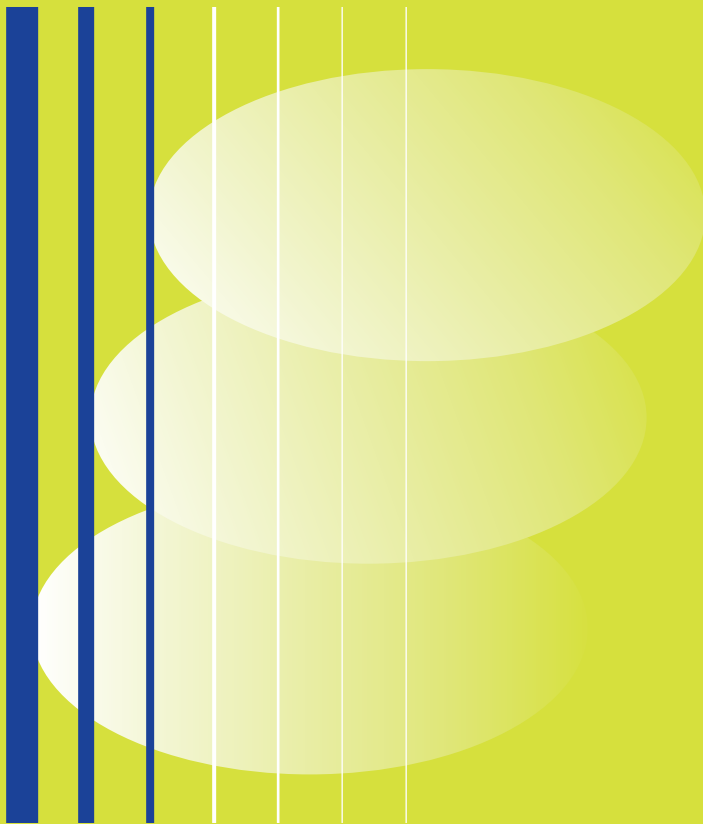


MAGNIFICATION USE
IN
DENTAL HYGIENE



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MAGNIFICATION USE IN DENTAL HYGIENE

by *Tricia Osuna, RDH, BS*

History

Not until the mid-1960s was dental treatment provided by an operator in a seated position. Up to that point, practitioners stood to visualize the patient's entire oral cavity. The seated position has been shown to reduce energy expenditure by the practitioner, decrease the static muscle activity and strain on the legs, and increase practitioner stability.^{1,2} Despite affording oral health care providers the advantage of improved vision, the seated position exacted ergonomic compromises. To reach instruments or adjust equipment, the seated body must twist in ways not required of the standing body. Magnification is a tool to lessen the effects of this compromise.

Dentists initially brought the use of magnification into dentistry through surgery, and from there it spread to the realm of general dentistry and continued on into all aspects of dental therapy. In 1876, magnification was introduced to dentistry to improve precision for dentists performing fine restorative dental work.³ Until recently, dentists were the primary users of magnification in the oral health care field. Now, clinical dental hygienists have incorporated magnification devices into their daily arma-

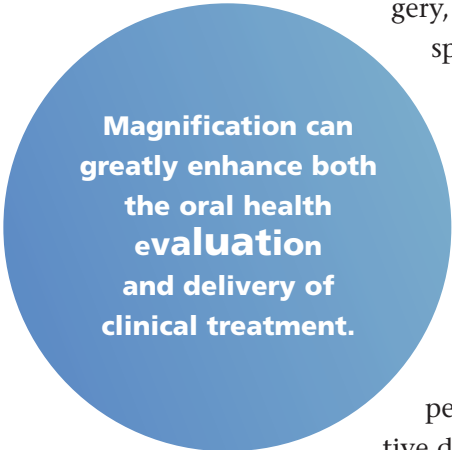
mentarium, and their use is increasingly being taught in dental hygiene education programs.

The adoption of magnification use and, more importantly, its acceptance by patients as well as clinicians has allowed oral health care professionals to diagnose oral conditions more accurately and treat them more comprehensively. Magnification use has also allowed oral health care professionals to maintain their careers longer by reducing physical stressors associated with visualizing the patient's oral cavity.

