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PERIODONTAL MICROSURGERY

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ABSTRACT Today a wide range of simple and complex Microsystems are available to the dentists, allowing improvement in the accuracy of their clinical skills. Basically, there are two types of optical magnification available to the dentists: magnification loupes and surgical microscopes. The application of magnification to periodontics promises to change clinical concepts of periodontal surgical care. Now the patients expect sound advice and careful treatment. They readily appreciate advances that give more predictable, more cosmetic and safer results. Lessening their inconvenience, anxiety and discomfort is another advantage. For these reasons invasive surgical procedures using various magnifying systems have been developed. Consistent successful periodontal treatment procedures demand clinical expertise that challenges the technical skills of periodontists to the limit of and beyond the range of visual acuity. Periodontal microsurgery is the refinement of basic surgical techniques made possible by the improved visual acuity gained with the use of surgical microscope. The purpose of this paper is to provide a brief review of periodontal microsurgery, the role of magnification systems, the benefits and potential of magnification in field of periodontics.

KEYWORDS : Loupes, microsurgery, periodontics, surgical microscope.

INTRODUCTION

In the minds of many dental professionals, microsurgery is an interesting concept. Periodontal microsurgery is the refinement of basic surgical techniques made possible by the improvement in visual acuity gained with the use of surgical microscope.1 In 1979, Daniel defined microsurgery in broad terms as surgery performed under magnification by the microscope.2 In 1980, microsurgery was described by Serafin as a methodology- a modification and refinement of existing surgical techniques using magnification to improve visualisation, with applications to all specialties.[5]

The main aim of a surgical intervention is no longer only the survival of the patient or one of his organs, but 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. This has led to the introduction of the Microscope into precision dental practice which is one of the greatest advances seen in modern dentistry.[9] Periodontal microsurgery is the refinement of basic surgical techniques made possible by the improved visual acuity gained with the use of surgical microscope.[6] In recent years periodontics has seen increasing application of procedures requiring progressively more intricate surgical skills. Regenerative and resective surgical procedures, periodontal plastic surgery and dental implants all demand clinical performance levels that challenge the motor skills of periodontal surgeons beyond a range possible with unassisted vision. Periodontal microsurgery introduces the potential for a less invasive surgical approach in periodontics.[3]

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.[10]

HISTORY OF MICROSURGERY

The history of microsurgery dates from 1922 when Nylen first performed eye surgery under a microscope. By the 1960s, microsurgery was standard in many specialties such as neurology and ophthalmology. A factor in its acceptance was lessened morbidity associated with smaller wounds. Microsurgery has been practiced in endodontics since 1986. It was introduced to the speciality of periodontics in 1992.[3]

MICROSURGERY IN PERIODONTICS

The reason microsurgery has gained acceptance among some periodontists is not reduced morbidity, rather, the end-point 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. As much as judgment and knowledge play a role in surgery, in the end it is a craft. Surgeons appreciate craftsmanship, especially when it rises to artistic levels greater than those possible with conventional surgery. With a little training, an average periodontist can consistently produce more finely crafted work than can the most gifted conventional surgeon. The clinician's personal gratification in performing more ideal work may be an important factor in the acceptance of microsurgery in periodontics.[5]

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.[10]

Advantages of microsurgery in Periodontics

Postural

- Less discomfort to the back and neck of the operator, protecting the spinal column from future problems.
- Can work at the same distance from the object at all the times, avoiding tiring the eyes, as there is no need to make the constant adjustment.[6]

Procedural

- Considerably improves manual abilities as operating field is

magnified.
- Lightening is magnificent.
- Collateral vision decreases, e.g. the area surrounding the visual field is dark, removing unnecessary visual information and improves sharpeness of vision.[1]

Psychological
- Decreases occupational, physical and postural stress.
- Increases personal, professional satisfaction with the improved quality of surgical treatments. Improves clinical results, with less post – operative discomfort to the patient.
- Gives patient the idea of high degree of professional qualification, as well as the impression of being up to date with new optical, digital and computerized technological applications and the patient feels more confident.[3]

Educational
- Makes it easy to gather clinical images to file, as camera can be incorporated.
- Easier to make reports, by referring dentists**,** legal assessment reports or damage valuation reports for insurance companies.
- Allows clinical videos of intervention or techniques to be recorded and presented at conferences, or as part of training.[6]

Microsurgical indications in periodontal surgery
- Guided tissue regeneration
- Vertical augmentation
- Horizontal augmentation
- Guided bone regeneration
- Split thickness flaps
- Double papilla flaps
- Apical or coronal repositioned flaps
- Connective tissue grafts
- Pedicle flaps[5]

Elements of microsurgery

There are three elements of microsurgery
1. Magnification
2. Illumination
3. Instruments

These 3 elements are collectively called the *microsurgical triad*. The improvement of which is a prerequisite for improved accuracy in surgical interventions. Without any one of these, microsurgery is not possible.

