MICROSURGERY IN PERIODONTICS

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Introduction

Microsurgery implies an extension of universally accepted surgical principles by which gentle handling of soft and hard tissues and extremely accurate wound closure are made possible through magnification and well planned and well executed surgical procedures. For individuals who want to inflict as little damage as possible to the tissues and have healing by primary intention, rather than relying on the surgical areas to granulate in and heal by secondary intention , microsurgery is the choice .It is one of the most important development in the surgical Periodontics.

In 1979 Periodontal microsurgery was broadly defined as surgery performed under magnification provided by the microscope. In 1980, Serafin described microsurgery as a methodology or a modification and refinement of existing surgical techniques using magnification to improve visualization that had implications and application to all specialities.

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 specialty of periodontics in 1992.[1]

Today a wide range of simple and complex magnifying systems are available to 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 the operating microscope.

Advantages of Microsurgery In Periodontics

Postural

- Less discomfort to the back and neck, protecting the spinal column from future problems
- Can work at the same distance from the object at all times, avoiding tiring the eyes, as there is no need to make constant adjustment
- No need for the dentist to wear prescription spectacles. If the eyes are different, all microscopic binoculars have corrective mechanisms to compensate.

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 sharpness of vision.
- Recording operations can assess the techniques followed and detect procedural errors or problems

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 computerised technological applications and the patient feels more confident

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.
- Easier to record diagnostic sequences and treatment in video format and shows a magnified image of the operating field on the monitor for the assistant or auxiliary worker.
- Allows clinical videos of interventions or techniques to be recorded and presented at conferences, or as part of training

Loupes [3,4]

The most common magnification system used in dentistry is magnification loupes. Loupes are fundamentally two monocular microscopes, with side by side lenses, angled to focus on an object. The magnification that is formed has stereoscopic properties that are created by the use of convergent lens system. 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.[3] Three types of loupes are commonly used which employs convergent optics and includes simple compound and telescopic loupes

Simple Loupes

Simple loupes consist of a pair of single, positive side by side meniscus lenses. Such loupes tend to be primitive magnifiers, with limited capabilities. Each lens has two refracting surfaces, with one occurring as light enters the lens and the other when it leaves. Disadvantages of such loupes are that they are highly subject to spherical and chromatic aberrations. The magnification of simple loupe can be increased only by augmenting the lens diameter or thickness. . Cost is the only advantage with simple loupes.

Simple loupe when positioned close to eye sacrifice depth of field for working distance. When positioned close to the object, sacrifice working distance for depth of field.

Compound Loupes

Compound loupes use converging multiple lenses with intervening air spaces to gain additional refracting power, magnification, working distance and depth of field. These loupes can be adjusted to clinical needs without excessive increase in the size or weight. Compound lenses can be achromatic, in addition to offering substantially improved optical design. This is a feature that dentists should seek when selecting any magnifying loupe because an achromatic lens consists of two glass pieces, usually bonded together with clear resin. The specific density of each piece counteracts chromatic aberrations of the adjacent piece. Compound loupes are usually mounted in or on eyeglass.

Prism loupe

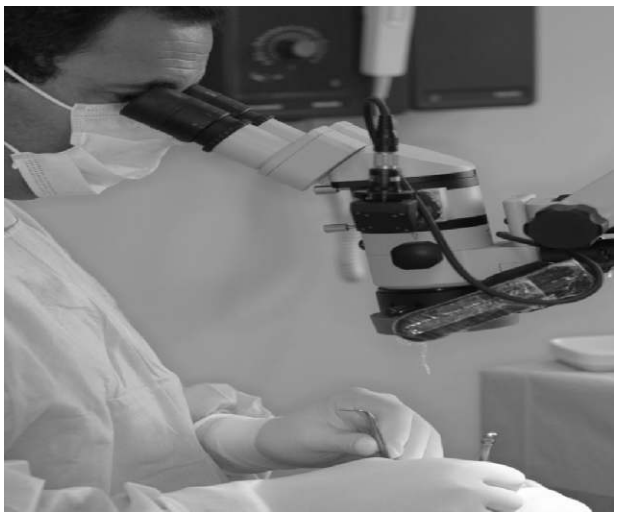
Prism loupes are most advanced type of loupe magnification system. These loupes contain Schmidt or roof top prisms that lengthen the light path through a series of mirror reflections within the loupes, virtually folding the light so that the barrel of the loupe can be shortened. Better magnification, wider depth of field, longer working distances and larger fields of view are produced by these loupes than other loupe types. The barrels of the prism loupe are short enough to be mounted on the eyeglass or headband, but the increased weight, at magnifications of 3.0 diameters or greater causes headmounted loupes to be more comfortable and stable than mounting on glasses.

