Review Article

Periodontal Microsurgery- Glory of Magnification

Parth Sharma[1], Nidhi Pandey[1], Siddhanth Singh[1], Prerna Tandon[1], Jaishree Garg[2]

[1]Postgraduate Student, Department of Periodontology and Implantology, Institute of Dental Sciences, Bareilly, Uttar Pradesh, India, [2]Professor, Department of Periodontology and Implantology, Institute of Dental Sciences, Bareilly, Uttar Pradesh, India.

ABSTRACT

The use of magnification to perform various procedures in the medical and dental field has long been recognized. Ironically, the practice of microsurgery in periodontology has not been widely promoted. The purpose of this article is to highlight the practice of microsurgical principles in several periodontal surgical procedures and thereby emphasize the integration of microscope into periodontal procedures.

Key words: Magnification, microsurgery, visual acuity, wound healing

INTRODUCTION

Over the years, the evolution of surgical periodontal therapy has undergone a plethora of changes both in concepts and techniques. Although usage of loupes and surgical operating microscopes to achieve magnification to perform various procedures in the medical and surgical field is widely acclaimed, their incorporation in dentistry particularly in the field of periodontology needs to be addressed at a broader level. This article provides a review of application of periodontal microsurgery for procedures ranging from mucogingival surgeries to regenerative procedures and implant dentistry.

HISTORY

Daniel (1979) defined microsurgery as a surgery performed under the magnification provided by operating microscope. Serafin (1980)[1] described microsurgery, as a methodology, a modification, and refinement of existing techniques that use magnification to improve visualization and have implications for their applicability to all specialties. Introduction of the first surgical microscope in dentistry was done by Apotheker and Jako in 1981.[2] Shanelac introduced microsurgery in periodontology 1992.[3]

PRINCIPLES OF MICROSURGERY

Principles of microsurgery are of importance for achieving the best prognosis possible by the operator. It is mainly possible by ameliorating the skills required to perform this modality. In order to achieve these skills a constant devotion is must, by practice of various steps as in order:

- Enhancing motor skills
- By emphasizing on passive wound closure with exact or near to exact approximation of the incision or wound
- By appropriate application of microsurgical instrumentation and suturing to reduce tissue trauma.

Enhancement of motor skills is achieved by maintaining a composed mind, correct chair position, comfortable posture with well-supported hand, minimal quiver of hand while instrumentation for best stability, feet must be flat on the floor. In chair position patients head must be perpendicular to the operator's chest by assuming head of patient at 12 ′O` clock. The most appropriate area for working on patient should be between 7 ′O` clock and 2 ′O` clock and if in case operator is left-handed area of working should be between 10 ′O` clock and 4 ′O` clock.

For stabilization, hand is kept on a flat surface in a dorsiflexed position which is about 20 degrees. By application, significant stability of hand and reduction of quivering can be accomplished.

For instrumentation most appropriate grip preferred is pen grip which provides greater stability to hand than any other grips. Pen grip is a three-finger grip which involves, index and thumb finger in the middle of the handle of instrument and pad of middle finger acting as tripod. With a steady contact in between three fingers, the instrument can be moved with efficiency without fatigue.[4]

Corresponding Author:
Dr. Nidhi Pandey, Postgraduate Student, Department of Periodontology and Implantology, Institute of Dental Sciences, Bareilly, Uttar Pradesh, India. Phone: +91-8218251306. E-mail: docpandey.n19@gmail.com

MICROSURGICALTRIAD

Three Imperative rudiments which lay down the foundations of the microsurgical triad include magnification, illumination, and micro surgical instruments. All three factors play an equal role in the success of microsurgery.

Magnification

Magnification loupes and operating microscopes are some of the most widely used magnification systems for increasing visual acumen.

Magnifying loupes

These are one of the most commonly used loupes in dentistry.[5] Based on a system of Keplerian system optics, these loupes constitute dual monocular telescopes with side-by-side lenses. Due to their ability of convergence, these loupes provide a magnified image with stereoscopic properties.[6] These are of three types: simple or single-element loupes [Figure 1], compound loupes, and prism telescopic loupes.

Prism telescopic loupes

One of the most advanced loupe systems available. They help in elongating the path of light through Schmidt or "rooftop" prisms which contain a succession of switchback mirrors amongst the lenses.[7,8] These can yield improved magnification, increased field depth, extended working distance with bigger field of view [Figure 2]. It can increase the magnification up to 4 times the original value. Illumination is significantly enhanced via coaxial fibreoptic lighting.

