ABSTRACT

Periodontal microsurgery is the refinement of basic surgical techniques made possible by the improved visual acuity gained with the use of the surgical microscope. In the hands of a trained and experienced clinician, microsurgery offers enhanced outcomes not possible with traditional macrosurgery, especially in terms of passive wound closure and reduced tissue trauma. This paper aims to briefly review the basics of periodontal microsurgery.

Keywords: Macrosurgery, Microscope, Microsurgery, Visual acuity.

INTRODUCTION

For the past 150 years, mortality and morbidity for all surgical operations have been tacitly accepted as unavoidable parts of the therapeutic process, but since the early 1980s it has become evident that less invasive methods of interventional treatment in some areas have produced far fewer complications with a reduced risk of death and morbidity. This realization has given rise to the idea of minimally invasive (MI) treatment with its general aiming at minimizing the trauma of any interventional process but still achieve a satisfactory therapeutic result.

In the minds of many dental professionals, microsurgery is an interesting concept, and yet the inability of most clinicians to perform such procedures shows the dental profession’s lack of understanding of what microsurgery truly encompasses. Dentistry has borrowed microscopic surgery from medicine, which dates back to 1922. Microsurgery was introduced to the specialty of periodontics in 1992. Carl Nylen, is considered the ‘father of microsurgery’.2

Microsurgery refers to a surgical procedure performed under a microscope. It is a practice that embraces three distinct values.

- First is enhancement of motor skills to improve surgical ability. This is evident in the smooth hand movements accomplished with increased precision and reduced tremor.
- Second is the decreased tissue trauma at the surgical site, which is apparent in the use of small instruments and a reduced surgical field.
- Third is the application of microsurgical principles to achieve passive and primary wound closure. The aim is the elimination of gaps and dead spaces at the wound edge to circumvent new tissue formation needed to fill surgical voids. A painful and inflammatory phase of wound healing can then be avoided.

The three elements, i.e. magnification, illumination, and refined surgical skills, are called the microsurgical triad (Belcher et al 2001) (Fig. 1).

Dental microscopes and loupes (Fig. 2) have transformed the way that the modern dentist operates and as

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Fig. 1: Microsurgical triad

Fig. 2: Clinician seated at microscope with correct posture and arms supported
it is well known that what often influences the quality of treatment is the degree to which the clinician can see.

Even though all the procedures can be performed using normal vision, performing these procedures using a surgical microscope and microsurgical instruments offers definite advantages in terms of improved visual acuity, superior approximation of wounds, rapid wound healing and decreased postoperative morbidity in the patients. The effect of periodontal microsurgery may include more predictable therapeutic results, less invasive procedures with reduced patient discomfort, improved cosmetic results, and greater patient acceptance. One aim of the microsurgical training is the reduction of tremor.

To minimize tremors, a microsurgeon must have a relaxed state of mind, good body comfort and posture, a well-supported hand, and a stable instrument-holding position. Attitude is also very important. Mental focus and patience during the procedure are important factors in maintaining precise motor control skills.

The microscope, with instantaneous magnification from 2.5× to 24×, with no visual noise and shadowless coaxial light, offers the best means for achieving complete visual information in dentistry. It can nurture great confidence, healthier posture, and better and surer hands for the clinician. And in the end, the excellent visual information it offers can help the dentist to create more precise, more healthful, and more esthetically pleasing dentistry.

**The dental angle:** Dental microsurgery can be used to enhance any dental procedure but is most often reserved for more complex oral surgery cases. Dentists often take advantage of dental microsurgery in the following cases:
- The placement of dental implants
- Locating the tooth’s roots and infection during root canal procedures
- An apicoectomy, where the root’s tip is surgically removed to treat a root canal
- Periodontal surgery or gum disease treatment
- Locating small cracks or defects in the tooth

**From patient’s viewpoint:** Because the dental microscope magnifies the area, dental microsurgery usually means less cutting and fewer stitches. Dental microscopes may also reduce the need to pull back the gums, which could result in less bleeding. The precision of dental microscopic procedures often make for faster treatment and less healing time.

The utilization of dental microsurgery could also lower the occurrence of failed dental treatments, which means less need for retreatment. For these reasons, the dental community is starting to embrace the use of dental microsurgery.

**MICROSURGERY IN PERIODONTICS**

The utilization of this perfect visual tool offers an aid as an eye opener for the dental clinicians. With the high power magnification, dentist’s vision can actually pass through tiny openings, such as pocket entrances and crestal gingival punched accesses. As a result, there would be no more need for traditional open flap surgery to create visibly large wounds.

