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Review Article

Periodontal Microsurgery- A Review

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A B S T R A C T

Introduction: The field of periodontology is under the refinement of various ongoing surgical procedures. The primary intention of any surgery is to preserve the functionality and well-being of the patient. The idea of microsurgery has enhanced the outcomes in terms of passive wound closure and has reduced tissue trauma. A surgical microscope offers the periodontist increased illumination and visual acuity to perform procedures with great precision.

Objective: The purpose of this review is to elucidate periodontal microsurgeries such as functions of magnification, microsurgical instrumentation and their application in the field of periodontology.

Methodology: Electronic searches on PubMed, Embase, and Research Gate were made and relevant articles published were reviewed.

Results and Conclusion: Periodontal microsurgery, though in its infancy, holds tremendous possibilities. It requires good skills and practice for gaining optimum proficiency in the relevant area. Despite being more technique sensitive than other conventional procedures, the future of periodontics will see increased use of magnification in all fields including implantology.

Keywords: Periodontology, Magnification, Microsurgery, Instruments

Introduction

The field of periodontology is under the refinement of various ongoing surgical procedures. The development in technology has improved our understanding of the aetiopathogenesis, diagnosis, and treatment modality to perform a simple, and minimally invasive surgical procedure to obtain better outcomes. The field of periodontal surgery has been enriched with this peculiar and innovative approach rather recently. Harrel and Rees proposed the "Minimally Invasive Surgery (MIS)" with the aim to produce minimal wounds, minimal flap reflection, and gentle handling of the soft and hard tissues.[1] Cortellini and Tonetti proposed the Minimally Invasive Surgical Technique (MIST) to stress the aspects of the wound and blood clot stability and primary wound closure for blood-clot protection.[1] Geissberger has explained a direct relationship between magnification and significantly enhanced performance of technique-sensitive dental procedures.[2] Hence, the concept of microsurgery came into practice in 1993 in periodontics. Periodontal microsurgery is reaching new heights of precision using loupes and surgical operating microscopes.[2] It emphasises more on increasing visibility, minimising trauma, and improving surgical results with the help of micro scalpels and micro sutures.[3] This article provides a review of applications of periodontal microsurgery for procedures ranging from mucogingival surgeries to regenerative procedures and implant dentistry. A brief overview of microsurgical

principles, ergonomics, and instruments is also discussed.

A thorough literature search of PubMed (or Medline) and Google Scholar was conducted for relevant material from studies up to 2018. Medical Subject Headings words searched were "periodontal microsurgery" and "minimally invasive periodontal surgery". Systematic and narrative reviews, relevant case reports/ case series, and clinical and comparative studies pertaining specifically to periodontal surgical procedures published in English were included. All articles were selected with no inclusion or exclusion criteria.

History

Daniel RK in the year 1973, coined the term "microsurgery" as surgery performed under magnification by the microscope.[4] Serafin, in 1980, described microsurgery as a methodology – modification and refinement of existing surgical techniques.[5] Apotheker and Jako first introduced a commercial operating microscope to dentistry in 1981.[6] Microsurgery was introduced to the field of periodontics in 1992.[6] A continuing education course was subsequently conducted by Shanelec and Tibbetts on periodontal microsurgery at the annual meeting of the American Academy of Periodontology held in 1993.[7]

Principles of Microsurgery

It embraces three key points:

- Enhancement of motor skills for increased precision
- Reduction of surgical field and tissue trauma
- Superior wound healing

Microsurgery is gradually gaining acceptance among periodontists; the reason being not reduced morbidity, rather the end-point therapeutic appearance of microsurgery is way superior compared to that of conventional surgery.[2] The advantages of microsurgery are cleaner précised incisions, better closer wound apposition, and reduced haemorrhage and tissue trauma at the surgical site.[3]

