

Microsurgery: A Periodontal Perspective

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ABSTRACT

Background: The purpose of this article is to review the various aspects of microsurgery in periodontics, which has attained new heights of precision in dentistry, thus reinforcing the utilization of microscopes in periodontics. It reviews the benefits and potential application of magnification and microsurgery in periodontics. The entire analysis pinpointed at the improved visual acuity, rapid healing, esthetics and ergonomic benefits, improved predictability of a surgical procedure along with better patient acceptance, thus making this minimally invasive procedure a better option.

Keywords: Microsurgery, Magnifying Loupes, Surgical microscope, Mucogingival surgery.

INTRODUCTION

There has been a tremendous advancement in the medical and dental fields to meet the patient's expectations along with achieving desired therapeutic objectives.¹ Now clinician is more concerned to produce high-quality dentistry. Microsurgery is defined as surgery performed under magnification with the help of surgical microscope.² The skills of microsurgery were advancing with the passage of time. The usage of microscopes has helped dentists with better visual acuity, thus distinguishing the finer details.³ Today, microsurgery has opened a new era of traditional microsurgery, and it brings the discipline to a more microscopic world. Dental microsurgery was introduced in 1922 through general medicine and surgery.^{4,5} After its introduction in dentistry it expanded hugely and flourished in the world.

Periodontal microsurgery is the refinement of basic surgical techniques made possible by the improvement in visual acuity gained with the

use of a surgical microscope. Throughout the process of microsurgery development, undoubtedly, the fundamental techniques for periodontal surgery or for scaling and root planning and introduction of the microscope were indispensably important. The skills of microsurgery were advancing with the passage of time. The establishment of first compound lens microscope by Amsterdam merchant Anton van Leeuwenhoek (1694) were milestone of microsurgery. Saemisch (1876) introduced simple binocular loupes to ophthalmic surgery. Apotheker and Jako (1978) first introduced the microscope to dentistry.⁶ Carr (1992) demonstrated the use of the surgical microscope during endodontic procedures.⁷ Shanellec and Tibbetts (1993) presented a continuing education course on periodontal microsurgery at the annual meeting of the American Academy of Periodontology.^{8,9} Microsurgery was introduced in periodontics in 1992. From the

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past many years, periodontics has been increasing in burnishing of various surgical procedures such as mucogingival surgeries, soft and hard tissue bone augmentation, Guided bone regeneration procedures, Dental Implants. All this procedures requires clinical expertise beyond the range of normal visual acuity. Microsurgery allows gentle handling of soft tissue graft, accurate wound closure, even to visualize the deep-seated calculus in root surface.¹⁰ To fulfil this surgical procedure, accurate planning is required to execute it. There are various principals in which microsurgery runs, such as refinement of motor skills, minimal tissue trauma to the surgical site as a smaller instrument were used and to achieve passive and primary wound closure. This paper describes the overall aspects of Magnifying loupes, surgical microscope and microsurgery aspects in periodontics.

Microsurgical Triad:

The combination of Magnification, Illumination and instruments lead to the formation of "Microsurgical Triad".¹²

Magnification: meaning to calculate the object which is enlarged from its apparent size.

There is a big role of visual acuity to visualize and clearly distinguished between the objects. To visualize the sharp details of an object, there should be fine celerity in the image. Either by magnification or by coming nearer to the object it improves the visualization of the image. During periodontal surgery, delicate tissue handling, wound closure, tissue craftsmanship and esthetics are the most emphasizing task which strains a lot of time to acquainted with the visual acuity.¹² And with improved magnification precision and quality of work will be increased.

There are two types of magnification:

1. The magnifying Loupes
2. The Operating Microscope

Magnifying Loupes:

Loupes are commonly used in Periodontics. They are binary monocular telescope with side by side lens. It has stereoscopic properties that are created with the help of convergent lens systems.¹³ To start with practice in magnification, loupes are the best equipment to start with the initial learning. This helps in acquaintantion and adaptation of the vision with hand-eye co-ordination. Loupes are less expensive and easier to use. Three types of loupes such as simple loupes, compound loupes and prism telescope loupes are commonly practised.

Simple Loupes

It consists of a meniscus lens which has two refracting surfaces, from one side it allows the light to enter, and from the other side, the light exists. Although it is very cost-effective but creates a lot of stress as the eyes have to converge to a fixed point or image constantly. Also, they are more incline towards spherical and chromatic aberration leading to the destruction of the image. The magnification beyond 1.5x has no effect due to size and weight constraint.

Compound Loupes

It consists of multi-element lenses with intervening spaces, thereby enhancing the magnification, working distance and depth field without an increase in size. They can be easily adjustable compare to simple loupes for image enhancing by increasing the distance between the lens. They are achromatic and produces correct colour images. They are commonly mounted on eyeglass and are ineffective beyond 3x.¹³

Prism Loupes

It is the advanced form of all the magnification loupe. It has the Pechan or Schmidt that lengthen the light path through a series of mirror reflections within the loupe.^{14,15} They lengthen the light path by virtually folding the light so that barrel of the loupe can be shortened. This gives better magnification, widened the depth of field and longer working

distance and a wide area of view.¹⁶ They are easily mounted on the eyeglasses or headband.¹⁷ The magnification can be increased up to 4x and headband are more comfortable than eyeglass. This loupe also has enhanced illumination properties.

