Minimally Invasive Periodontal Therapy: A Paradigm shift

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Abstract

Periodontitis is a complex term that affects all supporting tissues of the teeth and can be treated non-surgically as well as surgically. Periodontal therapy success is contingent on adequate case selection, patient cooperation, accurate diagnosis, and treatment plan. From a clinical standpoint, improved visualization during periodontal operations is required to achieve better results. Minimally invasive periodontal therapy (MIPT) explains need of utilizing minimally invasive techniques and provides information on how to improve visualization using a minimally invasive approach. Also, the reasons for minimally invasive periodontal procedures as well as numerous strategies for minimally invasive nonsurgical and surgical periodontal procedures in this Review will be explored.
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Introduction

For decades, the traditional non-surgical and surgical procedures for treating chronic periodontitis remained constant. We treat chronic periodontitis cases with these techniques by using all the blind non-surgical ways to rely on tactile perceptions to locate and remove subgingival deposits. For example, in nonsurgical periodontal therapy, root planing entails removing some structure of the teeth during periodontal instrumentation to obtain a 'hard' and 'smooth' root surface. Because it requires the removal of some tooth structure, it is an intrusive treatment. However, in early 1980s concluded that the purposeful removal of cementum during the technique of root planning was not justified[1,2] and therefore a new idea was established for the treatment of damaged teeth. There is evidence suggesting that extensive surgery may be necessary to address underlying bony defects in cases where the pockets are deeper.

Traditional surgical procedures for periodontal disease often involve creating a large flap to access the affected area, resulting in bone exposure. To address the shortcomings of traditional procedures, Minimally Invasive Surgery (MIS) was introduced in 1995 by Harrel and Ress.[3] MIS aims to minimize incisions and flap reflection, making it less time-consuming, less painful, more acceptable, beneficial, and cost-effective. This newer technique involves using micro incisions design to obtain all surgical therapies that were previously done through larger surgical access for the treatment of periodontal diseases. MIS allows for a gentler handling of both soft and hard tissues during surgery.

Objectives of Minimally Invasive Periodontal Therapy:[4]

- Minimum surgical trauma
- Increase stability of flap/wound
- Primary wound closure stability
- Less time on operating
- Reduce patient pain and discomfort while minimising side effects

Types and Principles of Magnification System:

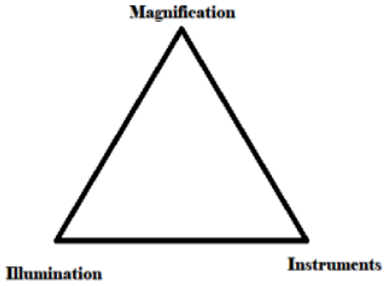
Precision is essential to the art of dentistry, and while the naked eye can detect fine details, enhancing and enlarging images can yield even better results. Despite the interest in microsurgery among dental professionals, many lack the necessary skills to perform such procedures, indicating a lack of understanding of its potential.[5] Periodontal microsurgery entails utilising a microscope to improve visual acuity at magnifications greater than 10x, and the use of loupes, surgical operating microscopes, and micro tools has elevated periodontal surgery to a new level of precision.

Application of periodontal microsurgery in procedures such as periodontal flap and recession coverage, periodontal regeneration, and implant surgery. The microsurgical triad, consisting of magnification, illumination, and refined surgical skills, is essential to achieving improved accuracy in surgical interventions **(Belcher et al. 2001).**[6] without any one of these elements, microsurgery is not possible. Enhancing the micro-surgical triad through the use of surgical microscopes and micro instruments can refine basic surgical techniques and improve surgical outcomes.

Dentists now have access to a wide selection of basic and complex magnifying systems, allowing them to improve the precision of their clinical abilities.

Fig.1 Magnification Triad

There are two types of optical magnification available to dentists which includes, Surgical Loupes and Surgical Operating Microscope



Surgical Loupes: Magnification loupes represent the most frequently employed magnification technique in the field of dentistry. These loupes consist of two separate monocular microscopes positioned next to each other to focus on a specific object. Dentistry commonly utilizes three distinct types of loupes, all employing convergent optics. These loupes are as follows: [7,8] Simple loupes, Compound loupes and Prism loupes

Surgical Operating Microscope: The Operational Microscope that enhanced adaptability and ease of use when compared to magnifying surgical loupes. However, comes with a significantly higher cost and a steeper learning curve initially. In the realm of dentistry, operational microscopes are designed based on Galilean principles. These scopes combine magnifying loupes with a magnification changer and a binocular viewing system, creating binoculars that work in parallel to minimize eye strain and fatigue. With fully coated optics and achromatic lenses, operational microscopes deliver higher quality of resolution and high colour contrast stereoscopic vision.

