MAGNIFICATION IN ENDODONTICS

Sharma N.*, Sharma A., Mantri V.*****

Abstract

Endodontists have frequently boasted that they can do much of their work blind-folded simply because there is "Nothing to see". The truth is that there is a great deal to see with the right tools.[1]The introduction and widespread use of operating microscope together with the power of ultrasonics and instruments for micro-endodontics are areas that have changed the face of endodontics.

Introduction

Modern dentistry places many stringent depends on the dentists. A necessary attribute for clinical work is a high level of visual activity. It certainly makes sense that if the clinician can see something more clearly and magnified he or she can better evaluate and treat.[8]

The operating microscope

Apotheker introduced the dental operating microscope in 1981.It was poorly configured and ergonomically difficult to use. It was capable of only one magnification (8x), was positioned on a floor, poorly balanced, had only straight binoculars, and had too long a focal length (250 mm). As a result, it did not gain wide acceptance in 1992, Dr. Gary Carr introduced an ergonomically configured operating microscope for endodontics, which allowed for easy use in nearly all endodontic procedures. [7]

Positioning the microscope

The introduction of the microscope in the dental office is a big revolution that involves many ergonomic changes. To reduce as much as possible any stress for the operator, the clinician should maintain the traditional working position previously used without the microscope. Working positions usually range from the 9 O'clock to the 12 O'clock position. It is also important for the clinician to maintain good posture with proper scope orientation.[1]In chronological order, the microscope should be prepared and positioned as follows:

- Positioning of the operator
- Positioning of the patient
- Positioning of the microscope
- Adjusting the interpupillary distance
- Fine positioning of the patient.
- Parfocaling
- Fine focus
- Adjusting the assistant scope

To position the operator, the microscope and the patient correctly, the simplest rule to follow in nonsurgical endodontics is that the back of the operator should be straight; the light of the scope should be perpendicular to the floor and also perpendicular to the root canal where he/she is working. Every single procedure in nonsurgical endodontics is made by indirect vision; therefore the light of the scope is directed to the mirror and, from there, into the root canal. In conclusion, the position of the patient

*PG Student, ***Professor Dept of Conservative Dentistry & Endodontics Modern Dental College & Research Centre, ** PG Student Dept of Public Health Dentistry K .D Dental College, Mathura.

depends on the position of the scope, and not vice versa[1].

In surgical endodontics, where the entire procedure is carried in direct vision, everything is easier. Nevertheless, in order to be able to check the retroprep through a micro-mirror, the light of the microscope should be perpendicular to the axis of the root canal.[3]

Ergonomics

After installing an operating microscope, it is necessary to organize the operatory ergonomically. The clinician should never move his/her eyes from the binocular and should never move his/her hands from the operating field to reach any instrument. This limits vertical dimension of movement. The operator should always stay in contact with the patient's mouth and instruments should be positioned exactly into his/her fingers. In nonsurgical endodontics this is achieved by the assistant who sits in front of the dentist, while in surgical endodontics it is done by a second assistant, who stands to the right of the operator and follows the surgical procedure through a monitor. During surgery, the first assistant has to keep the suction under control, so that bleeding does not interfere with visibility.

Table I.

TM = (FLB/FLOL)×EP×MV

TM – Total magnification
FLB – Focal length of binocular
FLOL-Focal length of objectives lengths
EP-Eyepiece power
MV-Magnification value

Magnification

Magnification of the operating field can be achieved with the use of magnifying loupes, which can be classified by the optical method in which they produce magnification. Compound loupes use two lenses to produce magnification, while prism loupes use refractive prisms. Both of these methods produce good magnification, have excellent depth of field and can be custom made, according to the specific interpupillary distance and to personal working distance. The disadvantage of loupes is that the practical maximum magnification is only 4.5x.They are available with higher magnification but some are heavy, with limited field of view and limited depth of field. Furthermore, they require a constrained physical posture and if not used as recommended may result in head, neck and back strain.

Most operating microscopes usually possess magnification steps or increments that can be adjusted manually or with motorized foot controls. The total magnification provided by the microscope can be computed using the formula shown in Table 1, which depends on the focal length of the binocular, focal length of the objective lens, eye- piece power and magnification value (Khayat BG ,1998). The clinician should remember that most procedures are made at minimum/medium magnification, while maximum magnification is used just to check what the clinician is doing. By increasing the magnification, the illumination of the operative field diminishes, together with the depth of field and with it the width of the operative field.

Illumination

Increased illumination of the operating field can be achieved using surgical headlights mounted on loupes, using a fiberoptic cable to transmit the light.

Even though any head movement moves the light so that it stays in the field of view, and even if the light levels are increased up to four times that of conventional dental lights, the illumination

of some loupes may not be powerful enough to allow good visibility deep inside a root canal.

