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Periodontal microsurgery: A leap in surgical intervention

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Abstract:

Recent developments in medical and dental field have shown that magnification and microsurgery can greatly improve clinical practice. The main aim of surgical intervention is not only the survival of the patient or one of his organs but also the effort to preserve a maximum amount of function and to improve patient comfort. These demands are mostly met owing to a minimally invasive surgical approach. The improved visual acuity provided by magnification opens a whole new world for those who make effort and take time to become proficient in microsurgical principles and procedures. The promising periodontal microsurgery will provide new possibilities to improve the therapeutic results for variety of periodontal surgeries. The purpose of this paper is to provide a brief review of periodontal microsurgery, role of magnification systems, and advantages of microsurgery over conventional surgery.

Key words: Magnification, microsurgery, periodontics

The main aim of surgical intervention is not only the survival of the patient or one of his organs but also the effort to preserve a maximum amount of function and to improve patient comfort. These demands are mostly met owing to a minimally invasive surgical approach.^[1]

This has led to the introduction of microscope into precision dental practice which is one of the greatest advances seen in modern dentistry. In 1921, Carl Nysten, who is considered as the father of microsurgery, first used a binocular microscope to correct otosclerotic deafness. Apotheker and Jako first introduced the microscope to dentistry in 1978. It was first introduced in the branch of endodontics in 1963. Later in 1992, the field of periodontology adopted the use of magnification in various surgical procedures. Current advances in video technology permit visualization of the surgical/microsurgical field on a video monitor three-dimensionally without necessitating physical viewing through the microscope. The assembly of the three dimensional on-screen microsurgery system comprises two single chip video cameras mounted on custom-fit eyepiece adapters, a dual camera controller, a view/record image processor, a video cassette recording for optional recording, digital monitor to enable viewing, synchronizing signal emitter, and 120 MHz shutter glasses (stereo eyewear). The development of this stereoscopic three-dimensional display technology proficient

of providing a clear and accurate sense of depth perception was a boon for the rapidly evolving field of minimally invasive surgery.^[2]

CONCEPT OF MICROSURGERY IN PERIODONTICS

Periodontal plastic microsurgery incorporates the use of a surgical dissecting microscope in an attempt to increase visibility, minimize trauma, and enhance surgical results. Miniature instruments such as microscalpels and microsutures have developed with hope to assist the surgeon and minimize tissue injury. Surgical magnification can allow the operator to see things that are not distinguishable with the naked eye. The concept of microsurgery is based on three important elements which form the microsurgical triad that includes magnification, illumination, and instruments. Without any one of these, microsurgery is not possible.^[3]

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Magnification methods and instrumentation

Loupes have long been and were introduced to medicine in 1876 by Saemisch, a German physician. However, it is only in the past decade that microscopes have been applied to clinical dentistry. It is now recognized that magnification has more to offer than corrective vision. The surgical microscope allows high-level motor skills and accuracy in clinical care. The introduction of surgical microscopes has led to considerably less invasive surgical incisions and flap reflections in periodontics. Microsurgical techniques create flaps with uniform thickness and margins with a scalloped butt joint; these features facilitate precise adaptation of tissue to the teeth.^[3]

Loupes can further be classified as single-lens magnifiers (clip-on, flip-up, jeweler's glasses) or multi-lens telescopic Loupes.^[4] Single lens magnifiers produce the described diopter magnifications that simply adjust the working distance to a set length. The drawback of this magnification system is that, with a set working distance, there is no range and opportunity for movement, which creates difficulty in maintaining focus and causing neck and back strain due to poor posture.^[5] Furthermore, diopter magnifiers give poor image quality, restricting the quality of work.^[6] Thus, these types of glasses cannot be considered a true means of magnification. Telescopic Loupes either compound or prism Loupes, on the other hand, offer improved ergonomic posture as well as significant advancements in optical performance.^[7] Compound Loupes consists of multiple lenses with intervening air spaces, which allows an adjustment of magnification, working distance, and depth of the field without excessive increase in size or weight. Prism Loupes are actually low-power telescopes, which are the most optically advanced type of loupe magnification available. They produce better magnification, larger fields of view, wider depths of field, and longer working distances than do other loupes. For the use in periodontal surgery, an adjustable, sealed prism loupe with high-quality, coated lenses offering a magnification between $\times 4$ and $\times 4.5$, either headband- or front frame-mounted, with a suitable working distance and a large field of view, seems to be the instrument of choice.^[8]