Benefits of Magnification

Improved Services for the Patient

This supplement is primarily concerned with the use of magnification by dental hygienists and the ways they can benefit from it. However, it is important to mention that their patients benefit, as well. Magnification can greatly enhance both the oral health evaluation and delivery of clinical treatment. Each day, more and more, clinicians see the value of magnification in recognizing oral lesions, assessing disease, recording periodontal pocket depths, evaluating the integrity of restoration margins, interpreting radiographs, and detecting calculus. It also can help ensure that accurately sharpened curet and scaler blades enhance patient comfort. Magnification has accompanied digital radiography and intraoral imaging devices into the dental hygiene operatory increasingly in the past few years. In turn, patients have enjoyed improved oral health due to practitioners' improved visual



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acuity, resulting in more accurate assessment and more effective treatment.

Improved Ergonomics for the Practitioner

Oral health care practitioners' overall ergonomic challenge, according to the Occupational Safety and Health Administration's ergonomic guidelines research is that it is common practice to fit the worker to the work and not the work to the worker.⁴ Discomfort experienced by oral health care workers in the office significantly increases as the workday progresses. This indicates that oral health care workers are repeatedly exposed to physical stress of significant magnitude throughout each day. In addition, another study shows that the length of work pauses taken does not allow for full recovery from the effects of dental work.⁵

The most serious risk factors for

ergonomics-related injury to oral health professionals are the awkward postures in which they sit and maintain for long periods of time with no back support. The confined area in which they practice also limits both range of motion and isometric muscle contraction. The physiologic effects of these two stressors are patterns of muscle imbalance and neuromuscular inhibition causing dysfunction and/or pain.⁶

Both repetitive motion and static posture are at the root of many ergonomic challenges facing oral health care practitioners. Magnification can help answer these challenges by limiting the amount of instru-

mentation; by improving practitioners' visualization, less time will be spent deciphering probe markings and identifying and removing

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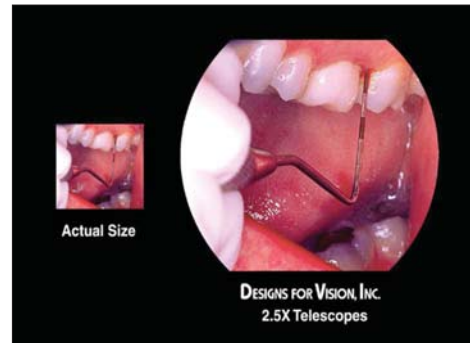


Figure 1.

debris. Dental hygienists who work with magnification enjoy the larger image and flexible working distance it provides. It has been demonstrated that dental students produce fewer clinical errors when using telescopes in preclinical training⁷ (Figure 1).

Types of Magnification Devices

Magnification and diopters are often confused with each other. A loupe system used in dentistry is manufactured with multiple lenses and prisms. By using these multiple lenses, a clearer view is obtained and the image is magnified without compromising neck and back



Figure 2.



Figure 3.



Figure 4.



Figure 5.

positioning and viewing distances. Diopters refer to a flat-planned, single-lens system

where the X power refers to a magnification system. Any lens or system that has the ability to focus light at a point closer than infinity will provide magnification.⁸

The choice of magnification devices is limited. The most common are through-the-lens (TTL) and flip-up magnification. The better choice is a matter of individual preference.

TTL, or fixed-system loupes, offer more comfort for the clinician because they are positioned much closer to the face and eyes than other styles. The weight is balanced evenly and offers a more comfortable fit. The lens is closer to the clinician's eye and offers an increased width of field.⁹ See Table I for advantages and disadvantages associated with TTL loupes (Figures 2 and 3).

Flip-up magnification devices incorporate moveable lenses that the clinician can move out of the line of sight as needed. The clinician does not have to remove the device when, for example, writing in the chart or providing patient education; he or she simply flips the magnification lens out of the line of

vision until it is needed again. See Table II for advantages and disadvantages associated with flip-up loupes (Figures 4 and 5).