The light source is one of the most important features of the micro-scope, as it is responsible for the illumination of the deepest portions of the root canal. This is due to the fact that the light source provides an absolutely coaxial illumination; which should enter the root canal without any angle, perfectly coaxial and with the operator's view eliminating the presence of any shadow. The light source can be powered by a halogen light bulb or by a xenon light.[6]

The operating microscope in non surgical endodontics

The operating microscope can be used in any single nonsurgical procedure: preparing and finishing the access cavity; shaping the root canal precisely; and filling the system completely in three dimensions.[2]

However, the enormous advantage of the microscope is better appreciated during retreatment. It is easier to diagnose a vertical root fracture, to find a missed root canal, to remove a broken instrument, to repair a perforation, or to seal a resorbed or immature apex.[2]

Diagnosis

The operating microscope can be very helpful in making a diagnosis of cracked tooth syndrome. In these cases, after the old restoration has been removed, using a dye (methylene blue) a hairline fracture can be easily seen.

When the clinician suspects a vertical root fracture, the diagnosis can be made by observing the internal wall of the root canal, eliminating the need for a surgical exploratory flap or examining the external root surface.[2]

Locating canal orifices

A perfect access cavity with visualization of all the canal orifices is prerequisites for ssuccessful endodontic therapy. The microscope can be very useful in locating hidden canal orifices, canals completely blocked by calcification in the pulp chamber and canals completely calcified in the coronal and middle two thirds.

Another advantage of the microscope is the enhanced visualization of the mesiopalatal canal (MB2) of upper first and second molars.

Retreatment

The biggest revolution due to the introduction of the microscope in nonsurgical endodontics is in the area of retreatment. Every single procedure that was previously made by chance or performed using tactile sensation can today be made with complete vision and control; **if you can see it, you can do it**! Any challenge existing in the straight portion of the root canal system, even if located in the most apical part, can be easily seen and often solved under the microscope with magnification and coaxial illumination.

The removal of a broken instrument, the repair of a perforation and the treatment of an open apex using the new material MTA are procedures that can be done in predictable time with predictable results.

The operating microscope in surgical endodontics

Surgical endodontics is an area that has benefited the most from a microsurgical approach. The introduction in 1990 by Excellence in Endodontics (EIE) of a dedicated microsurgical armamentarium has

revolutionized surgical technique and vastly improved the skill level of an entire specialty. The incision is made with a microsurgical scalpel blade and, therefore, is more precise, repositioning of the flap is also more precise and later no scar is to be expected. The introduction of optical-grade micromirrors has facilitated the detailed examination of the bevelled root-end in apicoectomy procedures. The orifices of lateral canals can be identified, prepared and sealed, in order to obtain a three-dimensional obturation of the root canal system even with a surgical approach. Ultrasonic root-end preparation has revolutionized apical surgical procedures, reducing the need for exaggerated bevels and, thus, reducing osseous crypt size.[4,5]

Microscopic techniques have also led to the development of soft tissue management techniques, including microsurgical suturing and the early removal of sutures, which has resulted in more rapid wound healing and minimal scar formation.[5] Recent studies show that surgical endodontic procedures performed under the operating microscope are followed by a success rate of 96.8%.

Conclusion

Endodontics has changed tremendously in the past two decades in relation to the use of equipments and instruments.This new approach of involving enhanced magnification has rectified all the shortcomings of traditional approach, thus making the procedure much more predictable and result oriented.[10]

REFERENCES

1. Garry B. Carr. The use of the operating microscope in endodontics. DCNA 2010;54:191-214.
2. A.H. Forgie et al. Restoration removal with and without the aid of magnification.Journal of oral Rehabilitation 2001;28:309-313.
3. Richard Rubinstein.Magnification and illumination in apical surgery. Endodontic topics 2005;11:56-77.
4. Daniel D.et al Use of the microscope in endodontics: Results of a Questionnaire.JOE2008;34;7:804-7.
5. Syngcuk Kim et al Color Atlas of microsurgery in endodotics;1st ed. W.B.Sauders 2001 pg 45-55.
6. Richard Rubinstein.The anatomy of the surgical operating microscope and operating positons.DCNA 1997;41(3):291-413.
7. Bertrand G. Khayat.The use of magnification in endodontic therapy.The operating microscope. Prac Perio Aesthet Dent 1998;10(1):137-144.
8. Kenneth Koch.The microscope.its effect on your practice.DCNA 1997;41(3):619-627.
9. **Dr.** David Clark. What does the future hold for high- level magnification in dentistry. Buyer's Guide to Microscopes.
10. **Lynne A. et al.** The influence of dental operating microscope in locating the mesio lingual canal orifice. Oral Surg Oral Med Oral Patho Oral Radio Endod ss2002:93;190-194.

Corresponding Author

Dr. Neha Sharma

Dept of Conservative Dentistry &Endodontics

MDCRC, Gandhi Nagar , Indore .