uncomfortable feeling if the magnification is not available. Furthermore, after several hours, the eyes require time to readjust to normal vision, just as they do each morning after the eye muscles have been dormant all night. Apparently, while using magnification, the eye muscles become accustomed to contracting to a given level, and they must relax again to regain normal function. To avoid or reduce this challenge, it has been suggested that those people wearing magnifying loupes should consider not wearing them all of the time; instead, they should use loupes for some procedures and unmag-

nified, normal vision for other procedures.

HOW CAN I OBTAIN MAGNIFIED IMAGES?

The closer you get to an object, the larger it appears to your eye. However, the closer you get to an object, the more difficult it is to focus, especially for older eyes. Single-lens loupes help you get closer to an object and focus your eyes on it. So-called $\times 5$ single-lens loupes can create about $\times 2$ magnification with normal eyes (oral communication, J. Chang, Ph.D., Sept. 25, 2003). However, getting closer to the object can create poor posture with the associated back, neck and shoulder pain. If you use surgical loupes or operating microscopes, the image appears larger because it has been optically magnified, and the clinician can sit at a comfortable distance from the operating site.

WHAT MAGNIFICATION LEVEL SHOULD I USE?

The answer to this question is personal. The taller the practitioner is, generally the higher the magnification should be, since the practitioner's head is farther from the operating site and the image is smaller. Consultants advise that if a person is 5 to $5\frac{1}{2}$ feet tall, the magnification needed (on average, about $\times 2.5$) is less than that needed if the person is $6\frac{1}{2}$ feet tall and therefore naturally sitting farther from the operating site (on average, about $\times 3$ or more) (oral communication, J. Chang, Ph.D., Sept. 25, 2003). For any specific clinician, the higher the magnification, the greater detail that can be observed, and the smaller the viewing field. Additionally, some practitioners prefer lower magnification,

while others cannot work well without higher magnification. The most popular magnification level is about $\times 2.5$ for an average-sized person. As an average-sized man, I have concluded the following on the basis of my clinical experience.

■ For procedures such as greeting a patient, reading patient records, making alginate impressions, most of the complete denture procedures, routine tooth extraction and similar procedures, I prefer to use normal corrected but unmagnified vision. In other words, my regular glasses. If magnification or vision correction is not being

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used, protective safety glasses should be in place during all oral procedures.

■ For procedures such as tooth preparations on typical, normal-sized teeth, routine surgical procedures on soft tissue or bone, seating crowns or evaluating dental hygiene patients, I prefer magnification at about $\times 2.5$.

■ I prefer $\times 4$ or higher magnification for procedures to be accomplished on very small teeth, or for procedures that are extremely delicate and require precision hand movements (such as crown preparations or crown seating on lower anterior teeth, evaluating if a fixed prosthesis is loose, evaluating the fit of a long-span fixed prosthesis, api-

coectomies or other procedures that are very small in scope).

■ Higher magnification using clinical microscopes has had a positive influence in endodontics. For procedures that have a limited operating field (such as endodontic therapy, finishing single-crown preparations or single-tooth operative dentistry), use of a clinical microscope at magnification levels up to $\times 20$ has been shown to be a significant aid to quality treatment. However, learning to use the microscope requires time and effort, and the cost of the devices is significant.

WILL USE OF LOUPES INFLUENCE MY POSTURE WHILE OPERATING?

The focal distance between the operator's eyes and the operating site is a critical distance that influences posture significantly. Therefore, the focal length of the loupes should be matched to your preferred operating distance. If you select loupes with a focal length that is too short or too long, you will be uncomfortable while operating, and muscle pain eventually will result. The so-called declination angle depends on many of your physical characteristics. If the declination angle forces you to sit with your head tilted, pain will result. Alignment of binocular loupe optics is critical also. Eyestrain results if they are not aligned properly.

While wearing loupes, clinicians should be able to sit or stand in a comfortable position with normal posture. This requires proper selection of focal length and declination angle, as well as proper alignment of the binocular loupe optics.² Selection of loupes with any of the three factors not related to the phys-

ical characteristics of the wearer can cause poor posture and the resultant shoulder, neck and back pain and physical debilitation.

WHAT ARE THE LIMITATIONS TO HIGHER-POWER MAGNIFICATION?

Many oral procedures require various objects to be parallel to one another or symmetrical with other objects. Examples are creation of a multiabutment fixed prosthesis, placement of several implants or determination of the facial midline for denture setups. A wide field of vision is required for these procedures. In my opinion, for an average-sized clinician, use of magnification of more than about $\times 2.5$ while accomplishing such procedures causes inadvertent errors because of the limited vision field, requires poor posture and slows the procedures significantly. Higher-power magnification often influences posture negatively if the focal length of the magnifiers does not allow the clinician to sit in a normal posture. Additionally, if the clinician requires vision correction or if safety glasses are being worn when loupes are not in use, there is a continual need to exchange loupes with normal glasses.