Illumination

Most of the manufacturers offer collateral lighting systems or suitable fixing options which are helpful, particularly for higher magnification in the range of $4\times$ and more. Certain essential considerations need to be made in the selection of an accessory lighting source; these include total weight, quality, and brightness of the light and ease of focusing and directing the light within the field of view of the magnifiers and ease of transport between surgeries.^[9]

Instrumentation technique

Proper instrumentation is fundamental for microsurgical intervention. As the instruments are primarily manipulated by the thumb and index and middle finger, their handles should be round, yet provide traction so that finely controlled rotating

movements can be executed. The rotating movement of the hand from 2 o'clock to 7 o'clock (for right-handed persons) is the most precise movement the human body can perform. The instruments should be approximately 18 cm long and lie on the saddle between the operators thumb and the index finger. They should be slightly top-heavy to facilitate accurate handling. To avoid an unfavorable metallic glare under the light of the microscope, the instruments often have a color coated surface. The weight of each instrument should not exceed 15–20 g (0.15–0.20 N) to avoid hand and arm muscle fatigue. The needle holder should be equipped with a precise working lock that should not exceed a locking force of 50 g (0.5–N) as high-locking forces generate tremor and low-locking forces reduce the feeling for movement. Finally, approximation of the wound margins to obtain primary closure is of utmost importance in microsurgery as in any other surgery. Either absorbable or nonabsorbable sutures (natural or synthetic) can be employed for wound approximation. The gauge of sutures as well as needles ranges in size and depends on the procedure and tissue to be sutured. By and large sutures of gauges 9–0 (0.03 mm) to 12–0 (0.001 mm) and needles with a diameter of < 0.15 mm are utilized in microsurgery.^[10]

USE OF MICROSURGERY IN PERIODONTICS

The reason microsurgery has gained acceptance among some periodontist not because of reduced morbidity. Rather, the endpoint appearance of microsurgery is simply superior to that of conventional surgery. The difference is shown in cleaner incisions, closer wound apposition, reduced hemorrhage, and reduced trauma at the surgical site. The difference is self-evident and can be startling when compared with conventional surgery. Periodontal surgery viewed under the microscope reveals the coarseness of most surgical manipulation. What appears as gentle handling of tissues is discovered to be a gross crushing and tearing. A microscope is a tool that permits less traumatic and less invasive surgery. Using of 7–0 to 9–0 microsutures allows more precise wound closure. This encourages repair through primary healing which is rapid and requires less formation of granulation or scar tissue.^[11]

In perio-esthetics

The continuous search for improved surgical procedures to address gingival deformities is a consequence of increasing demand for esthetics in the periodontal clinical practice. Innovative techniques have helped clinicians achieve predictability in root coverage. Periodontal plastic surgery is "technique-sensitive" and generally thought to be more demanding than other periodontal procedures. Hence, surgical microscope appears to be a natural evolution in this area of periodontics. Microsurgery has wide implications including the rotational, free gingival, double papilla, and subepithelial connective tissue grafts for the coverage since it causes minimal trauma and enhances the wound healing process. The combination of small microsurgical instruments and delicate surgical techniques allow for extremely fine, crisp, and accurate

incisions, gentle tissue handling, and precise repositioning of the wound margins with smaller needles and sutures. Along with rapid wound healing, low morbidity and less discomfort, narrow incision lines, and small surgical wounds can add to better esthetic results. Mucogingival surgical procedures designed for the coverage of exposed root surfaces, performed using microsurgical approach, had improved the treatment outcomes substantially and to a clinically relevant level compared with clinical performance under routine macroscopic conditions. The high survival rate of the vascularized graft is due to the retained blood supply from the base of the pedicle, which can be enhanced through microsurgery.^[11]

