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RESEARCH ARTICLE

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Abstract

Endodontists have frequently boasted they can do much of their work blindfolded simply because there is "nothing to see." The truth of the matter is that there is a great deal to see if only we had the right tools. And now clinicians have recognized that the use of magnification can improve the performance of dental procedures. This article reviews and describes application of surgical operating microscopes emphasizing its importance in endodontic treatment . Its introduction into dentistry in the last fifteen years, particularly in endodontics, has revolutionized how endodontics is practiced worldwide.

Introduction:-

Endodontists have frequently boasted they can do much of their work blindfolded simply because there is "nothing to see." The truth of the matter is that there is a great deal to see if only we had the right tools.[1] In the last fifteen years for both non-surgical and surgical endodontics, there has been an outburst of new technologies, new instruments and new materials. These developments have improved the precision with which endodontics can be performed. These advances have enabled clinicians to complete procedures which were once considered impossible or which could be performed only by extremely talented or lucky clinicians. The most important revolution has been the introduction and then the widespread adoption of the operating microscope. Operating microscopes have been used for decades in many other medical disciplines: ophthalmology, neurosurgery, reconstructive surgery, otorhinolaryngology, and vascular surgery. Its introduction into dentistry in the last fifteen years, particularly in endodontics, has revolutionized how endodontics is practiced worldwide.[2]

The operating microscope in endodontics:-

It was capable of only one magnification (8x), was positioned on a floor stand and poorly balanced, had only straight binoculars, and had a fixed focal length of 250 mm. This microscope used angled illumination instead of confocal illumination. It did not gain wide acceptance and the manufacturer ceased manufacturing them shortly thereafter their introduction. Its market failure was more a function of its very poor ergonomic design rather than its optical properties, which were actually quite good. .

Without question, the microscope has contributed to improved surgical treatment through enhanced vision. Surgical endodontics was the first area in which the microscope was used, and it still continues to be the most popular. It is a natural progression to go from strictly surgical use to continual microscopic use, in various perspectives.[3]

Digital optical microscope: (Surgical operating microscope – SOM)
Following are the important advantages of a surgical operating microscope:-
Magnification:
The magnification possibilities of a microscope are determined by the power of the eyepiece, the focal length of the binoculars, the magnification changer factor, and the focal length of the objective lens.

Eyepieces are generally available in power of 6.3X, 10X, 12.5X, 16X and 20X. (Fig 1)

Figure1: Magnifying lenses.

As in a typical pair of field binoculars, adjusting the distance between the two binocular tubes sets the interpupillary distance.

Binoculars are now available with variable inclinable tubes from 0^0 to 220^0 to accommodate virtually any head position. Magnification changers are available in 3-, 5-, or 6- step manual changers, manual zoom, or power zoom changers. (Fig 2)

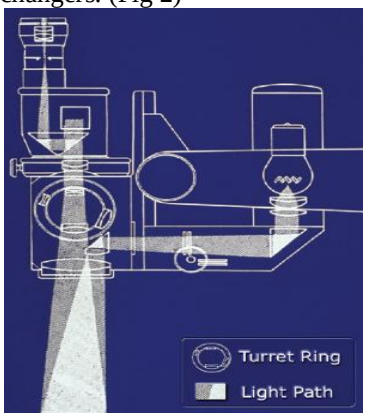

Figure 2: Cross-sectional diagram of a typical 5-step SOM head showing the turret ring in the body of the microscope.

The turret is connected to a dial, which is located on the side of the microscope housing. The dial positions one lens in front of the other within the changer to produce a fixed magnification factor. Rotating the dial reverses the lens positions and produces a second magnification factor.

Turning the dial rotates the turret ring inside the body of the SOM and creates five magnification factors. A typical 5-step changer has two sets of lenses and a blank space on the turret without a lens.

A manual zoom changer is merely a series of lenses that move back and forth on a focusing ring to give a wide range of magnification factors.

A power zoom changer is a mechanized version of the manual zoom changer. Power and manual zoom changers avoid the momentary visual disruption or jump that is observed with manual step changers as you rotate the turret and progress up or down in magnification. Power zoom changer microscopes have foot controls, which allow the surgical field to be focused and magnified hands-free.[4]

The SOM is focused much like a laboratory microscope. The manual focusing control knob is located on the side of the microscope housing and changes the distance between the microscope and the surgical field. As the control knob is turned, the microscope is brought into focus.

Some microscopes are fine focused by turning a focusing ring mounted on the objective lens housing. The focal length of the objective lens determines the operating distance between the lens and the surgical field. With the objective lens removed, the microscope focuses at infinity.

Many endodontic surgeons use a 200mm lens, which focuses at about 8 in. With a 200mm lens there is adequate room to place surgical instruments and still be close to the patient.