Without incision and tearing of periosteum, healing can be faster and more uneventful. So, the whole therapeutic course can be a more cost-effective one.

Microsurgery represents an amplification of universally recognized surgical principles in which gentle handling of soft and hard-tissues and extremely accurate wound closure are made possible through magnification, allowing for well-planned and precisely executed surgical procedures. The goal of the periodontist is to cause as little damage as possible to tissues and to have healing occur by primary rather than secondary intention. Healing by secondary intention occurs when the wound edges open and heal more slowly and with more inflammation as granulation tissue fills the wound. Microsurgery offers a more rapid and comfortable healing phase for the patient.

Root debridement is the most important component of periodontal treatment. In periodontics, studies demonstrate that root debridement done without magnification was incomplete. When debrided roots were examined with an aid of a microscope, substantial deposits remained. Magnification greatly improved the surgeon’s ability to create a clean and smooth root surface.

Periodontal microsurgery is commonly performed at 10× to 20× magnification. With normal vision the highest possible visual resolution is 0.2 mm. At this level of visual acuity, the greatest accuracy possible for the human hand movement is 1 mm. Physiologic tremor can further reduce the accuracy of movement to 2 mm. Under magnification of 20×, the accuracy of hand movement approaches 10 μ and visual resolution approaches 1 μ.

The reason microsurgery has gained acceptance among some periodontists is not 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. The 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. Wound healing studies show anastomosis of microsurgical wounds within 48 hours. Secondary wound-healing is slower because new tissue formation is required to fill voids at the edge of the partially closed wound. Because surgical trauma is minimized during microsurgery, less cell damage and necrosis occurs. This means less inflammation and reduced pain.

Periodontal microsurgery does not compete with conventional periodontal surgery. It is an evolution of surgical techniques to permit reduced trauma. Its methodology improves existing surgical practice and introduces the possibility for better patient care to periodontics.

The use of magnification systems and periodontal microsurgery are part of a broad movement in dentistry toward the use of MI procedures to replace the need for more extensive surgical procedures. While magnification systems are widely used in endodontology, their application in periodontics is still in its nascent phase.

There are many indications in which periodontal microsurgery can be beneficial. It appears to be a natural evolution for the speciality of periodontics. Microsurgery offers new possibilities to improve periodontal care in a variety of ways. Its benefits include improved cosmetics, rapid healing, minimal discomfort and enhanced patient acceptance.

In periodontal practice, the tissues to manipulate are usually very fine resulting in a situation in which the natural vision capacity reaches its limits. Therefore, the clinical procedure may only be performed successfully with the use of magnification improving precision and, hence, the quality of work.

The usual magnification of loupes for a general dentist is 2.5 to 3.5-fold. However, the magnification for a periodontist is 3.5 to 4.5-fold. The operation on delicate tissues requires loupes with a magnification of 5.5 to 6.5-fold.

PERIODONTAL INSTRUMENTATION

Magnification enables dentists to use smaller instrumentation with more precision. Knives, retractors, scissors, needle holders, tying forceps and others. The knives most commonly used in periodontal microsurgery are those used in ophthalmic surgery: blade breaker, crescent, minicrescent, spoon, lamella and sclera knives (Fig. 3). Common characteristics of these knives are their extreme sharpness and small size (Fig. 4). This enables precise incisions and maneuvers in small areas.

Needle holders are also downsized from sizes designed for conventional periodontal surgery. Microsurgical instrumentation can be made with titanium or surgical stainless steel. Titanium instruments tend to be lighter, but are more prone to deformation and are usually more expensive. Stainless steel instruments are prone to magnetization, but there is a greater number and wider variety of them.

The appropriate needle-holder length depends on the nature of the operation. The most commonly used are 14 and 18 cm. The tips of the forceps should be smooth and strong. The forceps should not damage the tissue, and no break to the suture should occur during suturing. The most commonly used microforceps are 15 cm long, with round handles and 0.2 to 0.3 mm tips. The rounded handle enables the direction, degree, and position of the instrument to be changed by merely rolling the fingers, which facilitates knotting and dissection. Also, the instruments should be circular in cross-section to allow for a smooth rotation movement.

The combination of using smaller needles, sutures, and magnification results in minimal dead space, closure with sufficient but appropriate tension, and immobilization of the wound.