Working of Surgical Microscope:

To appreciate the working of surgical operating microscope one needs to have knowledge about the following.[9] Magnification, Illumination, Documentation, Accessories

Effective microsurgical procedures demand precise instruments. A typical toolkit comprises all types of micro surgical instruments. In the field of Periodontics, various ophthalmic knives, such as the crescent, lamellar, blade breaker, sclera, and spoon knife, find application. Their distinct advantage lies in their exceptional micro sharpening ability and diminutive size. This combination reduces tissue trauma and expedites the healing process. Notably, these sharp instruments are etched rather than conventionally honed, ensuring a more precise wound edge.[10]

Instruments for Periodontal Microsurgery[11]

In the field of Periodontology, a variety of ophthalmic knives, including the curved shaped, lamellar, blade breaker, sclera, and spoon knife. Ophthalmic knives have the advantage of being both extremely sharp and small in size. This reduces tissue stress and speeds up healing. Ophthalmic knives' sharper blades generate a more precise wound edge because they are chemically etched rather than honed. The reduced size of the ophthalmic blades, when compared to the normal No.15 blade typically used in Periodontics, streamlines surgical work. Micro-instruments are placed in a sterile container or tray to avoid damage. During sterilisation or transit, the tips of the instruments must not come into contact with each other. Needle holder, they come in a variety of sizes and are designed to grab very thin needles. Their jaws are smooth, resulting in a straightforward and controlled knot. The most popular needle holders are 14 cm and 18 cm.[11] The needle holder tip should be 1mm for suturing 5-0 and 6-0 sutures, and 0.3 mm for suturing 8-0 and 10-0 sutures. Sutures and microsurgical needles to prevent breaking, needles have high flexural and ductile strength. Curved needles fit better into small areas. In periodontal surgery, needles with a 3/8 or 12 curve circular and an arc length of 8-15 mm are preferable. Needles ranging from 6-0 to 9-0 are commonly used.[12]

Indications: Microsurgical Periodontal Surgery:[13,14.] Minor Surgical Procedure, Flap Surgery, Regenerative surgery, Muco-gingival / Perio-plastic surgery.

Passive wound closure represents one of the three fundamental principles in microsurgery. Achieving precise primary closure of the wound edges is crucial for obtaining the desired outcome. Ideally, incisions should be nearly imperceptible, and they should be closed using meticulously positioned, small sutures that minimize tissue trauma and bleeding. Advances in suture materials and techniques have led to the development of sutures tailored for specific procedures across various surgical specialties, with dental procedures benefiting from these innovations.

In microsurgery, fine-gauge needles, ranging from small to extremely small, are used. These needles are designed to provide optimal stability when held by a needle holder, a critical factor influencing the entire suturing process. It's essential for the surgeon to have complete control over the procedure, particularly when passing the needle through the tissue. Therefore, the needle holder must be appropriately sized to match both the needle and the selected suture material. This ensures that the surgeon maintains the highest level of control and precision throughout the suturing process.

To facilitate passive wound closure, microsurgery relies on meticulous, minimal invasive entry incision design and dissection. The site is then closed utilising the proper fundamental techniques, with the aim of achieving both primary and passive wound site closure. (Price PB, 1948).[15]

In Mucogingival Surgery:

All these techniques yield varying degrees of therapeutic benefits due to their sensitivity to the operator's skill and the

specific technique employed. Microsurgical approaches, which require an extended period of learning and practice to achieve desired treatment outcomes, offer a more compatible method for complete successful muco-gingival surgical treatment results.

In the field of periodontics, microsurgery has proven to be a valuable approach for improving the predictive results of gingival transplantation techniques used in root coverage treatment. It also helps in reducing surgical damage and postoperative discomfort. When combined with accurate diagnosis, microsurgical techniques significantly enhance the predictability of achieving complete root coverage in various cases of mild to moderate marginal tissue recession abnormalities. Moreover, even in cases of class III and class IV marginal recession, where conventional surgery often yields partial root coverage results, microsurgery can lead to substantial improvements in outcomes.

