Magnification and Digital Imaging Technology for Enhanced Diagnosis and Communication

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Increased magnification is critical to various phases of restorative treatment—from initial treatment planning and diagnosis to information transfer and laboratory fabrication. Communication between the clinician and laboratory is further enhanced by the accurate detail that is captured using digital imaging modalities. The following article explores the restorative indications of increased magnification and digital imaging as well as the subsequent benefits of each modality.

ENHANCED VISUALIZATION FOR IMPROVED PATIENT CARE

The use of magnification is paramount for thorough diagnosis and treatment planning. Magnifying dental loupes offer the simplest, most convenient, and economical means of enhanced visualization of the treatment site. The use of loupes, however, relegates the operator to a single level of magnification, usually between 2x and 6x.

With superior optics, the operating microscope provides a wide range of magnification with multiple magnification levels, generally between 2x and 16x (or even higher; ie, up to 19x [G6, Global Surgical, St. Louis, MO]). In addition, increased visual acuity allows the early detection of caries, decay, and structural fractures, contributing to a more accurate diagnosis. As the practitioner becomes more proficient with loupes, higher magnification can then be employed using the microscope for intricate microsurgical procedures such as soft tissue grafting and gingival recontouring.

The surgical microscope is beneficial for routine procedures as well. Decay, fractures, and exposure of old bevels under preexisting restorations, not readily visible to the naked eye, can be detected at an early stage, facilitating minimal preparation of tooth structure. Utilizing the microscope for margin placement for crown preparations ensures clean, sharp surfaces and more accurate, detailed impressions.

DIAGNOSTIC APPLICATION OF DIGITAL PHOTOGRAPHY

The use of digital imaging in the dental practice has exploded over the last five years as a result of the improved photographic quality that rivals that obtainable with film. Although there are many adequate point-and-shoot systems, the use of a digital single lens reflex (SLR), combined with a 100-mm macrolens and a ring flash, services all basic intraoral and extraoral

The use of magnification is paramount for accurate diagnosis and treatment planning. Following is a list of several manufacturers of dental loupes and surgical microscopes:

G6 Dental Microscope System

Global Surgical Corporation, St. Louis, MO
www.globalsurgical.com
Global Surgical Corporation has introduced its new G6 dental microscope system. The G6 provides 6 steps of magnification with the optimal range of 2x to 19x, providing for full-mouth view and close inspection. Digital and video cameras are easily attached to the G6 microscope to facilitate diagnosis and procedure documentation for patient records and education, insurance purposes, and colleague communication. Global optics offer a lifetime warranty and 90-day money-back guarantee.

Revelation Series

Seiler Instrument Microscope Division,
St. Louis, MO
www.seilerinst.com
The Revelation Dental Operating Microscope is designed solely for the professional dentist. Available in floor, wall, or ceiling models, this microscope features precision optics for a superior image. Specifications include magnification levels of 3x, 5x, 8x, 13x, and 20x with a counterbalanced pantographic arm (340º rotation).

Dimension-3 Galilean Loupes

Orascoptic Corporation, Middleton, WI
www.orascoptic.com
Dimension-3 Galilean loupes set the industry standard for comfort and performance. The patented Dimension-3 optics deliver a large depth-of-field, the brightest images, and the best resolution across the entire field-of-view. In addition, the loupes are lightweight, waterproof, and hypoallergenic, with easy adjustment and maximum ergonomic benefits.

Vision GF Loupes

Carl Zeiss, Inc, Thornwood, NY
www.zeiss.com
Vision GF loupes are engineered and precision-manufactured to the exact specifications of Zeiss. Superb resolution means greater accuracy in diagnosis and treatment, and a large depth-of-field enables operation in a more natural position, a key ergonomic factor. Excellent light transmission results in less eyestrain and greater comfort.

imaging requirements. In addition, SLR systems offer consistent results and optimal photographic quality with the fewest settings and compensatory adjustments.

Digital imaging enables clinicians to identify existing areas of concern to ensure a satisfactory definitive result.

Digital imaging enables clinicians to identify existing areas of concern to ensure a satisfactory definitive result. For instance, restoration of a single anterior tooth often presents a challenge for the clinician and ceramist. It is, therefore, essential for the clinician to provide the laboratory with a diagnostic series of photographs that appropriately conveys the patient's condition and restorative requirements. These photographs include full frontal facial, retracted frontal, bilateral lateral retracted, and 1:2 mandibular and maxillary occlusal views. Close-up views of the tooth to be restored, as well as the adjacent dentition, are also obtained. For example, if tooth #7 (12) is to be restored, close-up photographs would be taken of tooth #6, #8, and #9 (Figure 1). These images also capture texture, luster, gingival margins, enamel cracks or surface striations, underlying dentinal strata, and incisal translucency (Figure 2).

IMAGING SOFTWARE

The utilization of imaging software (ie, Image FX, SciCan, Pittsburgh, PA) enables dental professionals to build a database for each patient as well as provide treatment simulations to increase case acceptance. These images can then be edited and retrieved for presentation to patients and/or colleagues, and subsequently compressed to conserve space. This can also greatly enhance communication during the preparation appointment (Figure 3).

The transfer of records for laboratory communication has also been improved significantly. Digital images can be processed and forwarded via e-mail to the ceramist within minutes of their capture. Unlike traditional film, there is no processing required, and feedback of image quality is instantaneous. In addition, the compact flash cards used for image capture enable hundreds of images to be obtained prior to downloading to a computer and can be erased and reused at a later date.

The advent of electronic shade-matching systems enables precise shade measurement to ensure accurate shade matching of the restoration. Advanced colorimeter technology (ie, ShadeVision, X-Rite, Grandville, MI) electronically measures the tooth to provide an average shade, color grid, and color mapping as well as an analysis of the hue, chroma, and saturation. It has the ability to deliver shade measurements via the Chromascop (Ivoclar Vivadent, Amherst, NY), Trubyte Bioform (Dentsply Trubyte, York, PA), and Vitapan Classical and 3-D Master shade guides (Vident, Brea, CA). The Easyshade system (Vident, Brea, CA) provides an immediate digital reading of the cervical, body, and incisal shades using either the Vitapan Classical and/or Vitapan 3-D Master shade guides (Figure 4). These systems are particularly beneficial when the laboratory is remote or when a custom chairside stain is not possible.

CONCLUSION

The use of magnification, digital imaging, digital photography, and shade-matching devices facilitates more accurate diagnosis and treatment planning, as well as communication between dentist, ceramist, and patient. These tools also enable the predictable fabrication of functional, aesthetic restorations that will satisfy every clinical indication.

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FIGURE 1. Tooth #7 was scheduled for restorative treatment, therefore, close-up photographs were also obtained of teeth #6, #8, and #9.

FIGURE 2. The gingival margins, underlying dentinal strata, and incisal translucency, as well as the presence of any enamel cracks or surface striations, can be readily apparent using enhanced visualization.

FIGURE 3. Digital images can be edited and retrieved for presentation to patients, especially during the preparation appointment.

FIGURE 4. The Easyshade system (Vident, Brea, CA) provides an immediate digital reading of the cervical, body, and incisal shades using either the Vitapan Classical and/or Vitapan 3-D Master shade guides.