Magnification: The first element of microsurgical triad

An optimal vision is a stringent necessity in periodontal practice. More than 90% of the sensations of the human body are perceived by visual impressions. Vision is a complex process that involves the cooperation of multiple links between the eye, the retina, the optic nerve, and the brain. Another important factor influencing visual acuity is the lighting. The relation between visual acuity and light density is well established: a low light density decreases visual acuity. The best eyesight can be achieved at a light density of 1000 cd/m^2. At higher densities, visual acuity decreases. This, in turn, means that claims for optimal lighting conditions have to be implemented. Visualization of fine details is enhanced by increasing the image size of the object. Image size can be increased in two ways:
1. By getting closer to the objects
2. By magnification

Using the former method, the ability of the lens of the eye to accommodate becomes important and has a relevant influence on the visual capacity. By changing the form of the lens, the refraction of the optical apparatus increases, allowing it to focus on nearer objects. During ageing, the ability to focus at closer distances is compromised because the lens of the eye loses its flexibility . This phenomenon is called Presbyopia. Presbyopia affects all people in middle age and becomes especially noticeable when the nearest point at which the eye can focus accurately exceeds ideal working distances.[9] To see small objects accurately, the focal length must be increased. Periodontal microsurgery is commonly performed at 10x to 20x 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 20x, the accuracy of hand movement approaches 10 µ and visual resolution approaches 1 µ. Today a wide range of simple and complex magnifying systems are available to dentists, allowing improvement in the accuracy of their clinical skills.[9]In dentistry two basic types of magnification systems are commonly used:
1. Loupes
2. Surgical microscope

Optical principles of loupes:

This is the most common magnification system used in dentistry , they were introduced to medicine in 1876 by Saemisch, a German physician. Loupes are fundamentally two monocular microscopes, with side-by-side lenses, angled to focus on an object. The magnified image that is formed has stereoscopic properties that are created by the use of convergent lens systems. Although loupes are widely used, their major disadvantage is that the eyes must converge to view an image, which can result in eye strain, fatigue and even vision changes with the prolonged use of poorly fitted loupes. Three types of loupes are commonly used which include simple, compound and prism loupes.[9]

Simple Loupes

They are also called as Single lens magnifiers or Clip-on, Flip-up, Jeweler's Glasses. Simple Loupes consist of a pair of single, positive, side-by-side meniscus lenses. Simple loupes produce the described dioptre magnification that simply adjust the working distance to a set length. As dioptre increases, the working distance decreases.[2] (fig 1)

Advantages:
- Cheapest source of magnification.
- Light weight.

Disadvantages:
- They are highly subjected to spherical and chromatic aberration, which results in distortion of the image of the object that is being viewed.
- Because of their size and weight limitations, they have no practical dental application beyond a magnification range of 1.5 diameters, beyond which working distances and depth of field are compromised.
- With a set working distance, there is no range and no opportunity for movement which eventually results in neck and back strain.[9]

Compound Loupes

Compound loupes use multiple converging lenses with intervening air spaces to gain additional refractory power, magnification, working distance and depth of field. Such loupes can be adjusted to clinical needs without excessive increase in the size or weight. These loupes are based on Galilean optical system and allow a magnification of about 2.5x. (fig 2)

Advantages:
- Achromatic.
- Improved optical performance.
- Improved depth of field and working distance.

Disadvantages:
- Optically inefficient at magnifications above 2.5x.

Prism or Telescopic Loupes

Telescopic loupes or Prism loupes, however, offer improved ergonomic posture as well as significant advancements in optical performance. Instead of increasing the thickness of a single lens to

increase magnification, compound loupes use multiple lenses with intervening air spaces. These allow an adjustment of magnification, working distance, and depth of the field without excessive increase in size or weight. Prism loupes are the most optically advanced type of loupe magnification available. While compound loupes use multiple refracting surfaces with intervening air spaces to adjust optical properties, prism loupes are actually low – power telescopes.[9] (fig3)

Surgical microscope

The surgical microscope is a complicated system of lenses that allows stereoscopic vision at a magnification of approximately 4–40x with an excellent illumination of the working area. In contrast to loupes, the light beam falls parallel onto the retinas of the observer so that no eye convergence is necessary and the demand on the lateral rectus muscles is minimal. The microscope consists of the optical components, the lighting unit and a mounting system. To avoid an unfavorable vibration of the microscope during use, the latter should be firmly attached to the wall, the ceiling or a floor stand. Mounted on the floor, the position of the microscope in the room must provide quick and easy access. (fig 4)

The optical unit of the microscope includes the following components:

1. Magnification charger
2. Objective lenses
3. Binocular tubes
4. Eyepieces
5. Lightning unit
6 Additional attachments

Illumination: The second element of the microsurgical triad

Since the beginning of the practice of dentistry, dentists have recognized the importance of light in viewing their work. Most of the manufacturers offer collateral lighting systems or suitable fixing options. These systems may be helpful, particularly for higher magnification in the range of 4x and more loupes with larger field of view will have better illumination and brighter image than those with narrower fields of view.

