
Original research article**DENTAL OPERATING MICROSCOPE IN ENDODONTICS: ENLARGED VISION & SUCCESS****Anil K Tomer¹, Ayan Guin², Geetika Sabharwal³, Nivedita Saini⁴***¹Professor And Head, Department Of Conservative Dentistry And Endodontics, Divya Jyoti College Of Dental Sciences And Research, Modinagar, Uttar Pradesh.**²⁻⁴Postgraduate Students, Department Of Conservative Dentistry And Endodontics, Divya Jyoti College Of Dental Sciences And Research, Modinagar, Uttar Pradesh.*

Received: 03-05-2022 / Revised: 07-06-2022 / Accepted: 10-07-2022**Corresponding author: Dr. Ayan Guin****Conflict of interest: Nil**

Abstract

Traditional endodontics has been supported feel not sight. Along with the help of radiographs and electronic apex locators this blind approach makes surprising success. There is, however, a big failure rate, especially in long-term. The utilization of magnification in endodontics isn't an isolated development. it's a part of trend in medicine and dentistry toward a research for perfection and application of minimally invasive technique for procedures that previously required extensive surgery. But now a days microscopic endodontics has totally changed the future of endodontics and endodontic surgery are practiced. High levels of magnification increase the combination amount of visual information available to endodontists for diagnosing and treating dental pathology. Initially resisted, but there has been a recent surge of interest in microscope enhanced dentistry among endodontists.

Keywords: Coronary Artery Disease, Percutaneous Intervention, ST elevation Myocardial infarction.

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Introduction

With the event of clinical techniques that need high levels of facility and involve fine detail there's increasing interest within the use of magnification for dental procedures. Endodontic procedures were performed using tactual sensation and also the only thanks to see inside a passageway was to require radiographs. Radiographs are inaccurate in this they're two-dimensional additionally to radiographs, various magnification systems like

magnification loupes / telescopes are wont to perform conventional endodontics.[1]

However the introduction of dental operationg microscope has heralded a replacement era in endodontics. Operating microscopes are useful right from diagnosis, trying to locate extra canals or missed canals, assessing efficacy of newer systems for cleaning and shaping, to forestall / or manage endodontic mishaps.[2]

The high magnification of the operating microscope helps to provide for a safer procedure since it allows for a very cautious applications of the proper instruments. High quality endodontic treatment needs a lot of knowledge, skill, expertise, energy and patience. This may be strenuous for the dentist. Thankfully proper use of the dental operating microscope helps to allow for a highly ergonomic posture.

In 1999, Gary Carr, introduced a DOM that had Galilean optics which was ergonomically configured for dentistry, with several advantages that allowed for straightforward use of the scope for nearly all endodontic and restorative procedures.[3] It used a confocal illumination module in order that the light path was within the same optical path because the visual path, gave far superior illumination than the angled light path of the sooner scope, gained rapid acceptance within the endodontic community, and is now the instrument of choice not just for endodontics except for periodontics and restorative dentistry likewise.

How does dental operating microscope works ?

There has always been a doubt on how, a microscope differs from a loupe. The dental microscopes uses the parallel beam light path better called "the Telescope system" that follows galilean optics wherein focus is at infinity and parallel beams of light are sent to every eye thereby reducing strain on clinicians eye. Also, illumination with binocular microscope is co-axial with line of sight.

From the light source light is reflected through condensing lens to an array of prisms to the target lens. From the target lens the light is concentrated to the surgical field. From the surgical site the light is reflected back to the target lens then passes through the magnification changers. From magnification changers the light reaches the binoculars

wherein the beam is split and also the surgical field is seen through the attention piece. The telescopic loupes follow the convergent beam path that's the Greenough system. to understand what a surgical microscope can do, it's vital to grasp how it works. the most parts are often divided into 3 groups.

- 1) Magnification
- 2) Illumination
- 3) Accessories

I. Magnification is decided by :

a) Eye pieces which are available in different magnification powers of 6.3X, 10X, 12.5X, 16X, 20X. It encompass

- 1) A viewing side with rubber cup
- 2) Adjustable diopter setting (-5 to +5).
- 3) Binoculars which is employed to carry eye piece which can be straight, inclined or inclinable and again of shorter or longer focal distance.

b) Magnification changer which can be a 3/5 step manual changer or power zoom charger.

c) Objective lenses whose focal distance (which ranges from 100 mm to 400 mm) determines the operating distance between lens and surgical field.