Ergonomics

An operating surgeon needs to have a relaxed state of mind, good body comfort and posture, a well-supported hand, and a stable instrument-holding position.[8] In order to accomplish precisely controlled movements of fingers, the ulnar surface of the forearm and wrist should be supported by resting on a flat surface, angled in a dorsiflexion position at approximately 20° to reduce muscle tremor originating from both the unintentional and intentional actions of the body.[8] The operating surgeon must be seated upright (back straight and head erect) with both feet flat on the floor so that the thighs are parallel to the floor.[7] All movements should be efficient enough to produce purposeful, deliberate motions.[7] Pen grip (or internal precision grip), is the most commonly advocated precision grip for microsurgical procedures (Figure 1). It provides greater stability in comparison to any other hand grip due to the tripod formed by the fingers, while the middle finger holds the instrument.[7]

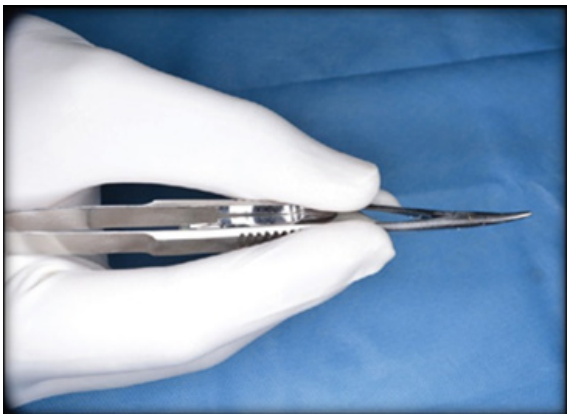

Figure 1.Pen Grip for Holding Microsurgical Instruments

Microsurgical Triad

The working principle of the microscope used in dentistry is based on co-axial illumination. An operating microscope renders three unambiguous benefits of illumination, magnification, and increased precision in the delivery of surgical skills, collectively known as the microsurgical triad (Figure 2).[9]

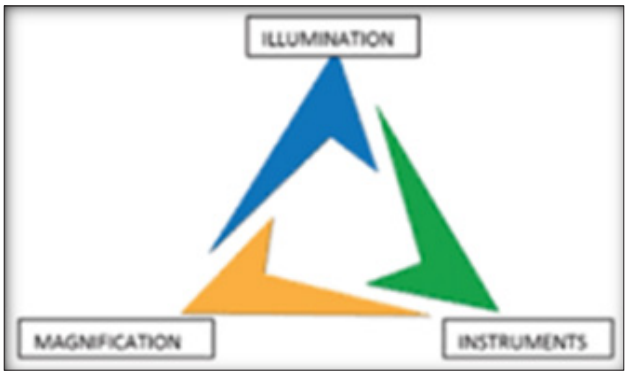

Figure 2.Pictorial Representation of Microsurgical Triad

Illumination achieved through fibre optics technology has improved the methods of focusing light on specific areas and is a standard feature of surgical operating microscopes. Illumination shows the path that light takes as it travels through the microscope (100 W halogen bulb). A rheostat controls the light intensity and a fan cools the lamp. The pathway of the reflected light follows through a condensing lens to a series of prisms and then to the surgical field through the objective lens.[2] The important things to contemplate are eye-to-object distance, light sources, coaxial illumination, parfocality, and beam splitter.[2]

Magnification, the second component of the microsurgical triad, can be achieved through the use of the loupes and

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the operating microscope.[10] Magnification is determined by the power of the eyepiece, focal length of binoculars, magnification change factor, and focal length of the objective lens.[11] Both types of optical magnification have their own advantages and limitations.[10] Loupes can be simple, compound, or prism in design. These are available in the form of eyeglasses or attached to a headset.[10] Compound and prism designs produce superior magnification and are commonly used in dentistry today.[10] Caplan published an excellent review article that describes a comparison of different types of loupes.[7] In a periodontal microsurgical practice, 70%–80% of the typical periodontal microsurgeries can be done at a magnification of ×10–×20 with the surgical operating microscope.[7] The remaining procedures can be performed with loupes under ×6–×8 using enhanced motor skills acquired during microsurgery training sessions with a surgical microscope.[3] Under a magnification of ×20, the preciseness of hand movement approaches 10 µm and visual resolution approaches 1 µm.[6] Proprioceptive guidance is therefore of little value under the microscope.[6] Increased precision in the delivery of surgical skills, the third component of the microsurgical triad, is the synergistic result of illumination and magnification. The equation for calculating total magnification is:

MT = fT x Me x Mc

where MT: total magnification, fT: focal length of the binocular tube, fO: focal length of the objective lens, Me: magnification of the eyepiece, and Mc: magnification factor

Increased precision in the delivery of surgical skills, the third component of the microsurgical triad, is the synergistic result of illumination and magnification.[7]

Microsurgical Instruments

Smaller instruments can be used with more precision due to improved visual acuity. To aid in proper handling and for a high-precision movement, microsurgical instruments should be slightly top-heavy, circular in cross-section, and approximately 18 cm in length.[7] Shorter instruments with a rectangular cross-sectional design do not allow precise manipulation and are not ideal for microsurgery. Microsurgical instruments usually have a colour-coated surface to avoid an unfavourable metallic flare due to the light of the microscope.[7] The weight of microsurgical instruments should not be more than 15-20 g to avoid the fatigue of hand and arm muscles.[7] Needle holders should have an appropriate working lock that does not surpass a locking force of 50 g (0.5 N) as low locking forces diminish the precision and high locking forces engender tremors. Titanium-made microsurgical instruments are stronger, lighter, and non-magnetised in comparison to stainless steel instruments, but are expensive and get readily distorted, if not properly cared for.[12] Care should be taken during sterilisation procedures and transportation so as not to allow instrument tips to touch each other. A basic set of microsurgical instruments comprises a micro-scalpel holder, needle holder, micro-scissors, micro-forceps, and elevators (Figures 3 and 4). Different types of blades used in ophthalmic surgery can also be used for periodontal microsurgery.

Figure 3.Microsurgical Scalpels

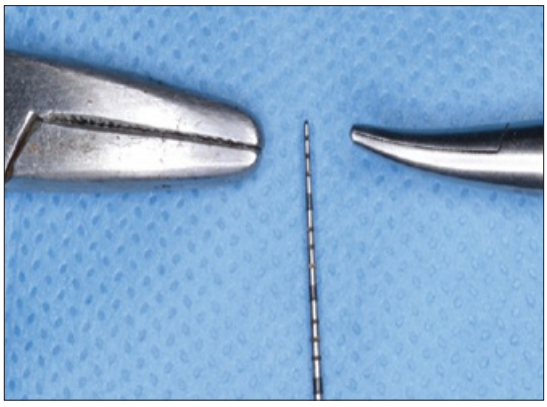

Figure 4.Microsurgical Probe

To minimise tissue trauma, the sharpest needles, spatula needles (6.6 mm long with a curvature of 140°) with micro tips, or reverse cutting needles with precision tips are preferred. For microsurgical periodontal procedures, 3/8" circular needles usually provide favourable results. Regarding the length of the needle, 13–15 mm long needles are considered adequate for papillary sutures in posterior areas, 10–12 mm needle lengths in the anterior region, and 5–8 mm long needles are suitable for approximating vertical incisions. Most periodontal microsurgical suturing is done with sutures ranging in size from 6-0 to 9-0 (Figure 5).

Among the different suture materials available, monofilament non-absorbable sutures are preferable but should be removed at the earliest biologically acceptable time. Interestingly, suture materials like Vicryl® Plus (Ethicon®, Norderstedt, Germany) coated with a bacteriostatic substance like triclosan seem to be a looming

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alternative to further minimise the microbial passage along the sutures.