Important considerations in the selection of an accessory lighting source are total weight, quality and the brightness of the light, ease of focusing and directing the light within the view of magnifiers, and ease of transport between surgeries It should be realized that each surface refraction in a lens will result in a 4% loss in transmitted light due to reflection. In telescopic loupes, this could amount to as much as 50% reduction in brightness. Anti-reflective coatings have been developed to counteract this effect by allowing lenses to transmit light more efficiently. This quality of lens coating also varies and should be evaluated when selecting loupes. Fiber optic technology has improved the methods of focusing light on specific areas. Several sources of fiber optic light can be attached to hand piece, instruments or loupes. The fiber optic illumination /transillumination is beneficial in removing deposits from moderate to deep periodontal pockets. Fiber optic lighting is a standard feature of surgical operating microscopes. In recent years, the use of halogen lamps have become popular for illumination.

Instruments: the third element of microsurgery

Proper instrumentation is fundamental for microsurgical intervention. Microsurgical instruments are much smaller, often by tenfold. This creates a smaller surgical field with less injury and bleeding. 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.[9]

Internal Precision Grip

It is also called pen grip, which is ideal for microsurgical instrumentation.

Features of the Internal Precision Grip are as follows

- It is a grip with thumb, index and middle finger.
- The instrument rests at the apex of the first web space and on the pads of the fingers.
- The thumb is straight.
- The metacarpal - phalange joint is flexed approximately 90^0.
- The interphalangeal joints are straight.

With this grip, the external muscles of the hand, its flexors and extensors, are relaxed to resist fatigue. As the instruments are primarily manipulated by the thumb, index and middle finger, their handles should be round, yet provide traction so that finely controlled rotating movements can be executed. The instruments should be approximately 18 cm long and lie on the saddle between the operator's thumb and the index finger; they should be slightly heavy to facilitate accurate handling. 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 15–20 g (0.15–0.20 N) in order 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.[9]

A basic set of periodontal microsurgery comprises

- **Knives**

The knives most commonly used in periodontal microsurgery are those used in ophthalmic surgery or plastic surgery:

1. Blade Breaker Knife
2. Crescent Knife
3. Mini crescent Knife
4. Spoon Knife
5. Lamellar Knife
6. Scleral Knife[8]

- **Micro scissors**

Scissors such as the micro – vannas tissue scissors are used for the removal of small fragments of tissue.[8]

- **Needle holder**

In order to avoid sliding of the thread when tying the knot, the tips of the forceps have flat surfaces or can be finely coated with a diamond grain that improves the security by which the needle holder holds a surgical needle. The configuration of the needle holder jaw has considerable influence on needle holding security. The presence of teeth in the tungsten carbide inserts provides the greatest deterrent to either twisting or rotating of the needle between the needle holder jaws. Additionally, the sharp outer edges of the needle holder jaws must be rounded to avoid breakage of fine suture materials. When the needle holder jaws are closed, no light should pass through the tips.[11]

- **Needles**

In *atraumatic* sutures, the thread is firmly connected to the needle through a press-fit swage or stuck in a laser-drilled hole. There is no difference concerning stability between the two attachment modalities. Tips of cutting needles are appropriate for coarse tissues or atraumatic penetration. In order to minimize tissue trauma in periodontal microsurgery, the sharpest needles, reverse cutting needles with precision tips or spatula needle with micro tips are preferred. The shape of the needle can be straight or bent to various degrees. For periodontal microsurgery, the 3/8" circular needle generally ensures optimum results.[9]

Microsurgery offers new possibilities to improve periodontal care in a variety of ways. Its benefits include improved cosmetics, rapid healing, and minimal discomfort and also enhanced patient acceptance.

CONCLUSION

Periodontal microsurgery though in a stage of infancy at present, will play a greater role in the future. It is a skill that requires practice to achieve proficiency. The small scale of microsurgery presents special challenges in dexterity and perception. Periodontal

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

FIGURE 1 SURGICAL MICROSCOPE

FIGURE 2 SIMPLE LOUPES

FIGURE 3 COMPOUND LOUPES

FIGURE 4 PRISM LOUPES

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