II. Illumination : is principally by means of a 100 watt Xenon halogen bulb, where intensity is controlled by a rheostat and cooled by an acquaintance. Illumination is principally co-axial with line of sight, which suggests that light is focussed between the attention pieces so no shadows are going to be visible this can be possible thanks to the usage of Galilean optics.

III. Accessories:

- 1) Pistol or bicycle grips
- 2) liquid display (LCD) and high resolution monitors which receives video signals from cameras.
- 3) Integrated video camera
- 4) Eye piece with rectile field: used for aligning during video taping and 35 mm photography.

5) Auxiliary monocular or articulating binocular for helper.



Figure 1 :Modern Dental Operating Microscope



Figure 2 :Auxiliary monocular for dental assistant

Advantages of Dental Operating Microscope :

There are mainly five basic advantages in using the DOM and accompanying documentation systems (digital microphotography and videography) for an endodontic specialist include: increased visualization, improved Quality and precision of treatment, enhanced ergonomics, easy proper digital documentation and increased communication ability through integrated video.

Increased Visualization

Carr reported that the human eye, when unaided by magnification, has the inherent ability to resolve or distinguish two separate lines or entities that are a minimum of 200 microns, or 0.2mm, apart. If the lines are closer together, two separate entities or the objects will appear together.[4]

The majority cannot refocus at distances closer than 10 to 12 cm. because the eye-subject distance (i.e. focal length) decreases, the eyes must converge, creating eyestrain. Furthermore, jointly ages, the flexibility to focus at closer distances is compromised, caused by the lens of the attention losing flexibility with age (presbyopia) because the focal length decreases, depth of field also

decreases. Considering the matter of the uncomfortable proximity of the practitioner's face to the patient, moving closer to the patient isn't a satisfactory solution for increasing a clinician's resolution.

Alternatively, a typical DOM can raise the resolving limit from 0.2 -0.006 mm ,thus with magnification the resolution of the human eye improves dramatically .In addition to having up to 6 levels of magnification starting from 2x to 26x available, illumination may be a critical component in increasing visualization. Most microscopes are equipped with an integrated coaxial source of illumination that enables for unobstructed, shadow-free illumination of the operating field which allows for significantly improved visualization of even the foremost difficult to access areas of the oral fissure.[5]

Improved Quality and precision of treatment

The visual information provided by the binocular microscope is, in fact, not indicative of the magnification that's being employed. the particular amount of visual information is that the area under the scope and is therefore the quantity of horizontal pixels multiplied by the quantity of vertical

pixels. A microscope at 10× magnification provides 25 times the data compared thereto obtained through the utilization of entry-level loupes (2×) and over 10 times that of 3× power loupes. As magnification increases, the depth and diameter of the field-of-view of the operating field decrease. there's an increased

demand at higher magnification for improved control of the micro-motor muscles and joints (fingers and wrists) which will require stabilization of the gross motor joints (elbow and shoulder) with microendodontist' chairs. [6]

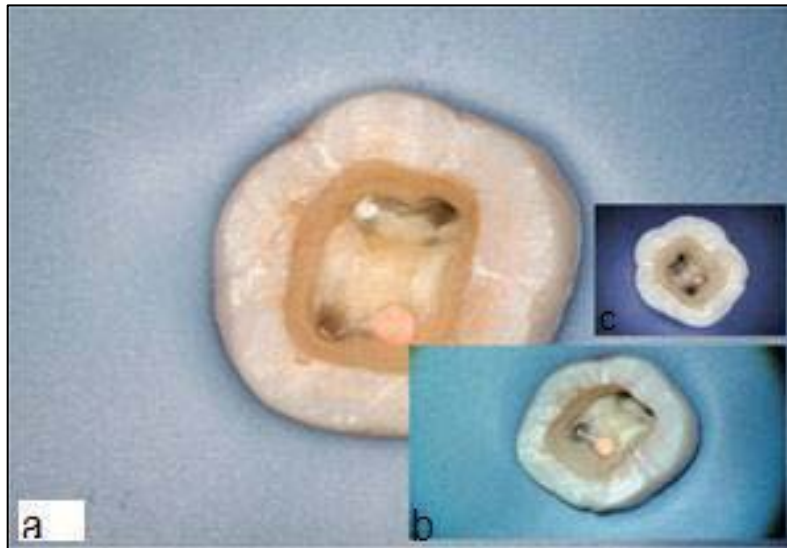


Figure 3: Comparison of magnification between DOM (a), loupes (b) and naked eye(c)