Many clinicians prefer to have one device of each style, with the TTL for general use and the flip-ups for exceptional situations that require a change of angle. In these cases, the flip-up pair can serve as a backup if the TTL has a prescription that needs adjustment, which always must be performed by the manufacturer. Magnification lenses do not have to have a corrective prescription, although one can be added. The alternative is to wear contact lenses beneath the magnification eyewear.

Aspects of Magnification Equipment that Affect Equipment Selection

The purchase of magnification equipment should not be taken lightly, as the choices made in selecting equipment will affect the way the clinician will have to adapt his or her posture when using it. While magnification can help alle-

Improperly selected or adjusted magnification equipment will support or even create poor working postures.

Table I. Advantages and disadvantages associated with TTL loupes.

Advantages:	Disadvantages:
Improved width of field	Not adjustable for extraordinary procedures
Closer to the operator's eyes	More expensive
Reduction of weight due to 'regular' positioning on bridge of nose	Returned to manufacturer for prescription changes
Always in correct position to view surgical field	
Customized declination angle and working distance	
Lighter weight	

Table II. Advantages and disadvantages associated with flip-up loupes.

Advantages:	Disadvantages:
Can be flipped out of the line of sight for enhanced communication with the patient	Increased contamination when flipped up for communication with patient
Able to adjust declination angle when ergonomics are altered	Depending on magnification, are heavier and bulkier
Able to adjust declination angle for multiple users	Larger scotoma ("blind spot")
Lightweight	
Easier to replace / quicker delivery of system	

clinician's eye to a patient's molar when the clinician is treating its surface. Another way to measure is to ask the clinician to adjust the sweep or second hand on their watch while holding their arm at mid-line or heart level. Once this correct view is established, the measurement is taken to determine that clinician's appropriate work-

viate dangerous physical stressors, improperly selected or adjusted magnification equipment will support or even create poor working postures.¹⁰ Working distance, width of field, depth of field, and declination angle are the most important factors to take into consideration when incorporating magnification into the practice.

Working Distance

Working distance is the distance between the plane of the eye and the surface being treated. It is the most important aspect of magnification equipment that has the greatest impact on user posture and comfort.

One way to calculate working distance is to measure the distance from the plane of the

ing distance. When determining working distance, some clinicians may be tempted to refer to recommendations touted by textbooks or other source materials; it is important that they remember that their own working positions may not match those prescribed. The correct working distance should never allow for overextension of the neck, chin, or shoulders. While



Figure 5.



Figure 6.



Figure 7.

most clinicians have an optimal working distance of 13 to 18 inches, some will be comfortable in the 11-inch range.

Width of Field

Width of field, also called “field of view,” represents the width and height of the area the

practitioner sees while using the magnification device. A practitioner looking at a typodont while trying on different loupes will notice that he or she sees fewer teeth as the power of magnification increases: the higher the magnification, the smaller the width of field.

Selection should be made based on clinician preference. If the user wants to see an area as large as a quadrant, or larger, the appropriate magnification would be in the 2–2.5X range (Figure 6). More precise magnification of 3.5X or higher allows visualization of only a sextant or a few teeth. Most dental hygienists find the 2.5X magnification appropriate, whereas an endodontist may prefer a 4.5X magnification to view the canal.

Depth of Field

Depth of field is the range within which one is able to maintain visual accuracy at the appropriate working distance. If the practitioner can visualize the area from the patient’s central incisors to distal molar with-

out needing to change loupe position, the depth of vision is about three inches. The proper depth of field will allow the practitioner to avoid too much leaning and any overextension while practicing.

Declination Angle

Declination angle is the degree that the eyes are declined to view the area being treated. Declination angles range from 15 to 44 degrees, which indicates the importance that individual measurements be taken for this aspect of magnification. The clinician should be working in a comfortable position and not have to raise the chin away from the chest or hyperextend the neck or shoulders. Devices selected based on correct measurement of the declination angle should consistently prevent any eyestrain for the clinician (Figure 7).