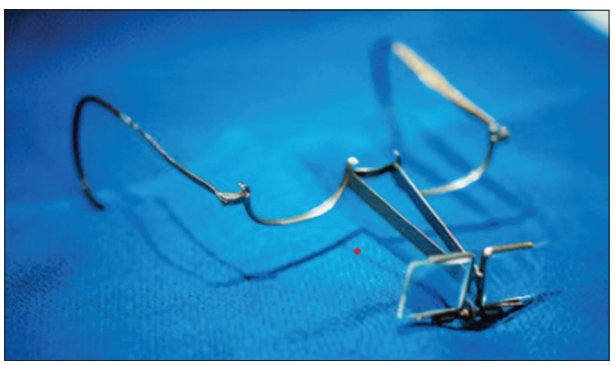


Figure 1: Simple loupes (Adapted from Carranza 13th edition)

Figure 2: Prism loupes (Adapted from Jan Lindhe, 6th edition)

Compound loupes

These provide supplementary refracting surfaces with multi-element lenses by means of intervening air spaces [Figure 3]. To evade unnecessary size and weight, magnification can be augmented by spreading the gap between the lenses. They have the ability to be achromatic and yield a color-correct picture.[8] These should not magnify beyond 3× as they are ocularly inadequate at this range.

Loupe magnification

Loupe magnifications vary within a range of 1.5×–10×. Magnifications less than 2× have proven to be less than adequate for microsurgery. Loupes of 5× show the most efficacy for utility in periodontal procedures where magnification is deemed necessary, by supplying effective magnification, field size, and focus depth.

Surgical operating microscope

Surgical microscopes are able to exploit the "Galilean optical principles [Figure 4]." They provide magnification of 4–40× through an intricate system of lenses which allow for stereoscopic vision. These can be mounted on ceilings, floors, or on walls. Clinicians need not worry regarding the weight or sustaining a stabilized field of view as all these aspects are external to the body.

Figure 3: Compound loupes (Adapted from Carranza 13th edition)

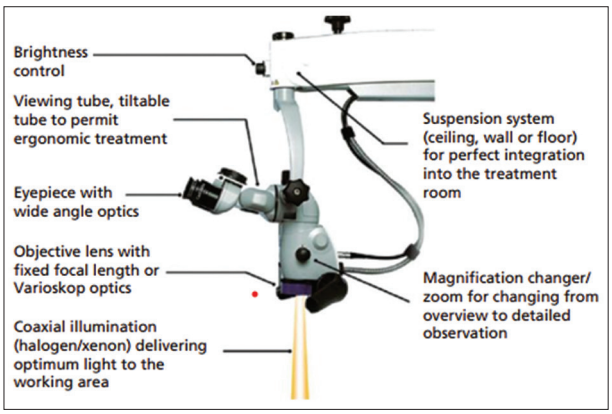


Figure 4: Parts of a surgical microscope. (Adapted from Jan Lindhe, 6th edition)

Surgical microscopes can provide for both maneuverability and stability.

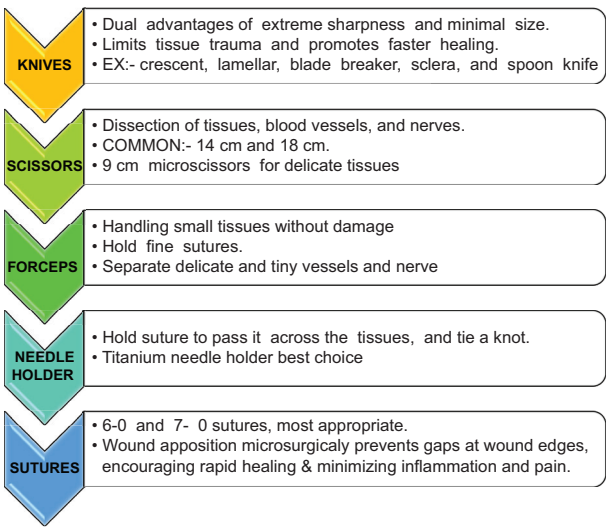
ILLUMINATION

Lenses must be equipped with antireflective coatings to prevent loss of transmitted light and reduction in brightness due to surface refraction. Loupes and various instruments can be equipped with fiber optic light. This is advantageous in getting rid of debris from deep periodontal pockets. Lamps made up of halogen have been evaluated and are sufficient enough to provide for the finest illumination.[9] Illumination also requires to bear in mind the quality, weight, brightness of the illuminating source with the luxury of directing and focusing the light within the working space.[10]

INSTRUMENTS

Microsurgical instruments are able to make clean incisions and flap closure which provide for wound healing via primary intention. The following are common in a microsurgery kit:

- Knives and scalpel blades
- Micro scissors
- Anatomic and surgical micro forceps
- Micro needle holder
- Micro sutures.



BENEFITS OF MICROSCOPES IN PERIODONTICS

A seasoned and dexterous surgeon will exhibit precision in his work. He can achieve this with planning.

1. Though an accurately placed incision small enough to employ smaller instruments and causing minimal trauma. This aids in improved field exposure and visibility and easy access to calculus. This results in its removal with minimal collateral damage resulting in the preservation of natural root smoothness
2. Re-approximating the incision using thin suture mounted atraumatic needles.