In periodontal flap surgery

Flap reflection in periodontics is to gain exposure of the underlying tissues, i.e., bone and the root surface. By using microsurgical techniques, periodontal flap margins can be elevated with uniform thickness that has a scalloped butt-joint. This facilitates precise adaptation of the tissue to the teeth or the opposing flap in an edentulous area, thus eliminating the gaps and dead spaces circumventing the need for new tissue formation and enhancing periodontal regeneration. The use of surgical microscope increases surgical effectiveness and thus has become the indispensable part of periodontal surgical practice.^[12,13] Studies have shown improved initial healing in the sites with microsurgical approach due to more accurate and atraumatic handling of the soft tissues. Further, the coronal displacement of the flaps over the defects was found to be easier and had less tension with the microsurgical technique which facilitates healing and return of the mucogingival line to its original position. Studies with enamel matrix proteins have shown that enamel matrix derivative could exert better biologic activity in microsurgically treated sites because of reduced tissue trauma and vessel injury to improve vascularization and achieve primary wound closure, which allows optimal retention of enamel matrix derivatives.^[14]

In root visualization and preparation

Success of periodontal therapy depends on visual access to the root surface for removing the residual calculus, treating the pathologically altered root surface, and achieving a clean and smooth root surface. Clinical and research studies with stereomicroscopy have demonstrated that the root planning is more effective when done under greater magnification and enhances periodontal regeneration.^[15]

In interdental papilla reconstruction

Microsurgical techniques have been developed to replace the lost interdental papilla which can create phonetic problems, saliva bubbles, and cosmetic deficiencies. A papillary deficiency can be created through iatrogenic surgical removal, as part of tissue collapse following extraction, with periodontal pocket elimination surgery, periodontal bone loss, and orthodontic separation of overlapped teeth. Success in the treatment of black triangle with periodontal microsurgery is

a significant leap in the field of perio-esthetics, making it a realistic possibility.^[15]

In gingival recession coverage

Mucogingival surgeries in today's practice are not only concerned with the treatment but also meet the esthetic demands of the patients. In mucogingival surgeries, the damage to the tissues during surgery can be greatly reduced by atraumatic surgical approach and excellent visualization of the operative field. Therefore, this field of microsurgery enhances the normal vision by magnification and providing with sufficient lighting, leading to improvement in predictability, cosmetic result, and patient comfort levels over conventional periodontal surgical procedures.^[16] There was a study conducted in which the comparison between the macro- and micro-surgical techniques was done for the root coverage using the coronally repositioned flap associated with enamel matrix derivative. It was found that there was a significant reduction in the gingival recession height in both the surgical techniques which were performed. However, the use of microsurgical technique depicted a greater increase in width of keratinized tissue and thickness of keratinized tissue as compared to the macro surgical techniques performed.^[1,12,17]

In alveolar ridge deficiencies, esthetic implant reconstruction, and sinus lifts procedures

If attention is paid to details of maintaining the interdental papillae, gingival architecture, and alveolar bone, implant reconstruction can proceed without loss of the preexisting dental anatomy. The execution of microsurgical technique limits collateral damage. When microsurgical principles are combined with an understanding of microanatomy, the surgeon becomes an architect of unique surgical method.^[17]

Microsurgery in implants

All phases of implant treatment may be performed using a microscope. Studies show that motor coordination and accuracy is generally increased when surgeons use a microscope. Although no studies establish that microsurgery reduces postoperative pain following extraction or implant placement, there is a strong theoretical rationale to suggest that less surgical trauma results in less pain and faster healing, and that microsurgery leads to those ends.^[7]

BENEFITS OF MICROSURGERY IN PERIODONTICS

The surgical operating microscope, like all magnification, enhances visual acuity. This leads to:

1. Increased precision in delivery of surgical skills, which results in more accurate incisions via smaller instrumentation, less trauma, and quicker postoperative 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.^[13]

DRAWBACKS OF MICROSURGERY IN PERIODONTICS

As we upgrade our surgical maneuvers with the aid of microsurgical concepts, there are a few shortcomings of this modus operandi, which need to be considered before its application. It is much more demanding and technique-sensitive; the cost incurred to establish a microsurgical set up is also high. Magnification systems used also pose some difficulties including restricted area of vision, loss of depth of field as magnification increases, and loss of visual reference points. An experienced team approach mandates microsurgery and is time-consuming to develop. Physiologic tremor control for finer movements intraoperatively and a steep learning curve are required for clinical proficiency.^[13]

CONCLUSION

Periodontal microsurgery is definitely a must for surgical procedures. The improved visual acuity provided by magnification opens a whole new world for those who make effort and take time to become proficient in microsurgical principles and procedures. The promising periodontal microsurgery will provide new possibilities to improve the therapeutic results for a variety of periodontal surgeries.

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Conflicts of interest

There are no conflicts of interest.

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