Loupe Magnification

Loupe can be purchased that are capable of providing a wide a range of magnification (1.5x to 10x). Those providing less than 2x are usually inadequate for the visual acquity necessary for microsurgery, whereas those providing more than 4.5x of magnification can often be awkward to use because of narrow field size and depth of focus. For most periodontal procedures in which magnification is needed, loupes of 4.5x to 5.0x provide an effective combination of magnification, field size and depth of focus.[4]

Operating Microscope [5]

The operating microscope offers a flexibility and comfort superior to magnifying loupes but is much more expensive to purchase and is difficult to use. For use in dentistry operating microscope should be designed on Galilean principles. It uses the application of magnifying loupes with the magnification changer and a binocular viewing system. It also incorporates fully coated optics and achromatic lenses, with high resolution and good contrast stereoscopic vision. There must be an adequate working distance for instruments between the object being viewed and the microscope. To be able to use the microscope throughout the various areas of mouth it must have extensive horizontal and vertical maneuverability with its attachment to the wall. Ceiling or floor mount.



Magnification of microscope is determined by the power of eyepiece, the focal length of binoculars, magnification changer factor and the focal length of the objective lens. Eyepieces are generally available in the powers of 6.3x, 10x, 12.5x, 16x and 20x. The viewing side of an eyepiece has a rubber cup, which is turned down if the surgeon wears eyeglasses. The viewing side of an eyepiece has a rubber cup. Eyepieces also have adjustable diopter settings. Diopter settings range from -5 to +5 and are used to adjust for accommodation, which is the ability to focus

the lens of the eyes. Diopter settings also adjust for refractive error, which is the degree to which a person needs to wear corrective eyeglasses.

The function of binoculars is to hold eyepieces. Inter-pupillary distance in binoculars is set by adjusting the distance between the two binocular tubes. Binoculars often come in different focal lengths. In choosing binocular focal lengths, it is important to remember that the longer the focal length, the greater the magnification and narrower the field of view. Shorter length binoculars allow the operator to have a wider field of view and to be a little closer to the patient. Binoculars are available with straight, inclined or inclinable tubes. Straight tube binoculars are oriented so that the tubes are parallel to the head of the microscope. Inclined binoculars are oriented so that the tubes are offset at 45 degrees to the head of the microscope. Inclinable tubes are adjustable between straight and slightly beyond the inclined tubes.

Straight tube binoculars allows for direct look from microscope towards the operating field. Inclined binocular tubes could be used for maxillary surgery , operator has to use indirect vision through mirror or patient head sharply to the side while performing the mandibular surgery. Straight tube binocular has the advantage of allowing the use of direct vision in both arches. Straight tube binocular gains more verstality when a 135 degree inclined coupler or variable coupler is placed between mounting arm and the microscope. This coupler provides additional axis of rotation and aligns the microscope so that straight tube binocular provides direct vision whether the patient is sitting up or lying down. Inclined tube binocular often provides operator with additional postural comfort during long procedures. The only disadvantage with the inclined tube binocular is that they are difficult to master and they are not economical.