Improved & Ideal treatment Ergonomics

With DOM improved ergonomics is realized on many levels, the foremost obvious being improved posture. With microscope, the clinician is ready to practice while looking straight ahead without having to either bend forward in an endeavor to determine better (causing lower back pain), or raise the patient horizontally so as to bring the rima oris closer to the clinician(causing neck pain). The microscope allows for 100% of the retina to be focused on the positioning.[6]

By operating during a more upright, neutral and balanced posture, the endodontist is a smaller amount likely to experience strain, tension or fatigue of neck or lower back muscles which allows one to focus

completely on the task at hand and able to work comfortably for extended periods of your time. this may enable the endodontist to supply more dentistry in fewer visits, increasing productivity and making more contented patients.

Ergonomics is additionally improved during digital documentation because intra-operative images is captured very efficiently by the assistant without interrupting treatment.[7,8] Moreover microscopes with a protracted working distance allow endodontist and his team members, distance from the patient during dental work reducing the danger of exposure to aerosols and spatter thus without putting in danger their own health and soundness.[9]



Figure 4: Improved ergonomics during working with dental operating microscope

Ease of Proper Digital Documentation Capabilities

With the optional addition of a beam-splitting device, one is ready to capture digital photos and record real-time video at multiple magnifications, by integrating various styles of digital recording devices, like an SLR and/or video camera and saved in hard drives and mini DV tapes or on to DVD.

Digital documentation capabilities enable the clinician to efficiently capture and share with patients what's seen during an examination

pre-operatively, intra-operatively and post-operatively and stored in patients chart. this is often especially useful when unforeseen problems are encountered. this could results in greater rates of case acceptance, increasing patient's level of trust and confidence and significantly streamline the number of your time required in gaining it. The usage of documentation for medico-legal, insurance, patient communication, and lecturing purposes, also as for communication with staff or colleagues, is additionally impressive.



Figure 5: Microscope attached with digital camera for proper documentation
Increased Ability to Communicate through Integrated Video

Mehrabian has shown that the maximum amount as 55% of the understanding that happens in verbal communication is

thru visual cues, and only 7% of the comprehension comes from the words we use. Stated differently, patients remember more of

what they see, and what they see is what they hear. Adding video to the microscope have found useful in providing information both to patients and to auxiliaries, because the microscope, like an intraoral camera, allows them co-observation of the multiple steps during the procedure in real time but also get entangled during a particular portion of the procedure.

Finally, the flexibility to quickly edit video files and integrate them into programs, like Windows film producer and PowerPoint and therefore the live video stream parades tremendous abilities to share information and discussions with colleagues,

either in a very lecture format, where live video will be transferred from the scope to an LCD projector and transmitted onto a screen for the audience to determine, or be captured on tape or disk drive and shared with colleagues at high magnification allowing greater learning experience.

Nowadays, the net has unfolded the likelihood of watching streaming live procedures, documented through the microscope, and a full new level of continuous education has emerged, as lectures and procedures become viewable via computer from the comfort of one's house.



