



INTERNATIONAL JOURNAL OF RESEARCH IN PHARMACEUTICAL SCIENCES

Published by JK Welfare & Pharmascope Foundation

Journal Home Page: <https://ijrps.com>

Role of Microscope in Endodontics

Manoj Chandak^{*1}, Manju Waradhbande², Kajol Relan¹, Pooja Chandak¹, Rakhi Chandak³, Darshan Dakshindas², Payal Chaudhari¹

¹Department of Conservative Dentistry and Endodontics, Sharad Pawar Dental College and Hospital, DMIMSDU, Sawangi (Meghe), Wardha, Maharashtra, India

²Government Dental College, Nagpur, Maharashtra, India

³Department of Oral Medicine and Radiology, Swargiya Dadasaheb Smurti Dental College, Hingna, Nagpur, Maharashtra, India

Article History:

Received on: 13 Nov 2020

Revised on: 17 Dec 2020

Accepted on: 18 Dec 2020

Keywords:

Endodontics,
Visual Aids,
Magnification,
Lenses,
Dental Operating
Microscope

ABSTRACT



Microscope is used in medical field to run over the limitations of human vision. Over the years many magnification devices are invented to achieve the goal. Quote given by Prof Syngcuk Kim that states "You can only treat what you can see". If the right tools are available many things can be visualized. They are endoscopes, intraoral camera, magnifying glass, surgical loupes, surgical microscope. Surgical loupes and Dental Operating Microscope are most convenient and practical to use in endodontics. By increasing the image size, fine details can be visualized. Hence to increase the image size, magnification is necessary. The invention of microscopes in modern endodontics helps in visually guided and sensory aided endodontic procedure. The microscope as a diagnostic tool may be used in caries detection, fracture line and craze evaluation, crown margins or restorations that are deficient, in caries elimination, access preparation, calcifications removal. It is also helpful in orifice detection and treating internal resorptions. All procedure are performed under various magnification grades. They are flap surgery, cutting of bone, root apex identification, apicoectomy, removal of inflamed tissue, observe resected end of root, root end preparation, retrograde filling, and suturing, surgical correction of unsuccessful RCT. Also, Cervical resorption and External resorption and perforation repairs can be done using Microscope. The invention of microscopes in modern endodontics helps in visually guided and sensory aided endodontic procedure. Furthermore the role of microscopes in endodontics is reviewed.

*Corresponding Author

Name: Manoj Chandak

Phone: 9822693276

Email: drmanojchandak@yahoo.com

ISSN: 0975-7538

DOI: <https://doi.org/10.26452/ijrps.v11i4.4734>

Production and Hosted by

IJRPS | <https://ijrps.com>

© 2020 | All rights reserved.

INTRODUCTION

Microscope is used in medical field to run over the limitations of human vision. Quote given by Prof Syngcuk Kim that states "You can only treat what you can see" (Das and Das, 2013). Endodontists work blindfolded because there is nothing to see. If the right tools are available many things can be visualized (Selden, 1989). Over the years many magnification devices are invented to achieve the goal. They are endoscopes, intraoral camera, magnifying glass, surgical loupes, surgical microscope. Surgical loupes and Dental Operating Microscope are most convenient and practical to use in endodontics. By

increasing the image size, fine details can be visualized. Hence to increase the image size, magnification is necessary. Magnification helps visualise finer details of the area to be treated (Fabbro *et al.*, 2015). This increases the precision of work to be done (Fabbro *et al.*, 2015). To practice endodontics with precision, training skills and experience of the clinicians is important. Magnification allows the extraocular muscles to relax for greater time. Distance from eye to object increases. Hence there is less strain to the eye (Carr and Murgel, 2010). The concept of extreme magnification (operating microscope) was introduced by Dr Apotheker and Dr Jako in 1978. Chayes-Virginia Inc invented Dental Operating Microscope (DOM) -Dentiscope in 1981 (Das and Das, 2013). DOM had Galilean optics that are ergonomically organised. This allows its use in all endodontic and restorative procedures. It was introduced by Dr Gary Carr in 1999. The fields in which operating microscope is used are eye procedures, head and neck procedures, ENT procedures, surgeries of arteries veins and lymphatics etc. The tissues in dental practice are very fine. This results in a situation where natural visual capacity reaches its limits. The invention of microscopes in modern endodontics helps in visually guided and sensory aided endodontic procedure.

Why Enhanced Vision is Necessary in Dentistry

Human eye's resolving power is 0.2 mm. When the two points are nearer by 0.2 mm are seen they are visualised as one by the human eye. Crown and bridge cements has the film thickness of 25 μ . It is not in the resolution of naked eye. Various optical aids have been developed to improve resolution by many orders. They are loupes. There are microscopes. There are surgical headlamps. There are fibre optic handpiece lights etc. There is a substantial improvement in resolution of 6 μ of a common operating microscope. Operating Microscope can be used in various procedures such as Restorations, Endodontic procedures, Periodontic procedures. Various Prosthodontic, Periodontic and Endodontic, and grafting procedures require resolution beyond 0.2 mm (Selden, 1989).

