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Review Article

Periodontal Microsurgery: Useful Tool or Just another Gimmick?

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ABSTRACT

Periodontal microsurgery necessitates modification in traditional techniques and philosophies, which allow one to achieve better clinical results. Optical magnification, better illumination and use of smaller instruments has therefore, broadened the horizons of dentistry in general and periodontics in particular. Improvement in visual acuity, made possible through optical magnification has become an integral part of modern dental practices.

Key Words: Periodontal Microsurgery, Microscopes, Loupes, Minimally Invasive Surgery

INTRODUCTION

Over the last decade, periodontics has been increasing refinement of procedures that require more detailed surgical skills. Guided tissue regeneration, cosmetic crown lengthening, gingival augmentation, osseous resection and dental implants demand clinical expertise that challenges the technical skills of periodontists to the limits of and beyond the range of visual acuity. Therefore in a broader and more important sense, microsurgery implies an extension of those universally accepted surgical principles by which gentle handling of soft and hard tissues and extremely accurate wound closure are made possible through magnification. For individuals who want to inflict as little damages as possible to the tissues and have healing by primary intention, rather than relying on the surgical areas to granulate in and heal by secondary intention, microsurgery is the best option. Periodontal microsurgery can be defined as the refinement in existing basic surgical techniques that are made possible by the use of a surgical microscope and subsequent improvement in the visual equity. (Tibbets 1998) [1]

HISTORICAL BACKGROUND

Amsterdam merchant Anton Van Leeuwenhook constructed the first compound lens microscope. Magnification for microsurgical procedures was introduced to medicine during the late 19th century.2 In 1921, Carl Nylen, who is considered the "father of microsurgery", first used a binocular microscope for ear surgery. Apotheker and Jako first introduced the microscope to dentistry in 1978. During 1993 Shenalec and Tibbetts presented a continuing education course on periodontal microsurgery at the annual meeting of the American academy of periodontology. [2]

THE MICROSURGICAL TRIAD [2]

Operating microscopes offer three distinct advantages to the clinician. Collectively, these advantages are referred to as the microsurgical triad. They are

1. Illumination
2. Magnification and
3. Increased precision in the delivery of surgical skills

MAGNIFICATION SYSTEMS

Each type of magnification has got its own advantages and disadvantages. But the main aim of using this is to improve the visual acuity. The types of magnification systems are mainly 2 types: loupes and operating microscope.

Loupes

Loupes are the most commonly used magnification system used in dentistry. They are basically two monocular lenses kept side by side which is angled to focus on an object. So it forms a stereoscopic image of the object which is formed by the use of convergent lens system. Three types of loupes are there i.e simple, compound and prism loupe. In general loop magnification can be purchased that are capable of providing wide range of magnification for 1.5 X to 10 X. whereas operating microscope provides magnification of approximately 4 X to 40 X.[2] The differences in features among them are shown in Table 1.

Loupes			Microscope
Simple	Compound	Prism	
→A pair of single positive side by side meniscus lenses. →Most primitive system. →Highly subjected to chromatic aberration which destruct the image of the object that is being viewed. →The magnification can be increased only by the manufacturer to increase the size. →Because of its size and weight limitation, they have no practical use beyond a magnification range of 1.5 X Advantages : →Light weight. →Cheap. Disadvantages : →Fixed focal length and working distances which leadto a poor working posture and possibly neck and back pain. →Depth of field is not adjustable. →Eye strain. →Optical and chromatic aberration. 	→It uses converging multiple lenses with intervening air spaces to gain additional refractive index. →Poor magnification, working distance, & depth of field. →It is achromatic 	→Most optically advanced type of long magnification. →Contains Schmidt or roof top prism that lengthen for light path through a series of mirror reflection within the loupes Advantages : →Better magnification. →Wider depth of field. →Longer working distances. →Larger fields of view are produced by these loupes than other loupe types. →Superior optical clarity. Disadvantages : →More expensive. 	→Designed on Galilean principle. →It uses the application of the magnifying loupes in combination with changer, binocular viewing system so that it employ parallel binocular for protection of the eyes. →Contain fully coated optical and a chromatic lenses. →Surgical operating microscope is a system of lenses that allow binocular viewing of an object. →In contrast to loupes, both light beams fall parallel onto the retinas of the observer so that no eye convergence is necessary and the demand of eye muscle is minimal. →The operating microscope consists of the magnification changer, objective lenses, inbuilt illumination, binocular tubes and eye pieces. →Can be fixed to the floor or mounted on the wall or ceiling. →Provides magnification of approximately 4 X to 40 X. 

BENEFITS OF MICROSCOPES IN PERIODONTICS [2]

1) Increased precision in delivery of surgical skills, which results in more accurate incisions via small instrumentation, less trauma and quicker post-operative healing.
2) Precise repositioning of tissues with smaller needles and sutures.
3) Improved view of root surfaces, which permits more definitive removal of calculus and improved smoothness of the root surface.