SCRATCHING MAGNIFYING LENSES

Dental procedures produce significant debris, much of which contains very hard particles of tooth structure or metal. Although most magnifying loupes have protective coatings on the lenses, unless extreme care is taken, some lenses soon become scratched, cloudy and difficult to use. When cleaning lenses, the clinician should

remove gross debris carefully, using a water lavage if the loupes are water-resistant, followed by use of microscope-cleaning wipes or lens-cleaning cloths provided by some loupe manufacturers. I recommend purchasing loupes with water-resistant lenses to allow proper cleaning and disinfection. If the loupes are not water-resistant, a moist Kimwipes (Kimberly-Clark, Neenah, Wis.) tissue used with the same manufacturer's lens cleaning solution should be blotted on the lens to remove the major debris, followed by use of

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successive new microscope cleaning wipes to eventually clean the lens, and concluding with disinfection. In some procedures, such as multiple tooth preparations, cleaning the magnifying lenses may be required more than once during the procedure.

INFECTION CONTROL

Magnifying loupes collect debris from many procedures during a clinical day. Infection control is difficult at best. Ideally, all areas of the loupe should be disinfected with a high-level disinfectant after each patient. However, facing the reality that most dentists using loupes have only one set of loupes, and that some loupes will not tolerate constant use of disinfectants, the infection control challenge is obvious.

Disinfecting with high ethyl

alcohol solution is recommended. If the lenses are water-resistant, products such as Lysol Disinfectant Spray (Reckitt Benckiser Professional, Wayne, N.J.) may be sprayed into a gauze sponge and used to wipe the frames and lenses. Whenever possible, the clean, disinfected loupes should be in position on the clinician when the clinical procedure is started and left in place until the clinical procedure is completed, and hand contact with the loupes should be avoided during the procedure. At the completion of the clinical procedure, the lenses can be cleaned and the frames and lenses disinfected.

WHAT ARE THE POPULAR BRANDS OF LOUPES?

According to estimates I have gathered from several loupe manufacturers and informal polls I have conducted in my continuing education courses, the most popular high-quality loupes in North America are manufactured by Designs for Vision (Ronkonkoma, N.Y.); Orascoptic/SDS (Middleton, Wis.) and General Scientific/SurgiTel (Ann Arbor, Mich.).

There are numerous other brands that also are of high quality but are not as well-known as the brands described above: Carl Zeiss (Chester, Va.); Den-Mat (Santa Maria, Calif.); Eagle Optical Products (Bowmansville, N.Y.); Keeler Instruments (Broomall, Pa.); and SheerVision (Rolling Hills Estates, Calif.).

Practitioners interested in loupes should request information from the respective companies in which they have interest, then make the decision regarding which brand seems most acceptable to them. The

most popular brands have many advocates and offer different alternatives that need your consideration. Some of the lesser-known brands cost less.

Some practitioners prefer to use another category of very low-cost single-lens loupes for the procedures that produce the most debris, such as air abrasion, cutting metal out of teeth and polishing procedures. An example of a company selling low-cost loupes is Almore International (Portland, Ore.). Of course, many of the advantages available in more expensive loupes are not present in the low-cost versions, and posture will be compromised, but on the other hand, destruction of the loupes by accumulation of debris and scratches is not a major financial loss. Some practitioners use high-quality loupes for most procedures and

inexpensive loupes when they know the oral debris will be significant.

The treatment of oral disease using a microscope needs further observation and use by practitioners. There is a good potential for producing higher-quality treatment in some areas of dentistry when a clinical microscope is used. A well-established clinical microscope company is Global Surgical Corporation (St. Louis).

SUMMARY

In spite of their significant cost, the relatively long learning curve associated with their use, frustrations during use, their occasional need for being replaced and their peculiar appearance to patients, magnifying loupes assist all types of clinical dentists in producing higher-quality dentistry. Seeing

better also means decreasing operating time. Properly fitted loupes also can improve posture during operating and reduce muscle pain in the shoulders, neck and back. Working under magnification is useful, and clinicians should give strong consideration to adopting the concept. ■

The views expressed are those of the author and do not necessarily reflect the opinions or official policies of the American Dental Association.

Educational information on topics discussed by Dr. Christensen in this article is available through Practical Clinical Courses and can be obtained by calling 1-800-223-6569.



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