Classification of Dental Operating Microscope

Based on Use

1. Surgical Microscope
2. Examination Microscope

Based on Installation

1. Floor mounted

2. Ceiling mounted
3. Wall mounted

Based on Magnification

1. Lower magnification (2.5 – 8x)
2. Midrange magnification (8 – 14x)
3. Higher range magnification (14 – 30x)

Anatomy and Parts of Dental Operating Microscope

The surgical microscope is a complex arrangement of lenses. It allows stereoscopic resolution from 4-40X.² This does not demand eye convergence. This results in relaxation of lateral rectus muscle when the light beam falls parallel on the retinas of the observer (Selden, 1989). There are three primary components (Selden, 1989; Panchbhai, 2019) supporting structure, body of the microscope, the light source.

Supporting Structure

When used at high power, the microscope should be stable while in operation. It should remain easy to handle with precision (Gundappa and Mohan, 2013; Carr, 1992). Mounting of the structure can be done on floor, ceiling, or wall. By putting fixation point nearer to the body of microscope, the set up can be made stable (Panchbhai, 2019; Fabbro *et al.*, 2015).

Body of the Microscope

Body of the microscope contains lens and prisms. They help in magnification and stereopsis. It is the most important component of the microscope. The body consists of eyepieces, binoculars, magnification changer factor, and the objective lens. The powers of eyepieces available are 10x, 12.5x, 16x, and 20x. Mostly used powers are 10x and 12.5x (Singla *et al.*, 2018; Low *et al.*, 2018). Binoculars are available in different focal lengths. They hold the eyepieces. With smaller field of vision, there is better magnification if the focal length of binocular is long. Magnification changers provide the option of four different magnification levels. They are available as three or five step manual changers. Distance of microscope to surgical field is determined by objective lens. Focal length range is from 100 – 400 mm. Most used by the endodontists is 200 mm lens that focuses at about 8 (Panchbhai, 2019; Fabbro *et al.*, 2015).

The Light Source

It is the most contributory feature of DOM. Apart from optics, the light source helps for observing small

and deep areas. It is due to powerful coaxial illumination of the microscope, that means light is in the line of sight and it prevents any shadow. The two light sources available are halogen light and xenon light. Quality documentation is not possible at high powers with halogen light. Xenon light provides bright light at 5000 degree Kelvin approximating day light. It is more powerful (Selden, 1989; Gundappa and Mohan, 2013). Light approaches the area of surgery. Then it is reflected back through “magnification changer lenses, objective lens, and binoculars” to eye as different beams. This results in stereomicroscope effect. This improves operator’s vision for depth.

Principles of Dental Operating Microscope

The main principles include Magnification, Illumination, Documentation, Accessories.

Magnification

The factors that determine the magnification are eyepiece power, the changer factor of magnification, objective lens focal length, binocular’s focal length. For refractive error and accommodation adjustment, eyepiece diopter should be set in the range of -5 to +5. In binocular tubes, to achieve stereoscopic view of operating area, exact interpupillary distance is of utmost importance. This is achieved by managing the two binocular tubes. Available focal lengths of objective lenses range from 100 to 400 mm. A 175-mm lens focuses at 7, a 200-mm lens focuses at about 8 inches and a 400 mm lens focuses 16 inches (Selden, 1989).

Illumination

After controlling the light intensity by regulator and cooling by a fan, light is reflected through condensing lens to a series of prisms and through the objective lens to surgical field. Proper illumination allows stereoscopic effect. This helps clinician to view depth of field (Selden, 1989).

Documentation

Documentation is the capability to create videos and slides. For photographic and video documentation, brightness is helpful produced by beam splitter. Photo and cine adapters are joined to beam splitter. A video camera that is 35 mm is attached to it (Gundappa and Mohan, 2013).

Accessories

1. Pistol grips/ Bicycle style handles.
2. Observation ports/ beam splitter/ teaching purpose.
3. Assistant observation devices such as:

- a. High resolution monitors.
- b. LCD screens
- c. Assistant binoculars

Advantages of Using Dental Microscope

1. Increased Visualization.
2. Quality improvement and accuracy of treatment.
3. Improved & Ideal treatment Ergonomics.
4. Proper Digital Documentation Capabilities are easy.
5. Increased Skill to Communicate through Joined Video.
6. Working posture is improved.
7. Increased Referral.
8. Fun factor in practice.