Magnification changers are available as either three or five step changer or power zoom changers. Some companies also make a manual version of zoom changers. Magnification changers are located within the head of the microscope. Manual step changer consists of lenses that are mounted on a turret. The turret is connected to a dial that is located on the side of microscope housing. The dial positions one lens in front of other within the changer to produce a fixed magnification factor or value. Rotating the dial reverses the lens positions and produces a second magnification factor. A conventional three step magnification changer has one set of lenses and a blank space on the turret without the lens.

When the power of eyepiece, focal length of the eye piece, focal length of binoculars with the magnification changers and lenses are factored three fixed powers of magnification can be obtained. Two from each pair lens combination and one from the blank space. The blank space produces magnification by factoring only the eyepiece, the focal length of the binoculars and focal length of the objective lens. A five step magnification changer has a second set of lenses mounted on the turret and produces five fixed power of magnifications. A power zoom changer is merely a series of lenses that move back and forth on a focusing ring to give a wide range of magnification factors. Power zoom changers avoid the momentary visual disruption or jump that occurs with three or five step magnification changer as the clinician rotates the turret and moves up and down in magnification. Magnification change functions in power zoom microscopes are controlled by either a foot control or a manual override control knob located on the head of the microscope.

Before the microscope can be used it must be made parafocal, meaning that it is focused throughout the entire range of the magnification and when the microscope is parafocused all the accessories such as cameras and auxillary binoculars are also in focus.

The focal length of the objective lens determines the operating distance between the lens and the surgical field. With the objective lens removed microscope focuses at infinity and performs as a pair of field binoculars. A variety of objective lenses are available with focal lengths ranging from 100 to 400mm. A 175mm lens focuses about 7 inches, a 200mm lens focuses about 8 inches and 400mm lens focuses about 16 inches. 200 mm objective lens is recommended because there is adequate room to place surgical instruments and still be close to the patient.[5]

Instruments used in Periodontal Microsurgery

Several types of ophthalmic knives, such as the crescent, lamellar, blade breaker, sclera, and spoon knife, can be used in the field of periodontal microsurgery

Ophthalmic knives offer the dual advantages of extreme sharpness and minimal size. As ophthalmic knives are chemically etched rather than ground, their sharper blades produce a more precise wound edge compared with the standard 15 blades commonly used in periodontics, The smaller size of the ophthalmic knives facilitate surgical work.

The crescent knife can be used for intrasulcular procedures. This knife is designed with a unilateral bevel and measures 2.4 mm -3.7 mm. It can be used in connective tissue graft procedures to tunnel, to prepare the

recipient site, or to obtain the donor graft. The spoon knife is often used to undermine into the lateral sulcular region in preparation for placement of connective tissue grafts using a sulcular, non relief technique. This knife is also bevelled on one side, thereby allowing the knife to track through the tissue adjacent to bone.

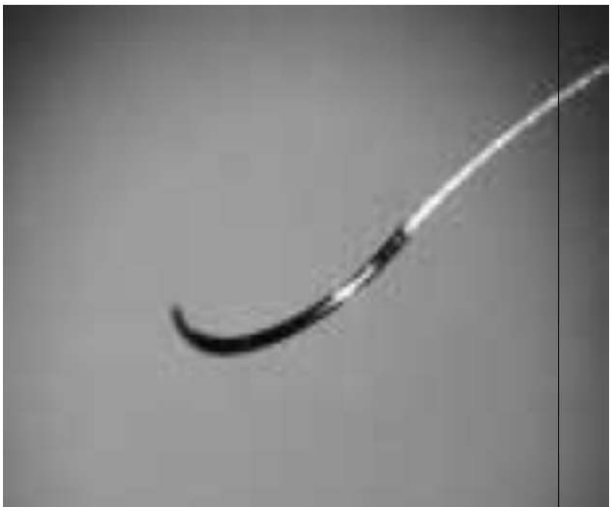
Using ophthalmic knives allows the periodontist to make precise, minimally invasive incisions while leaving a sharp wound edge. This improved technique helps limit tissue trauma and promotes faster healing In addition to ophthalmic knives, several other instruments have been designed for use under a surgical operating microscope. These include needle holders, retractors, and scissors. Using these smaller instruments under magnification allows surgeons to refine their movements with the end result of enhanced surgical skills.