RECOMMENDED INSTRUMENTS FOR PERIODONTAL MICROSURGERY [3]

1) Titanium Micro-Instruments:

2) Micro-scissors
3) Micro-Blades
4) Micro-Mirror
5) Micro-Elevators
6) Micro-Retractors
7) Root Resection Instruments
8) Micro-Osseous Hoes and Chisels
9) Basic Microsuturing kit

APPLICATIONS IN PERIODONTAL FLAP SURGERIES [4]

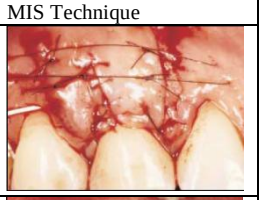
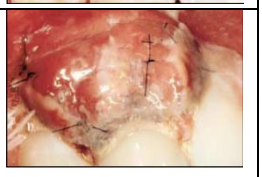
1) To diagnose the problem correctly.
2) To plan the appropriate procedures.
3) To make the initial and secondary incisions in accordance with where it is perceived that the final flap placement will be to accommodate primary healing.
4) To reflect gently and atraumatically, the flaps for passive procedure access and treatment.
5) To suture properly the flap in the most advantageous position for the defined results and patient comfort at the completion of the procedure.

OTHER APPLICATIONS [5-7]

1) Correcting gingival recession :
2) Establishing an esthetic smile line
3) Excessive gingival display
4) Uneven Gingival levels
5) Alveolar ridge deficiencies
6) Interdental papilla reconstruction
7) Esthetic implant reconstruction

DIFFERENCES BETWEEN TRADITIONAL TECHNIQUE AND MINIMALLY INVASIVE SURGERY (MIS) IN PERIODONTAL SURGERIES [8-10] (Table 2,3)

MIS approach	Traditional approach
1) Case selection : →An ideal site for bone grafting using MIS is an isolated, usually interproximal, defect that does not extend significantly beyond the interproximal site. →MIS can be used for patients who have many isolated defects and treated as multiple separate sites within a single quadrant.	→Generalized horizontal or multiple interconnected vertical bone defects are best handled with more traditional surgical approaches.
Surgical procedure : **1) Incision :** →The incisions for MIS are designed to conserve as much of the soft tissue as possible. →Incisions should be made as separate incisions and should not be continuous across the interproximal tissue as in most other periodontal surgery procedures. By not making these incisions continuous, it is been able to retain more of the interproximal papillary tissues and tissue height	→In most of the times, broad incisions which includes separating of interdental papilla are used.
2) Tissue reflection and flap elevation: →The tissue/flap is elevated utilizing sharp dissection only. →With care, the papillary tissue can be thinned to a thickness of 2-3 mm and the small flaps reflected. →It is felt that the use of sharp dissection minimized trauma to the flap and preserves much of the blood supply to the soft tissues that is the probable reason for improved soft tissue healing and the minimization of post-operative soft tissue changes in MIS.	→Comparatively broader instruments are used. Therefore, more of tissue trauma occurs, which affects wound healing.
3) Visualization : →Visualization during MIS requires some form of magnification and a light source that can be focused into the surgical site. →Various light sources can be used. A high intensity halogen head light mounted on a headband or a fiber optic light probe placed directly in the defect can also be helpful.	→Visualization of the surgical site is compromised.
4) Debridement : →The small surgical opening of MIS limits the instrumentation that can be used to remove granulation tissue and to debride the root surface. Successful MIS requires specialized instrumentation.	→Granulation tissue removal is better
5) Placement of graft material : The root surface preparation and the placement of graft material into the defect is same as the traditional technique.	
6) Wound closure : →The flaps will be closed using a 2-layered suturing approach. →Usually 6-0 to 8-0 plain gent or monofilament polypropylene sutures were used for optimal wound closure. →Smaller needles allow precise approximation of tissue edges, extremely accurate opposition, closure. →Healing takes comparatively less time than traditional techniques.	→Usually 3-0,4-0 or 5-0 black braided silk suture is used. →Healing takes more time.

Traditional approach	MIS Technique
 Suturing	
 3 days post-op view	
 4 weeks post-op view	
 1 year post-op view,note the visible scar line and root exposure, which is absent in microsurgical technique.	

ERGONOMICS APPLIED TO MICROSURGERY

- The ergonomics of hand position and body posture are closely related to improved motor skills made possible by a microsurgical approach to therapy.
- Microsurgical instruments are circular in cross-section to permit precise rotational movements.
- Instruments made up of titanium because of its strength, lightness and nonmagnetic properties.
- Optimal working distance is 13-18 inches and declination angle of 15-44 degrees, which prevents overextension of neck, shoulders.

MAGNIFICATION IN DENTISTRY: USEFUL TOOL OR ANOTHER GIMMICK?

Does use of magnification weaken your eyes?