ROLE IN PERIODONTOLOGY

Microsurgery has proven to surpass conventional periodontal surgery not just because of reduction in post-operative morbidity felt amongst the patients undergoing surgical therapy, but also because this modality is able to bestow the clinician with squeaky clean incisions, contiguous wound emplacement, diminished hemorrhage, and minimal trauma at the operating site. Usage of a microscope will enable the clinician to view the operating field with immense clarity and enable them to perform with great precision which can boost the periodontal repair via primary healing and minimal granulation tissue formation.

Role in scaling and root planing

Purging of plaque and calculus from the tooth and root surface is a vital principle for controlling and treating periodontal diseases and a proper visual access of the operating site enhances debridement and helps to deliver a smooth debris-free surface. Kotschyin 2010[11] was able to achieve significant root debridement and pocket therapy using microscope holding a magnification power of 15×–20× combined with kinetic glass bead blasting achieving optimal results. Liao *et al.*[12] utilized surgical microscope for evaluating the effectiveness of magnification in clearing debris around tooth surfaces and noted effective removal of plaque and calculus around periodontally affected teeth after using the microscope.

Role in regeneration

The usage of barrier membranes, demineralized freeze-dried bone allograft, a combination of barrier membranes and grafts, and enamel matrix derivative have been the most sought out techniques for the treatment of intrabony defects.

Minimally Invasive Surgical Technique (MIST) was first proposed by Cortellini *et al.* in the therapy of intrabony defects.[13] Depending upon the morphology of the defect site the approach toward the diseased interdental papilla is decided. The Modified-MIST,[14] prevents or prohibits the involvement of the papilla and the palatal flap and recommends only elevation of a minute buccal flap.

Primary closure of the flap was reported in 100% of cases treated with MIST and maintained in 95% of the cases at 1 week in single sites[13,15] and in 100% of the cases in the treatment of multiple sites.[16] When applying the M-MIST,[14] the reported primary closure was obtained and maintained in 100% of the cases.

Role in papilla reconstruction

Reconstruction procedures for diseased or defective papilla have proven to be one of the most strenuous procedures for aesthetic correction and this is mainly due to the narrow architecture as well as constrained blood supply to the papilla. Therefore, microsurgery was suggested to overcome these anatomic and biologic obstacles.

Nordland *et al*. in 2008 anticipated the usage of microsurgical instruments and surgical microscopes to the original pouch and tunnel technique.[17] This case report presented without the application of vertical releasing incisions onto the soft tissues preventing any chances of obliteration the donor tissue, unnecessary hemorrhage, discomfort and helped in tissue survival. They reported improvements in the interdental space indicating successful regeneration of the interdental papilla using the microsurgical principles.

Burkhardt and Lang have shown superior vascularity and enhanced treatment outcomes with microsurgery.[18]

Role in sinus lift

Deterioration of the subantral bone is common sequelae which occurs due to loss of posterior teeth. Tooth loss leads to reduced occlusal contacts and bone pneumatization. This can be a common complication during delivery of implants which require a stable amount of alveolar bone for the implant to adhere into the socket and allow for unimpeded osseointegration. Incidencesranging from 10% to 44% have been reported wherein due to inadequate amount of bone height has led to the perforation of the sinus by the implant. Steiner in 2010[19] demonstrated a novel method of sinus lift procedure incorporating microsurgery and have observed improved visualization of the sinus membrane, negative risks of perforation allowing for 97% implant rate of success.

Role in root coverage

Gingival recession is one of the most common complications perceived in the dental clinic. Atraumatic surgery, excellent visualization, and surgeon's dexterity contribute to better root coverage.

Bittencourt *et al*. in 2012 operated on patient requiring recession coverage via soft tissue grafts by utilizing a surgical microscope. On 12 months follow-up, 98% coverage with superior aesthetics was observed in patients who underwent coverage under the guidance of a surgical microscope.[20]

Yadav *et al*. in 2018 utilized a surgical microscope for treating a patient with miller's class 1 recession using the GTR technique. 91.6% mean root coverage was demonstrated which is attributed to the enhanced visualization via the microscope giving a detailed view of the surgical site and the precision with which the procedure was performed.[21]

Role in implant

Microscope can be effective in implant placement. As of yet, there is no evidence reporting reduction of post-operative pain after extraction or placement of implant. However, there are significant observations which report of decreased pain and improved healing due to diminished surgical trauma.

Shanelec in 2005[22] conducted a case series which evaluated usage of microsurgery principles in 100 patients who were in need of extraction of maxillary central incisors, lateral incisors and reported that utilization of microsurgery for placing implants in extraction sockets showed remarkable success.

Minimally invasive implant surgery has come across as an efficient and clinically effective mechanism for the placement of implant. Aided with the digital pre-surgical plan during guided implant surgery has provided significant boost in minimally invasive surgical procedures.[23]

CONCLUSION

Application of microsurgery in periodontology has proven to be a beneficial modality for treating periodontal complications. Although it is a technique-sensitive procedure, the boons of this modality are manifold. Utility of the microscope allows the clinician to practice a precise, effective, and less traumatic procedure which allows for maximum healing and better surgical outcomes. The application of magnification for periodontal surgeries will become a standard treatment protocol in the near future once its precedence is validated worldwide.

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