Needles And Sutures [6,7]

Three principal goals of surgery are eliminating dead space, closing with sufficient but appropriate tension, and immobilizing the wound. These same goals are essential criteria for effective, predictable root coverage. An appropriate combination of properly selected needle and closure materials allows the surgeon to precisely position the suture and to approximate the tissue with as little trauma as possible while eliminating dead space and preventing movement of the wound. Microsurgery has increased the periodontist's options for appropriately sized needles and sutures.

Needles vary in size, shape, and curvature, but most needles used in dentistry are 3/8 curvature. Periodontists frequently use a reverse cutting needle of a significant size (16 to 19 mm). Although larger needles are sometimes indicated for periodontics, several needles allow more precise approximation of tissue edges. One such needle is a spatula needle, which is 6.6 mm in length and has a curvature of 140 degrees. Designed for ophthalmic surgery, the needle track is shallow and the needle purchase point is precise. These characteristics allow extremely accurate apposition, closure, and immobilization of the connective s

Several other needles with sizes ranging from 6.6 to 19 mm can be used in Periodontics. The availability of smaller needles can affect the choice of suture. An accepted surgical practice is to select the smallest suture that will adequately hold the mending tissue. This practice minimizes the opening made by the needle and minimizes the trauma through the tissues. Although 4-0 or 5-0 sutures are typically used in periodontics, in periodontal microsurgery 6-0 and 7-0 sutures are appropriate.Sutures can be nonabsorbable and absorbable; sutures can be multifilament or monofilament in design. Although absorption rates vary significantly, surgical gut (plain and chromic), polyglactin 910, poliglecaprone 25, and polydioxanone are four absorbable sutures indicated for use in periodontal surgery.



Effectively using smaller needles and sutures requires magnification. The surgical operating microscope allows the clinician to use smaller sutures and needles and results in minimal dead space, closure with sufficient but appropriate tension, and immobilization of the wound

Application of Microsurgery in Periodontal Flaps[3]

Surgical microscope introduces the less invasive surgical incisions and flap reflections in Periodontics. By using microsurgical techniques, flap margins and closure can best be controlled by dissection of a uniform thickness periodontal flaps that has scalloped butt joint margin. Precise and crisp initial incisions made at right angle of the surface tissues, are best done using a blade of carbon steel, fractured with a blade breaker of desired size from a sterile surgical grade razor blade. Secondary incisions follow for flap dissection to uniform thickness at right angles to the

initial incisions and are made with a double edged ophthalmic blade.

Application of Microsurgery in Mucogingival Surgeries[3]

Microsurgery offers a predictable means of improving the reliability of three broad types of gingival transplantation procedures used in treating gingival recessions. The first procedure includes a vascularised graft from a contiguous site to the exposed radicular surface. In this, the high survival rate of vascularised graft is due to the retained blood supply from the base of the pedicle which can be enhanced through microsurgery. In the second type of transplant procedure, an avascular graft makes use of donor tissue that is completely separated from its blood supply and moved to the area of recession from palatal donor site. The predictability of full root coverage with this procedure is due to the high degree of operator and technique sensitivity.

Microsurgery offers the possibility of greatly enhanced results with avascular graft.

The third type of procedure is transplantation with a composite tissue graft, which uses a pedicle or an envelope flap raised at the recession site, with connective tissue transplanted to the subepithelial space created beneath the flap. This procedure has been the technique of choice for root coverage for the past 15 years. Microsurgical principles and methodology application have made all the three of these gingival transplant procedures extremely reliable.

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. Its execution is technique - sensitive and more demanding than are conventional periodontal procedures. As the benefits of the microscope are realized, it will be applied more universally. There are many indications in which periodontal microsurgery can be beneficial. It appears to be a natural evolution for the specialty 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.

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