Papillary Reconstruction Procedure:
The restoration of missing interdental papillae remains difficult. Microsurgical treatment is an atraumatic approach for positioning donor tissue under a deficient interdental papilla. Surgical magnification and microsurgical devices are important because to the small size of the interdental papilla and the limited access.[16]

Root Coverage Procedures:
The success of the root covering operation is dependent on the surgeon's dexterity, excellent visualisation of the working region, and, of course, an atraumatic surgical technique. A surgical microscope can meet all these requirements. To maximise treatment outcomes, it is necessary to regulate aspects impacting the degree of coverage, such as root preparation, sensitive tissue handling, tissue biotypes, and thorough plaque control.[17]

Minimal Invasive Surgery in Implant Therapy:
Techniques that give function, aesthetics, and comfort using a minimally invasive surgical approach are widely recognised among clinicians and patients in the modern era. Many clinicians suggest trans-gingival (flapless) implant surgery to meet this need. This method can be utilised to ease the implant placing procedure.[18]

The one-piece implant technique promotes improved tissue recovery by improving gingival mucosal adhesion to build a collar that is adequate for healing and adapting to the surface of implant, so eliminating a second surgical treatment (Prithviraj DR, et al 2013).[19] Single unit implant prosthetic approach allows the normal structure of the Peripheral tooth tissues to be preserved by allowing a endline preparation that follows the contour of the gingival margin, resulting in a better keeping of the mucosal seal (Barrachina-D'ez JM et al in 2013).[20] The success rate of single unit immediate loading implants is comparable to that of delayed loading implants (Shigehara S, et al in 2014).[21]

Sinus Floor elevation:
Numerous authors have proposed modifications to conventional techniques, leading to the rise in popularity of "Minimally Invasive Techniques". One notable advancement in the realm of sinus augmentation is the "Sinus Lift System" an example of minimal invasive indirect sinus lift tools. When combined with Platelet-Rich Plasma (PRP) and Tricalcium Phosphate (TCP), this procedure becomes even more reliable, potentially accelerating bone production and sinus elevation.

It is reasonable to assert that elevation of sinus floor using the "sinus-lift system" is a dependable method for getting significant sinus lift during augmentation procedures. This approach, involving sinus lift prior to implant placement, is poised to play a more prominent role in the future due to its evident advantages. Minimal invasive technique provides successful implant

procedure and maximize the augmentation. This proposed technique is minimally invasive, reduces procedural time, enhances the precision of implant dentistry with predictable outcomes, and enhances the comfort of implant patients.[22]

Wound Healing in MIPS

Microsurgery promotes a healing process. Reduces the formation of granulation or scar tissue. Research suggests that wounds treated with microsurgery typically heal within 2 days. In contrast secondary wound healing takes longer as new tissue needs to be generated to fill the gaps at the wound's edges. The reduced surgical trauma, during microsurgery leads to cell damage, necrosis, inflammation and pain.

Microsurgery promotes healing with granulation or scar tissue formation. Studies indicate that wounds treated with microsurgery typically heal within 48 hours. In contrast secondary wound healing takes longer as new tissue needs to be generated to cover the gaps at the wounds edge. The advantage of microsurgery is that it causes cell damage due, to reduced trauma.

The Transition Sequence:

Periodontists are now able to receive training in periodontal microsurgery. However, microsurgery training differs from other types of continuing education courses. First and foremost, the courses are practical rather than academic. Their primary educational emphasis is on the clinical skills required for excellent microsurgical technique. To guide students' skills from beginner to advanced levels, a programme requires at least two days of rigorous training with direct one-on-one instruction. Movement education focusses the mind and enhances the neurobiology of learning to new heights of performance and achievement. As the twenty-first century progresses, such learning approaches will play an increasingly essential role in teaching periodontists for microsurgery as it enters the mainstream of periodontal therapy.[23]

A practitioner who aspires to learn microsurgery must become visually acclimated to the microscope. Visual movement of the instruments without reference to surrounding cues (known as kinaesthetic movement) necessitates a slower, more nuanced movement. New microsurgical skills, such as tool grip and posture, must be learned by the practitioner. Structured training creates an optimal setting for developing these abilities. After training, the practitioner might gradually integrate microsurgery into his or her office practise.

Common errors in the use of surgical microscope are using magnification that is too high, inadequate task sharing between surgeon and assistant, Lack of practice. The technology currently considered cutting-edge for both non-surgical and surgical minimally invasive periodontal therapy is likely to be seen as primitive or outdated in the next 30 years. The potential for advancements in periodontal therapy seems boundless, with a strong likelihood that treatment procedures will become progressively more effective and less invasive.[24]

Conclusion

Minimally invasive periodontal surgery (MIPS) is becoming increasingly important as medicine and dentistry pursue less invasive treatment options. The use of microscopes allows for precise and detailed information for diagnosis and treatment. MIPS has many benefits, such as improved aesthetics, faster healing, and less patient discomfort. Utilizing endoscope-assisted root planning and regenerative surgery is proving to deliver superior results with reduced patient morbidity when compared to conventional techniques. The goal of any treatment is the regeneration of lost tissue with minimal post-operative issues, which

MIPS is proving effective in achieving. Specific training, instruments, and materials are required for a successful minimally invasive approach. Further studies are necessary to determine if MIPS can substitute conventional methods while accomplish similar or better results.

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