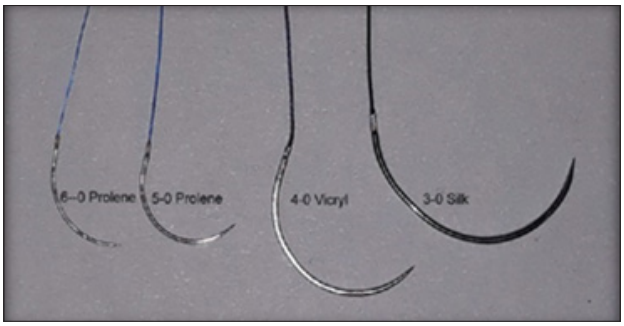

Figure 5.Microsurgical Needles and Sutures

The combined use of small-sized needles and sutures under magnification permits wound closure with sufficient tension and the least possible dead space.[7]

Suturing techniques in microsurgery differ from that in conventional surgery. In microsurgical procedures, the needle should penetrate perpendicularly to the tissues and exit at equal distances. Suture bite size should be approximately 1.5 times the tissue thickness to achieve proper wound approximation. Knot tying using the microscope is done using instrument ties, with a microsurgical needle holder in the dominant hand and a microsurgical tissue pickup in the non-dominant hand.[7]

Clinical Applications

Periodontal microsurgery is an alternate form of conventional periodontal surgery to reduce surgical trauma and open the horizons for better patient care.

Root Surface Debridement

The importance of root debridement is recognised universally as an essential component of periodontal therapy. Several authors have emphasised that thoroughness of root surface debridement is crucial for the improved outcome of periodontal treatment rather than the choice of grafting modality. It has been reported that root instrumentation is effective when done under illumination along with an improved early healing index and less postoperative pain. Furthermore, root preparation can be done with micro ultrasonic instruments. The smaller size (about 0.2–0.6 mm in diameter) and variable power settings (25,000 to more than 40,000 cycles per second) of these instruments allow subgingival treatment in deep pockets with fewer chances of over-instrumentation of the root surface. Moreover, these instruments have active working sides on all surfaces; deliver ultrasonically activated lavage in the working area, and can be used with minimal water spray. In conclusion, magnification improves the root surface debridement by enhancing the clinician's ability to differentiate the calculus from tooth surface and biofilm to the microscopic level, which reveals morphological contours of both supragingival and subgingival tooth surfaces and accurately procreates working end angles during instrumentation.[7]

Mucogingival Surgery

In order to achieve excellent results in terms of both aesthetics and function, it is utmost essential to perform extremely fine and accurate incisions, meticulous suturing to promote stabilisation and immobilisation of the tissue and precise closure of wound margins. Hence, the use of the surgical microscope in mucogingival therapy might be helpful for those sites in which aesthetics demand complete and perfect coverage. Periodontal microsurgery performed by trained and skilled surgeons offers an improved outcome of root coverage procedures for interdental papilla augmentation. Compared to the conventional macrosurgical approach for the treatment of gingival recession, the microsurgical approach has been shown to offer the distinct advantage of increased vascularisation of the grafts, relatively better percentages of root coverage, a significant increase in width and thickness of keratinised tissue, an improved aesthetic outcome, and decreased patient morbidity.

Implant Therapy

Surgical microscope can be a valuable tool in implant dentistry. Different stages of implant treatment ranging from implant placement to implant recovery and peri-implantitis management may be accomplished with more precision under magnification. One of the novel applications of microsurgery is in the sinus lift procedure with a success rate of 97%. The surgical microscope can aid indirect visualisation of the sinus membrane and minimises the risk of perforations. The incorporation of microsurgical techniques for an improvement of altered sensation due to implants encroaching on the inferior alveolar nerve even without unscrewing them has also been reported.

Crown Lengthening

Although the comparative studies of crown lengthening and ridge augmentation with microsurgical methods are finite, it seems logical to substantiate the fact that magnification is beneficial in such procedures.