Figure 6: Microscope attached with SLR or video camera for communication

Use of Dental Operating Microscopes :

In all areas, from exposure of the access cavity and preparation to third-dimensional obturation and put up endodontic management, the microscope offers principal benefits over operating with out suitable magnification. As a result, the usage of the microscope may be expressly encouraged for the subsequent precise indications and unique aspects:

Examination, diagnosis, and treatment planning :

With more suitable visualization, the clinician's capacity to diagnose issues in the sooner ranges of a disorder method is possible. High-powered magnification lets in endodontists to perceive a microscopic blemish, color alteration, tiny quantities of plaque accumulating inside the grooves, microscopic quantities of chalky white demineralization across the grooves, and tiny

quantities of flaking of darkened carious enamel shape inside the crevices of those grooves. Treatments additionally may be finished with a extra stage of precision, thereby lowering the prevalence of screw ups and the want of retreatment.[11]

Diagnosis of cracked tooth :

Microfractures and longitudinal fractures which can be regularly hard to diagnose



Figure 7: Microfracture diagnosed during Orthograde root canal treatment

clinically and constitute symptoms and symptoms of occlusal damages which encompass cracks in tooth or restorations, craze lines, put on facets, cracks at barely accelerated marginal ridges, or regions in which the teeth has been worn via way of means of opposing porcelain, exposing dentin and as a result inflicting sensitivity and ache may be regarded greater exactly with DOM.[12]

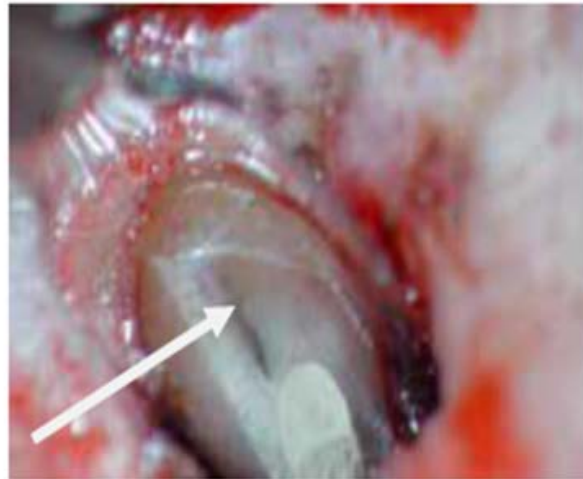


Figure 8: Microfracture diagnosed during Microsurgical endodontic treatment

During instrumentation :

During instrumentation, the progressed capacity to peer unique canals lets in endodontists to move documents into canal openings with more efficiency, to differentiate among important and necrotic canals, and to come across tiny quantities of purulence or blood draining thru unique canals or see any tiny quantities of necrotic pulp cloth that had been now no longer eliminated at some point of canal instrumentation. So it's miles viable for an endodontist to decide if all canals are accessed and instrumented nicely whilst an immediate view is probably hard with out

eliminating immoderate quantities of coronal teeth structure.[13]

Locating hidden canals/canal structures :

Anatomical versions aren't as uncommon or unusual as is regularly assumed as defined via way of means of Walter Hess as early as 1917. Many of those critical systems can't be easily detected or dealt with with conventional endodontic remedy methods. If the radiographic photograph is tested extra closely, there are regularly symptoms and symptoms of uncommon root and/or canal shapes like the ones because of modifications withinside the route of canal anatomy or root surface. An off middle publicity or 3 dimensional photograph can offer in addition

precious information. Three rooted premolars, for example, are encountered in 6% of all first maxillary premolars. However, anatomical versions additionally consist of different complicated systems like center mesial canal (Fig. 9) in mandibular first molar and C-formed canals in mandibular second molar.[14]

Identification and removal of Obliterations and calcifications :

These signs occur to a greater or lesser extent in 50% of all teeth, impairing instrumentation considerably or essentially preventing treatment of the root canal system.



Figure 9: Excavation of a C-shaped root canal



Figure 10: Localization of the second mesiobuccal canal (MB II) of an upper first molar

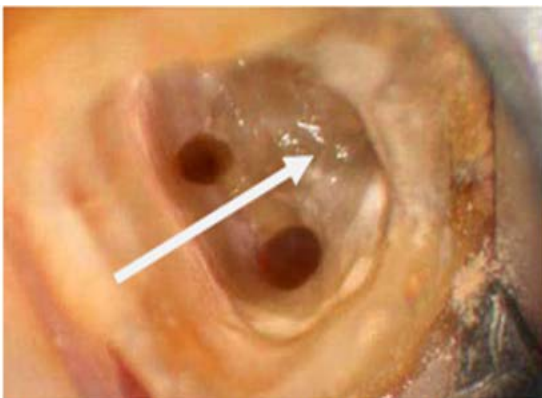


Figure 11: Obliterated canal orifices impair instrumentation or even prevent root canal treatment

In Open apex cases :

Modern apexification healing procedures name for unique remedy strategies and materials, the manipulation of that is facilitated extensively beneath a dental microscope.