As mentioned earlier, as you increase the magnification, you decrease the depth of field and field of view. While there is a limitation for fixed magnification loupes, it is not a limiting factor with the SOM because of the variable ranges of magnification. If the depth of field or field of view is too narrow, the operator merely needs to back off on the magnification as necessary to view the desired field.

Illumination:-
The light provided in an SOM is two to three times more powerful than surgical headlamps. Hence standard overhead operating lighting is not required in endodontic surgery while operating with SOM.

The light enters the microscope and is reflected through a condensing lens to a series of prisms and then through the objective lens to the surgical field. After the light reaches the surgical field, it is then reflected back through the objective lens, through the magnification changer lenses, through the binoculars, and then exits to the eyes as two separate beams of light.

The separation of the light beams is what produces the stereoscope effect that allows us to see depth.
Illumination with the SOM is coaxial with the line of sight. This means that light is focused between the eyes in such a fashion that you can look into the surgical site without seeing any shadows.

Elimination of shadows is made possible because the SOM uses Galilean optics.

Galilean optics focuses at infinity and sends parallel beams of light to each eye. With parallel light, the operator's eyes are at rest and therefore lengthy operations can be performed without eye fatigue.[5]

Accessories:-
A beam splitter can be inserted into the pathway of light as it returns to the operator's eyes. The function of the beam splitter is to supply light to an accessory such as a video camera or digital still camera.

In addition, an assistant articulating binocular can be added to the microscope array.

The advantages of adding assistant articulating binoculars are numerous. The assistant becomes optically important to the surgical team and develops a keener understanding not only of what is expected in the surgery but why it is expected.(Fig 3)

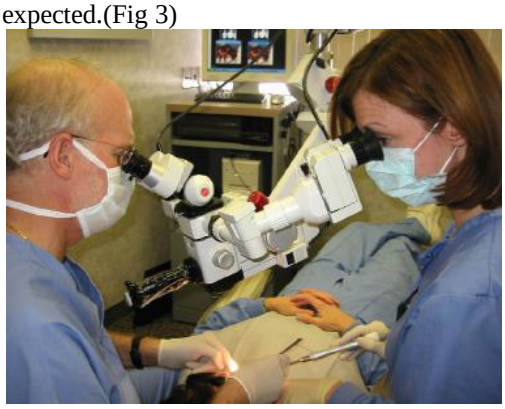

Figure 3: working along with assistant .

She/he sees stereoscopically exactly what the operator sees. Placement of a surgical suction becomes accurate and the assistant can visually anticipate the surgeon's next step in the procedure. Most clinicians have found that bringing the assistant into the visual sphere increases job satisfaction significantly.

Diagnostic use:
The practical use of the microscope enhances the dentists capabilities as a diagnostician in terms of better analysis of the oral cavity in general and some certain specific features like cracked teeth, vertical and horizontal fracture determination, microanatomy of the root apex and extra canal estimation. [6]

Procedural use:
Carr, Kim, Pecora and Rubinstein promoted the use of the microscope for surgical procedures in the late 1980s and early 1990s and for the first time, dentists could truly visualize the root end anatomy.

The discovery and treatment of the isthmus, was a significant step in reducing the rate of failures in endodontic surgery, and hence, increasing the overall success rate by 96%.

In conjunction with endodontic microscopy was the introduction of ultrasonic technology for retropreparations.[7]

Healing:-
Another aspect of the microsurgical revolution in endodontics has been the postoperative healing that occurs through the use of finer sutures, combined with precision.

Precise incisions and reapproximation, made possible by the microscope, have contributed to quick, uneventful healing leading to a new concept of suture removal in 48 hours.

Documentation and patient education:-
All microscopes, for intra oral use have the capability to videotape the procedures and to produce videotapes. Not only is the tape helpful legally, but, also it should be a source of patient education.

The ability to produce quality slides and videos is proportional to the quality of magnification and illumination systems within the microscopes such as beam splitters and cine adaptors. Commercially available video cameras capture about 340 lines of resolution, which is comparable to recording capability of video cassette recorder and resolution of the monitor.

These video cameras can also be used for video print of the whole case and digital interpretation due to an inbuilt microcomputer inside the video printer.[8]

Ergonomics:-
The binoculars on many SOMs have variable inclination. This means that the operator's head can develop and maintain a comfortable position. All stooping and bending is eliminated, thereby forcing the operator to sit up straight tilting the pelvis forward and aligning the spine in proper position.

This positioning should create a double s-curvature of the spine, with lordosis in the neck, kyphosis in the midback, and lordosis again in the lower spine.

Such posturing is not possible when the clinician is wearing a headlamp and loupes or using an endoscope. With these devices, there is still the tendency to bend over the patient, creating poor ergonomics and developing head, neck, and shoulder strain. Constant bending over the patient collapses the diaphragm and may inhibit oxygen exchange causing fatigue later in the workday.