Fig. 3: Periodontal microsurgical knives: 1—blade breaker; 2—crescent; 3—minicrescent; 4—260° spoon; 5—lamella and 6—sclera

Fig. 4: Spoon knife shown in sulcular undermining incision
There is much emphasis not only on the quantity of the sutures but also the quality. Three common techniques are used in microsurgical tying: nondominant, dominant, and a combination of the two. The nondominant and combination tying techniques are the two most commonly used in dentistry. Square knots are the best to guarantee the integrity of the knot. A surgeon’s knot followed by a square knot is the preferred knot combination. Adding excess ties to a knot does not increase its strength or integrity; it only adds to the bulk of the knot. The instrument is commonly held in a pen grip or a precision grip (Figs 5 and 6).

The rotating movement of the hand from 2 to 7 o’clock (for right-handed persons) is the most precise movement the human body is able to perform. In order to avoid an unfavorable metallic glare under the light of the microscope, the instruments often have a colored coating surface. The weight of each instrument should not exceed 15 to 20 gm (0.15–0.20 N) in order to avoid hand and arm muscle fatigue.

An important characteristic of microsurgical instruments is their ability to create clean incisions to prepare the wound for healing by primary intention. In order to see that there is no damage, the micro instruments are to be stored in a sterile, container or tray. Care should be taken to prevent the tips of the instruments not to touch each other during sterilization procedures and during transportation.

**SMILE TECHNIQUE IMPLANTS**

The simplified microsurgical implant lifelike esthetics (SMILE) technique is an immediate dental implant method performed directly following tooth removal as well as a temporary crown that emerges like a natural tooth.

**SMILE TECHNIQUE ADVANTAGES**

- Employs MI tooth removal
- Secures an immediate implant placed below the gum surface preserving the gum line and facial contour
- Temporary crown preserves a natural smile
- Requires minimal invasion, less stitching and trauma
- Reduces the risk for infection and complications
- Eliminates the need for multiple surgeries that typically accompany dental implants.

**ROBOTIC-ASSISTED MICROSURGERY**

The robotic-assisted microsurgery (RAMS) represents one of the latest innovations of telerobotics in the microsurgical field.

Basically, the RAMS system is a telerobot with mechanical arms which is controlled by a computer but operated by a surgeon. Robotic-assisted microsurgery allows performing high dexterity microsurgical operations with the help of robotic arms and improves microsurgery through tremor filtration, articulation, motion scaling and improved ergonomics (Fig. 7).

Robotic surgery offers many benefits over conventional surgery which includes reduced trauma, less blood loss, less postoperative pain, shorter hospital stay, faster recovery and early return to work. The other exciting aspect of robotic technology is teleconsultation and teleproctoring.

Another important feature is that there is greatly increased precision due to scalability of movements which can be up to 1:6 scale, meaning that 6 mm movement of fingers will result in 1 mm movement of the instrument.

Though majority of surgeons agree that robotic microvascular surgery is feasible but puts a question mark over its superiority over the conventional methods both from technical aspect and cost-effectiveness.

**CONCLUSION**

Periodontal microsurgery is still in its infancy but the scope for it in future is enormous. It is a skill that requires

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*Fig. 5: Precision grip*

*Fig. 6: Pen grips*
practice to achieve proficiency of the highest level in the area to which it is applied. The miniature world of microsurgery presents special challenges in dexterity and perception which when mastered increases the innovative methods of treatment for better results. Its execution is technique sensitive and is more demanding than the conventional periodontal procedures. As the benefits of the microscopes are realized, it will be applied more universally.

As public awareness of periodontal microsurgery increases, the conventional surgical approach with extensive incisions will become a less acceptable form of treatment. Microsurgery offers new knowledge and technology for periodontists that can dramatically improve the therapeutics results of many periodontal procedures like improved cosmetic results, rapid healing, and minimal discomfort and enhance patient acceptance.

Periodontal microsurgery has many applications and benefits. As healthcare professionals and the public become familiar with the benefits of microsurgery, applications of this philosophy in periodontics will likely become a treatment standard. Microsurgical periodontics requires a different practitioner mindset. It is technique sensitive and more demanding than periodontal microsurgery, but it results in more rapid healing because it is less invasive and less traumatic. The improved visual acuity and ergonomics provide significant advantages to those who take the time to become proficient in microsurgical principles and procedures. The operating microscope allows the surgeon to practice enhanced, precise, delicate surgical procedures that have important healing processes and outcomes for patients. Periodontal microsurgery and periodontal plastic microscopic surgery provide a natural evolution in the progression of periodontics.

Dentistry of tomorrow will see increasing use of magnification in all areas of practice, including periodontics. Microsurgery will shift the focus of periodontal procedures from a macro to a micro field, thus, achieving precise results with this technique seems a reality.

The ‘magnification escalation’ in dentistry is likely to continue.

REFERENCES