The most accurate measurements for the purchasing of a magnification system are taken in the clinician’s own office treatment setting. Clinicians who prefer to measure for themselves rather than have a manufacturer’s representative perform in-office

The most accurate measurements for the purchasing of a magnification system are taken in the clinician’s own office treatment setting.

measurements may wish to follow the suggestions in the sidebar “Guidelines for Measurement” on this page to attain more accurate information to lead to a successful purchase (Figure 8).

Additional Considerations

Use of magnification will not adversely affect a clinician’s vision, either short- or long-term. Some individuals initially experience blurring, eyestrain, or headache; however, with continued use of the device, these side effects should diminish and disappear completely. Although a practitioner will not become dependent upon magnification for general vision, as with any helpful workplace tool, he or she may develop the habit of depending on them to work. It is not recommended that clinicians share TTL eyewear, unless both can perform their clinical duties equally and effectively or with equal effectiveness without compromising ergonomics.

Magnification is cost-effective. Magnification telescopes or loupes can cost anywhere from approximately \$400 to \$1,500. A clinician who invests \$800 to \$1,500 and practices for the average career of 25 years will have paid \$32 to \$60 per year—a small price for ergonomic safety and improved instrumentation.

Guidelines for Measurement

- 1. Balanced seating position**—The clinician should remove any prescription or safety glasses and other optical devices, and sit in a balanced position on the operator seat.
- 2. Optimal control point**—With eyes closed, the clinician should bring his or her hands to the most balanced and relaxed operating position.
- 3. Balanced access position**—A patient should be positioned so that the mesial incisal points of the maxillary incisors are brought to the clinician’s optimal control point, as determined in the previous step. This may be most easily accomplished by mounting a mannequin head in the dental chair or enlisting the help of someone in the office who will assume the role of a patient for the purposes of these measurements.
- 4. Balanced head position**—With his or her head in its least strained position and without concern for focal distance or resolution, the clinician should open the eyes and cast them downward to look at the optimal control point. Keeping the eyes on this point, the clinician should tip the head forward and downward until the musculoskeletal strain is felt in the neck. Then, the clinician should raise the head until strain is felt in the ocular musculature (that is, while peering down at the optimal control point over the lower eyelids). These two postures are the extreme head positions that will allow the clinician to achieve visual contact with the operating site. Keeping the eyes on the optimal control point, the clinician tips the head forward and backward a few times through this range of movement until an optimal balanced head position is determined. This position will simultaneously indicate the clinician’s optimal sight line and optical declination angle.
- 5. Declination angle assessment.** The declination angle can be measured by an assistant using a protractor, or the suitability of a surgical magnification system can be established without an actual numeric value for the declination angle.

Source: Rucker L, Beattie C, McGregor C, et al.: Declination angle and its role in selecting surgical telescopes. *Journal of the American Dental Association* 1999;130:1096-1100.

While all of these are important in their own right, without them in concert, the clinician can suffer from neck, back, shoulder pain, eyestrain and severe headaches.

Summary

Whatever the magnification system chosen, the enlarged image should be crystal clear

across the entire viewing area, with no distortion in brightness, coloring, or shape.⁹ Also, it must be comfortable enough and fitted well enough to ensure its

Manufacturers of magnification systems for dental hygienists:

Designs for Vision	www.designsforvision.com	800/345-4009
Keeler Instruments	www.keelerusa.com	800/523-5620
Orasoptic	www.orasoptic.com	800/369-3698
Sheervision	www.sheervision.com	877/678-4274
Surgitel	www.surgitel.com	800/959-0153
Carl Zeiss, Inc.	www.zeiss.com	800/442-4020

usefulness over the long term.⁹ Surgical magnification devices must accommodate the user's anatomical and physiological needs the same way that clinicians are being trained to view all aspect of ergonomics.¹¹ Vision can be enhanced through the use of telescopic loupes, which can also improve posture by decreasing the dental hygienists' tendency to lean forward in the chair.¹²

One way to view the addition of magnification telescopes to your armamentaria is the difference between an exceptional and average dental hygiene delivery system. It may not have anything at all to do with your clinical skills of instrumentation however may simply be that ... If you cannot see it, you cannot assess it, treat it, or remove it.

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