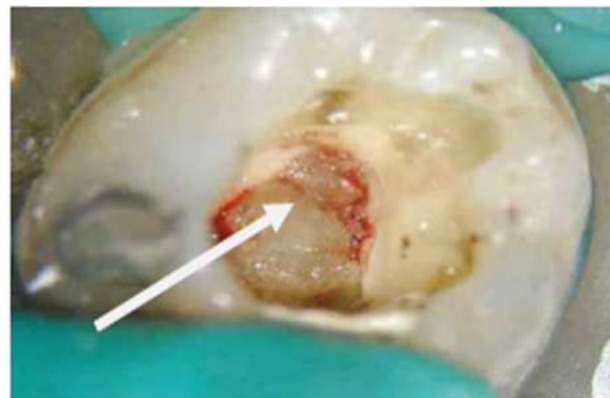


Figure 12: Denticles may block the canal entrance.

Perforation repair Treatment of iatrogenic hassle along with pulpal ground perforation, lateral root perforation and analysis mainly contain visualization of the hassle so the microscope actually performs a chief function on this context .

Removal of fractured instrument :

The superior imaginative and prescient with magnification and illumination from a microscope lets in endodontist to study the maximum coronal components of fractured

submit and damaged gadgets and to dispose of them with none principal lack of enamel shape and perforations, the analysis for renovation of the enamel is pretty good.[15]



Figure 13: Localization of the root canal end



Figure 14: Creation of a barrier across the Open apex, before obturation



Figure 15: Cleaned out perforation site visible bone in the furcation

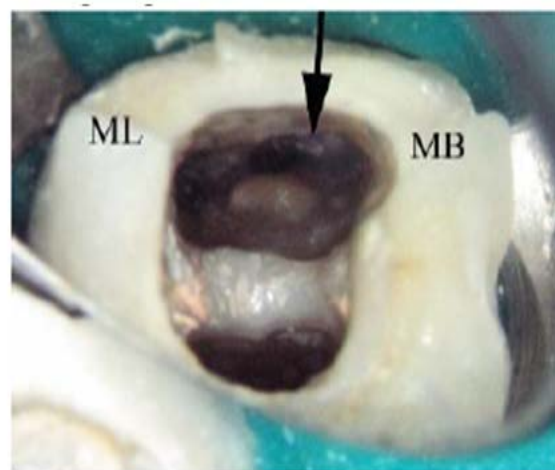


Figure 16: Visualization of a fractured and instrument is essential for retrieval

Microsurgical apicoectomy :

Incorporating microscopic method in surgical endodontics, conceptualised via way of means of Prof. Kim withinside the 1990s with Use of the smaller unfashionable mirrors it's far viable to cautiously have a look at the apical section of the basis quit and carry out an atraumatic , greater moderated bevel apical

resection strategies and allow a coaxial ultrasonic practise into the basis, higher control of the bone systems thereby making minimally invasive magnificence I retrograde hollow space practise and retrograde filling of the canal device and all its branches alongside the longitudinal axis of the basis clean to carry out. Microsurgical flap layout and

Surgical soft-tissue control is likewise significantly more desirable via way of means of a microscopic method, main to quicker recovery, much less disturbing soft-tissue control, and the arrival of microsurgical

suturing (7-0 to 10-0) strategies that limit trauma and cause rapid, number one purpose wound recovery and less post-operative ache and complications however additionally a far higher analysis than conventional strategies.



Figure 17: Microsurgical retro preparation and retrofill with MTA

Conclusion :

Those who carry out endodontic processes with out the microscope are nevertheless comparing the advantages of its use. Practicality is the important thing concern. After the preliminary getting to know curve, endodontic processes may be finished in much less time due to the more visibility of the basis canal anatomy and procedural mistakes may be reduced. The key to a hit endodontic exercise lies withinside the operator and his or her commitment. If honest attempt is made , one may be rejuvenated and endodontics may be extra enjoyable.

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