Disadvantages of Using Dental Microscope

1. Working field is restricted of 11 mm – 55 mm.
2. With only the tip of instrument visible, they can be used in delicate movements of small amplitude.
3. Learning curve.
4. Cost.
5. Infection control and lens scratching (Cohen, 2007; Apotheker and Jako, 1981).
6. Sharp injuries in endodontics (Apotheker and Jako, 1981).

Role of Microscope in Endodontics

Dental Microscope Used for Diagnostic and Clinical Procedures (non-surgical)

The microscope as a diagnostic tool may be used in caries detection, fracture line and craze evaluation, crown margins or restorations that are deficient. Magnification and illumination will help in caries elimination, access preparation, calcifications removal. It is also helpful in orifice detection and treating internal resorptions. Microscope is also used in retreatment cases such as removal of gutta-percha from canals not properly obturated (Selden, 1989; Panchbhai, 2019). Microscope makes the delicate changes in dentin colour and quality, visible. Dark colour of floor of the pulp, developmental

lines present on floor of pulp becomes visible helping clinician for safe dentin removal. It is used for managing sclerosed canals, locating missed canals, managing perforation, confirming canal cleanliness before obturation. Microscope helps in retrieving silverpoint, separated instrument, fractured post, outlining and removing pulp stones. Additional endodontic procedures such as vital pulp therapy help in cautious handling of pulp tissues. Regenerative endodontics help in proper handling of blood clot. Dens Evaginatus or fused teeth will be best treated under enhanced vision by microscope (Das and Das, 2013; Carr and Murgel, 2010).

Dental Microscope for Endodontic Surgical Procedures

Surgical procedures are better performed with precision under enhanced vision. Surgical endodontics is completely transformed by microscopic procedures. Microscope with the help of ultrasonic tips and biocompatible materials plays an important role in modern endodontic microsurgery (Fabbro et al., 2015; Gundappa and Mohan, 2013). All procedure are performed under various magnification grades. They are flap surgery, cutting of bone, root apex identification, apicoectomy, removal of inflamed tissue, observe resected end of root, root end preparation, retrograde filling, and suturing, surgical correction of unsuccessful RCT (Arens, 2003). Also Cervical resorption and External resorption and perforation repairs can be done using Microscope (Fabbro et al., 2015; Gundappa and Mohan, 2013).

CONCLUSION

Ensuring that the patient remains pain-free is the basis of endodontic therapy. Hence to provide successful endodontic treatment better vision with illusion of the field is necessary. With the invention of dental operating microscope, this long term goal is accomplished. Evidences prove that with the use of magnification, treatment outcomes in endodontics are improved.

ACKNOWLEDGEMENT

The authors would like to thank Dr Pradnya Nikhade for her valuable guidance and support.

Funding Support

The authors declare that they have no funding support for this study.

Conflict of Interest

The authors declare that there is no conflict of interest for this study.

REFERENCES

- Apotheker, H., Jako, G. J. 1981. A microscope for use in dentistry. *Microsurgery*, 3(1):7–10.
- Arens, D. E. 2003. Introduction to Magnification in Endodontics. *Journal of Esthetic and Restorative Dentistry*, 15(7):426–439.
- Carr, G. B. 1992. Microscopes in endodontics. *Journal of the California Dental Association*, 20(11):55–61.
- Carr, G. B., Murgel, C. A. 2010. The Use of the Operating Microscope in Endodontics. *Dental Clinics of North America*, 54(2):191–214.
- Cohen, E. S. 2007. *Microsurgery*. Cohen ES, ed. Atlas of cosmetic and reconstructive periodontal surgery. pages 433–438. 3rd edition. Italy: B C Decker Inc, ISBN: 1550092677.
- Das, U. K., Das, S. 2013. Dental operating microscope in endodontics-a review. *J Dent Med Sci*, 5(6):1–8.
- Fabbro, M. D., Taschieri, S., Lodi, G., Banfi, G., Weinstein, R. L. 2015. Magnification devices for endodontic therapy. *Cochrane Database of Systematic Reviews*, 12:CD005969.
- Gundappa, M., Mohan, R. 2013. Magnification tools: Surgical operating microscope and dental loupe in dental practice. *Int J Eng Res Tech*, 2:14–20.
- Low, J. F., Dom, T. N. M., Baharin, S. A. 2018. Magnification in endodontics: A review of its application and acceptance among dental practitioners. *European Journal of Dentistry*, 12(04):610–616.
- Panchbhavi, A. 2019. Nanotechnology in dentistry. pages 191–203. In Applications of Nanocomposite Materials in Dentistry, Woodhead Publishing.
- Selden, H. S. 1989. The role of a dental operating microscope in improved nonsurgical treatment of “calcified” canals. *Oral Surgery, Oral Medicine, Oral Pathology*, 68(1):93–98.
- Singla, M. G., Girdhar, D., Tanwar, U. 2018. Magnification in Endodontics: A review. *IP Indian Journal of Conservative and Endodontics*, 3(1):1–5.