How does loupe work:

There are various ranges available for loupes from 1.5X to 10X. The loupes depend on the distance between size and object called as working distance. Secondly, it depends on the depth of the field, which means focusing on the object leading to a decrease in the depth of field while magnification increases. The correct depth of the field allows the clinician to avoid forward bending while doing clinical cases and maintain the position following maintaining ergonomics. Usually, periodontitis practised under 2.5xmagnification as more is the magnification smaller is the width of the field. When the image depends on the angular extension of an object is called the width of the field. The higher magnification smaller the width of the field. The angular position of optics called a View angle allows the comfortable working zone for the periodontist while doing the treatment, particularly mucogingival surgery. Convergence angle help to maintain the accurate position of extraocular muscle which lead to avoid the tiredness. Loupes less than 2x magnification are insufficient for performing anastomoses and another microsurgical process. However scaling, flap surgery, mucogingival

surgery can be best performed under 4x and 5x.¹⁸ Although loupes are less expensive and easier to use, it has many disadvantages such as lack of variable magnification. Compound and Prism loupes require a protective coating to maintain the brightness. Also due to its heavyweight difficult to wear for longer period.¹⁷

Surgical Microscopes

It is the advance form of magnification which is highly beneficial for both the clinician and the patient. It consists of magnifying loupes with magnifying charger and binocular viewing system lighting unit and camera. It provides

stereoscopic vision. With a resolution of approx. 4x to 40 x, it is highly compatible with the clinician while performing surgeries or scaling and explaining the treatment procedures to the patients by showing the clear images. Also, video recording of the clinical cases can be easily done as they can be easily mounted on the wall or floor. It has fibre- optic illumination, which produces bright and uniformly illuminated light. It is thus highly helpful in identification of the embedded calculus in the root surface which was not visible in naked eyes, also various pathologies can be identified documentation and performing various dental procedures can be done easily.¹⁹

Advantages of Surgical Microscope

It enhances the ergonomics of the clinician.¹⁵ Reduces fatigue as it works on Galilean optics with various magnification thus gives less strain to the eye.¹⁶ It makes feasible detection of finer details which cannot be easily seen by naked eyes such as calculus present in furcation areas, root convexities, or any hidden pathology.¹⁷ It also helps in case documentation with the use of still and video cameras.¹⁷ Also helps in discussing the case with the patient. As special instrument are used while performing surgeries; thus, it creates less trauma to the tissues, increases rapid healing with less post-operative pain.^{15, 19}

Disadvantages of Surgical Microscope

A microscope is very bulky thus difficult to move from one place to another. It occupies a lot of space in the operating area. Highly expensive instrument and requires lots of maintenance.

There is a very steep learning curve as it require proper training before any clinical procedure to perform.^{17,18,19}

Magnification in Periodontics

The "Microsurgical Triad" consists of magnification, illumination and increased precision while performing surgeries offer by surgical microscope and microsurgical instruments. The microscope provides clear and magnified images. This requires special designed atraumatic instruments which provide

sharp and clean incisions leading to minimal tissue trauma. It also renders gentle manipulation of soft and hard tissues conducting minimal bleeding and enhanced wound closure.

Such instruments are set of a needle holder, micro scissors, micro scalpel holder, anatomic and surgical forceps, and a set of various elevators. Ophthalmic knives are of various types such as the crescent, lamellar, blade breaker, sclera and spoon knife. Ophthalmic knives are highly sharp and minimal in size.²¹ In microsurgery scissors of different sizes are available such as 14 cm and 18 cm long while performing mucogingival surgeries as uneventful healing is a primary concern in periodontics which enables primary closure of the wound and avoid dead space. Needle such as spatula needle, which is 6.6mm in length and has a curvature of 140 degrees is used for accurate apposition closure and immobilization of free or connective tissue graft in microsurgery. Also for such needles sutures, 6-0 and 7-0 sutures are used.¹⁵

Application of Magnification in periodontics

The microscope helps the clinician to find embedded calculus in furcation areas, root concavities and other inaccessible areas which cannot be easily detected by naked eyes.²¹

Periodontal microsurgery proved to be highly beneficial for the root coverage procedure. It provides less operative trauma, rapid healing and minimal discomfort to the patients treating for grafts procedures. Microsurgery gives best result class 1 and class II gingival recessions cases. It also enhanced the results of papillary reconstructions. Minimal invasive surgery (MIS) was introduced by Harrel in 1999. In this surgical procedure, he did small incision with minimal exposure to the underlying bone. This enhances the esthetics and leads to less morbidity to the wound site.²² The microscope also enhances the visualization of the sinus membrane in sinus lift surgeries during implant placement.²³

CONCLUSION

In the 20th century, microsurgery achieved many miracles in dentistry, particularly in

periodontics. In this advance era, most surgeries have moved towards microsurgies compared to conventional macro surgeries. Microsurgery has enormous benefits. It has been diversifying to a large extent in many periodontal surgeries. It not only enhances the visualization of embedded calculus which cannot be seen by our naked eye or increase the wound morbidity but also improves the ergonomics of the clinician. It provides a clear image which is highly helpful for patient counselling and maintaining clinical records. However, it faces challenges with respect to skill and dexterity, resulting in a steep learning curve. This is a wonderful revolution dragging the progression in dentistry, particularly in periodontics. Working under magnification gives strong consideration to adopting the concept.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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