Periodontal Regeneration

In the last few years, a modification in the existing surgical procedures and their clinical effectiveness for periodontal regeneration of intra-bony defects has been extensively studied.[7] The advantages of the microsurgical approach in regenerative therapy relate to improved illumination and magnification of the surgical field which permits proper access to and debridement of the intra-bony defect with increased accuracy and minimal trauma. Furthermore, the competency to achieve and maintain a primary wound

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closure minimises bacterial contamination and thereby provides more favourable conditions for periodontal regeneration.[7] A recent meta-analysis found no significant differences in the treatment of intrabony defects treated with minimally invasive periodontal surgery (MIPS) plus biomaterials and MIPS alone for the observed parameters (probing depth, clinical attachment level, marginal recession, and radiographic bone fill), pointing out that costs and benefits should be considered substantially while deciding a regenerative therapeutic modality. Isolated interproximal defects that are usually limited to the interproximal site are considered ideal for bone grafting with MIPS.[7]

Conclusion

The use of an operating microscope and microsurgical instruments are beneficial by elevating the ability of a clinician to handle, thus increasing the potential for treating tissues around the periodontium. The success of surgical and non-surgical periodontal therapies, especially periodontal plastic surgeries and implant therapy, has been revolutionised by the use of magnification. Though it is technique sensitive, it requires less time to produce promising clinical results and more patient acceptance. Microsurgery, although has many benefits, also has many drawbacks that include limited vision, loss of depth of field, and an arduous learning curve with the high initial cost of setup. Despite being more technique sensitive than other conventional procedures, the future of periodontics will see increased use of magnification including implantology.

Conflict of Interest: None

References

1. Cortellini P, Tonetti MS. A minimally invasive surgical technique with an enamel matrix derivative in the regenerative treatment of intra-bony defects: a novel approach to limit morbidity. J Clin Periodontol. 2007 Jan;34(1):87-93. [PubMed] [Google Scholar]
2. Dhir R, Jayasheela M, Triveni MG, Shetru MN. Periodontal microsurgery: a boon for precision. Anna Dent Sci. 2022 Apr 10;2022. [Google Scholar]
3. Hegde R, Hegde V. Magnification-enhanced contemporary dentistry: getting started. J Interdisc Dent. 2016 May 1;6(2):91. [Google Scholar]
4. Schoeffl H, Lazzeri D, Schnelzer R, Froschauer SM, Huemer GM. Optical magnification should be mandatory for microsurgery: scientific basis and clinical data contributing to quality assurance. Arch Plastic Surg. 2013 Mar;40(2):104-8. [PubMed] [Google Scholar]
5. Satyanarayana D, Reddy GV, Babu RP. Periodontal microsurgery: a changing perspective. Indian J Dent Advanc. 2011 Oct 1:698-705. [Google Scholar]
6. Tamai S. History of microsurgery. Plast Reconstr Surg. 2009 Dec 1;124(6S):e282-94. [PubMed] [Google Scholar]
7. Yadav VS, Salaria SK, Bhatia A, Yadav R. Periodontal microsurgery: reaching new heights of precision. J Indian Soc Periodontol. 2018 Jan;22(1):5. [PubMed] [Google Scholar]
8. Tibbetts LS, Shanelec D. Principles and practice of periodontal microsurgery. Int J Microdent. 2009 Aug 1;1(1):2-12.
9. Mamoun J, Wilkinson ME, Feinbloom R. Technical aspects and clinical usage of Keplerian and Galilean binocular surgical loupe telescopes used in dentistry or medicine. Surg Dent Ergonom Loup. 2013 Jan.
10. Belcher JM. A perspective on periodontal microsurgery. Int J Periodontics Restorative Dent. 2001 Apr;21(2):191-6. [PubMed]
11. Hoerenz P. The operating microscope I. Optical principles, illumination systems, and support systems. J Microsurg. 1980 Mar;1(5):364-9. [PubMed] [Google Scholar]
12. Samal A, Kumar M, Nayak R, Satpathy A, Das AC, Mohanty G. Periodontal microsurgery: an evolution in the progression. Indian J Forensic Med Toxicol. 2020 Oct 1;14(4). [Google Scholar]

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