The use of magnifying loupes does not harm or weaken the eyes, nor does it causes the user to become compromised in any way. However, after wearing loupes for a period, the user becomes accustomed to seeing more detail than that apparent with natural vision, and a psychological feeling develops. Furthermore, after several hours, the eyes require time to readjust to normal vision, just as they do each morning after the eye muscles have been dormant all night. Apparently, while using magnification, the eye muscles become accustomed to contracting to a given level and they must relax again to regain normal function. To avoid or reduce this challenge, it has been suggested that those people wearing magnifying loupes should consider not wearing them all of the time. Instead, they should use loupes for some procedures and unmagnified normal vision for other procedures.

How can I obtain magnified images?

The closer you get to an object, the larger it appears to your eyes. However, the closer you get to an object, the more difficult it is to focus, especially for older eyes. However, getting closer to the object can create poor posture with the associated back, neck and shoulder pain. If you use surgical loupes or operating microscopes, the image appears larger because it has been optically magnified and the clinician can sit

at a comfortable distance from the operating site.

What magnification level should I use?

The taller the practitioner is, generally the higher the magnification should be, since the practitioner's head is farther from the operating site and the image is smaller. Consultants advise that if a person is 5 to 5½ feet tall, the magnification needed (on average about2.5X) is less than that needed if the person is 6½ feet tall. The most popular magnification level is about 2.5X for an average sized person. For procedures that have a limited operating field, use of a clinical microscope at magnification levels up to 20X has been shown to be a significant aid to quality treatment.

What are the limitations of higher power magnification?

Many oral procedures require various objects to be parallel to one another or symmetrical with other objects. For example, placement of several implants. A wide field of vision is required for these procedures. In author's opinion, for an average sized clinician, use of magnification of more than 2.5X while accomplishing above mentioned procedure causes inadvertent errors because of the limited vision field, requires poor posture and slows the procedure significantly. Higher power magnification often influences posture negatively if the focal length of the magnifiers does not allow the clinician to sit in a normal posture. Additionally, if the clinician requires vision correction or if safety glasses are being worn when loupes are not in use, there is continual need to exchange loupes with normal gasses.

Scratching magnifying lenses

Although most magnifying loupes have protective coatings on the lenses, unless extreme care is taken, some lenses soon become scratched, cloudy and difficult to use. When cleaning lenses, the clinician should remove gross debris carefully, using a water lavage if the loupes are water resistance, followed by use of microscope cleaning wipes or lens cleaning cloths provided by manufacturers. The authors recommend purchasing loupes with water resistance lenses to allow proper cleaning and disinfection.

Infection control

Magnifying loupes collect debris from many procedures during a clinical day. Infection control is difficult at best. Ideally, all areas of loupe should be disinfected with high level disinfectant after each patient. Disinfecting with high ethyl alcohol solution is recommended. If they are water resistant, products such as Lysol disinfectant spray may be sprayed into a gauge sponge and used to wipe the frames and lenses.

Will use of loupes influence my posture while operating?

The focal distance between the operator's eyes and the operating site is a critical distance that influences the posture significantly. Therefore, the focal length of the loupes should be matched to your preferred operating distance. If you select loupes with a focal length that is that is too short or too long, you will be uncomfortable while operating, and muscle pain eventually will develop. The so called declination angle depends on many of your physical characteristics. If the declination angle forces you to sit with your head tilted, pain will result. Alignment of binocular loupe optics is critical also. Eyestrain results if they are not aligned properly.

FUTURE PERSPECTIVE

Periodontal microsurgery is in its infancy but will play a role in the future. It is a skill that requires practice to achieve proficiency. The small scale of microsurgery presents special challenge in dexterity and perception. Its execution is technique sensitive and more demanding than are conventional periodontal procedures. As the benefits of the microscope are realized, it will be applied more universally. There are many indications in which periodontal microsurgery can benefit. It appears to be a natural evolution for the specialty of periodontics. Microsurgery offers new possibilities to improve periodontal care in a

variety of ways. Its benefits include improved cosmetics, rapid healing, and minimal discomfort and also enhanced patient acceptance.

CONCLUSION

The improved visual acuity provided by magnification opens a whole new world to those who make the effort and take the time to become proficient in microsurgical principles and procedures. The application of these principles to existing periodontal surgical procedures represents an extension of those procedures that is less invasive and traumatic with more rapid healing. Increased patient awareness and patient acceptance of microsurgery has been shown to be excellent. The surgical operating microscope provides a microsurgical triad of illumination, magnification and an environment in which surgical skills can be refined. Incorporation of smaller instrumentation, sutures and needles into this environment also allow clinicians to increase the precision of their skills. Although clinical studies are lacking and research is needed, the visual acuity provided by the surgical operating microscope enhances the periodontist's delivery of surgical skills. The application of magnification to periodontics promises to change the clinical concepts of periodontal surgical care. An important factor in recent public and professional acceptance of microsurgery is the significant decrease in morbidity. The reduced trauma and relative painlessness that microsurgery offers, is an appealing alternative to traditional surgical approaches. Periodontal microsurgery offers an improvement in predictability, cosmetic results and patient comfort level over conventional periodontal surgical procedures. [8, 10, 11,12]

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