This is eliminated with the upright positioning achieved while using the SOM.

While performing apical surgery, the clinician uses two assistants.

The primary assistant or suctioning assistant is seated so that she/he can observe the doctor's perspective through the assistant articulating microscope. The secondary assistant stands to the doctor's dominant side and is responsible for

placing instruments into the doctor's hand. If desired, the secondary assistant can view the surgery in real time on either of two monitors placed in the operatory, which display digital radiographs and real-time video.

Positioned this way, the doctor should never have to take his eyes from the SOM and the surgical field and should be able to maintain an appropriate and beneficial posture throughout the entire procedure.[9,10,11] (Fig 4)

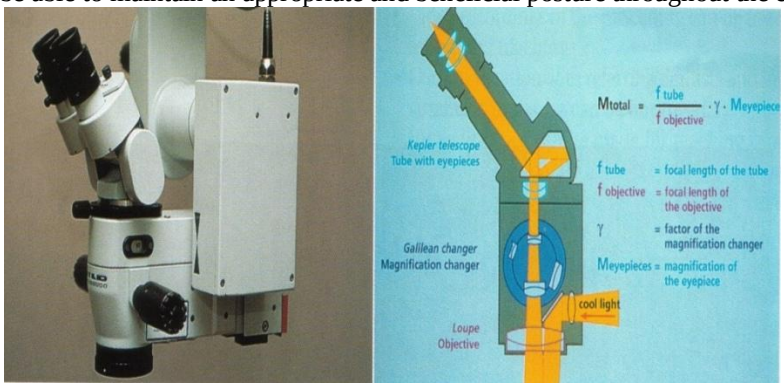

Figure 4: A,Surgical microscope. B, Diagram of the microscope. The basic components are the binocular with eyepiece, magnification changer, objective lens, and illumination system. Calculation of magnification is given at right.

Microscope position:

Most endodontists prefer an operating microscope that is mounted to the ceiling. Suspension arms support and position the microscope in horizontal and vertical dimensions, in an infinite number of axes within the three dimensional space. Selection of binoculars is critical in determining correct microscope position. Indirect tube binoculars are used in maxillary surgery while straight tube binoculars have an advantage that can be used for surgery on either of the jaws. [12,13,14]

Conclusion:-

The SOM was originally introduced as a surgical tool. Almost immediately after its introduction many clinicians realized its benefit in conventional treatment and non-surgical retreatment. A difficult question to answer when considering a non-surgical versus a surgical approach is whether the clinician can readdress the original biology of the case. This question may be impossible to answer without actually re-entering the case and possibly rendering the tooth non-restorable after disassembly. What is clear is that clinicians who use the SOM and microsurgical armamentarium now possess the necessary magnification, illumination, armamentarium, and subsequent precision to perform apical surgery at the highest level of care.

References:-

1. Rubinsten R. Magnification and illumination in apical surgery. Endodontic Topics, 2005; 11:56–77.
2. Arx, Montagne, Zwinggi et al: Diagnostic accuracy of endoscopy in periradicular surgery – a comparative study with SEM. Int. Endodontic Journal, 2003; 36: 691.
3. Dental Clinics of North America: Microscopes in Endodontics. July 1997; 41: 3, Saunders Publication.
4. M.B. Kreisler, H. Al Haj, N. Noroozi, B. Willershausen, B. d'Hoedt: Efficacy of low level laser therapy in reducing postoperative pain after endodontic surgery – A randomized double blind clinical study. Int. J. Oral Maxillofac. Surg. 2004; 33: 38-41.
5. Mohamed I. Fayad, Robert Hawkinson, Jon Daniel and Jianjun Hao: The effect of CO_2 laser irradiation on PDL cell attachment to resected root surfaces. Oral Surg Oral Med Oral Pathol Oral Radiol Endod, 2004; 97: 518-23.
6. Louis I. Grossman: Endodontic practice, Eleventh edition, 1991.
7. Ingle, Bakland: Endodontics, Fifth edition, 2002.
8. Ingle, Bakland: Endodontics, Sixth edition, 2008.
9. Stephen Cohen, Richard C. Burns: Pathways of pulp, Eighth edition, 2002.
10. Franklin S. Weine: Endodontic therapy, Fifth edition, 1996.
11. Walton and Torabinejad: Principles and practice of endodontics, Second edition, 1996.
12. Syngcuk Kim: Color atlas of Microsurgery in Endodontics. W.B. Saunders Company.
13. Christopher J.R. Stock, Kishor, Walker: Colour atlas of endodontics, third edition 2004.
14. James L. Gutmann, John W. Harrison: Surgical Endodontics. All India Publication.

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