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Article Info Received 18/07/2016 Revised 25/07/2016 Accepted 9/08/2016 Key words: Microsurgery, Periodontology, Trauma	ABSTRACT Newer treatment modalities including new technology, instruments, and techniques enhance the skill of the clinician as well as ensure better results. Microsurgery is a minimally invasive technique that is performed with the surgical microscope, instruments and suture materials. The increased motor skills, minimal tissue trauma and passive wound closure forms the triad of the microsurgery. This review briefs about the various magnifying systems and their working principles used in dentistry, in particular Periodontology.
Trauma	

INTRODUCTION

There has been a tremendous advancement in the medical and dental fields to meet the patient's expectations along with achieving desired therapeutic objectives. Microsurgery is an advanced surgical technique, which is defined as surgery performed under magnification of $10 \times$ or more performed under a surgical microscope [1-3]. This increases motor movement precision from 1mm to 10 µm [4]. The properties of microsurgery include increased visual acuity and improved manual dexterity [5].

History

• Amsterdam merchant Anton van Leeuwenhook (1694) constructed the first compound lens microscope.

• Saemisch (1876) introduced simple binocular loupes to ophthalmic surgery.

• Apotheker and Jako (1978) first introduced the microscope to dentistry [6]

• Carr (1992) demonstrated the use of the surgical microscope during endodontic procedures [7].

• Shanelec and Tibbetts (1993) presented a continuing education course on periodontal microsurgery at the annual meeting of the American Academy of Periodontology [1,2,5,8, 9].

Philosophy of Periodontal Microsurgery

It embraces three core values viz.,

1. Enhanced motor skills which is accomplished through improved visual acuity and the use of a precise hand grip.

2. Minimal tissue trauma, which is accomplished through smaller incisions.

3. Primary passive wound closure. This is accomplished by microsuturing.

Magnification Systems Magnifying Loupes

The most common system of optical magnification used in Periodontics are dental loupes.² Loupes are basically dual monocular telescopes with sideby-side lenses. It is based on Keplerian optical system (Figure 1). The magnified image formed has stereoscopic properties by virtue of their convergence [2,9,10]. Three types of Keplerian loupes used in periodontics include simple or single-element loupes, compound loupes, and prism telescopic loupes.

Simple Loupes

It consists of a pair of single meniscus lenses (Figure 2). Each lens has two refracting surfaces. The magnification can be increased by increasing lens diameter and its thickness. Size and weight constraints make simple loupes impractical for magnification beyond $1.5\times$. They are greatly affected by spherical and chromatic aberration, thus distorts the image shape and color of objects being viewed [9, 11,12].

Compound Loupes

They use multi-element lenses with intervening air spaces to gain additional refracting surfaces (Figure 3) [13]. Magnification of compound loupes can be increased by increasing the distance between lenses, thereby avoiding excessive size and weight. Compound lenses can be achromatic and produces a color-correct image [14, 15]. However, compound loupes become optically inefficient at magnifications above $3 \times [2,10]$.

Prism Telescopic Loupes

The most advanced loupe is the prism telescopic loupe. They use Schmidt or "rooftop" prisms and lengthen the light path through a series of switchback mirrors between the lenses (Figure 4) [9-15]. They produce better magnification, wider depths of field, longer working distances, and larger fields of view than other types of loupes. The magnification is increased upto $4\times$. Inclusion of coaxial fiberoptic lighting has improved properties of illumination.

The Surgical Microscope

Surgical microscopes employ Galilean optics, which have binocular eyepieces joined by offset prisms (Figure 5). They establish a parallel optical axis and permit stereoscopic vision without eye convergence or eyestrain [1,2,4, 9]. They have coated achromatic lenses and high optical resolution. Depth-of-focus and field-of-view characteristics are greatly enhanced. Mountings are available for the ceiling, wall, or floor. Fiberoptic coaxial illumination is a major advantage as it eliminates shadows. Digital images can be captured using a beam splitter and camera attachment. A foot-control switch permits a surgeon to record, as the procedure unfolds, without interrupting surgery [1-4,9,11-12].

Advantages Of Microsurgery

There are many advantages of microsurgery. Surgical decision making is enhanced as the quality and quantity of visual data reaching the cerebral cortex is increased [2]. It is ergonomic as well as reduced neuromuscular fatigue and occupational skeletal pathologies [1, 5]. The ability to create clean incisions prepares wounds for healing by primary intention [5,9,11,12] It also minimizes gaps or voids at the wound edges and encourages rapid healing with less postoperative inflammation and less pain [2,16].

Microsurgical Knots

Two basic knots employed in microsurgery are the square knot or reef knot and surgeon's knot. The reef knot is composed of two single loops thrown in opposite directions. It lies flat when tied well and is ideal for passive wound closure. As postsurgical edema occurs, the reef knot opens sightly then becomes self-locking [2,11,12,16]. The surgeon's knot is composed of two double loops thrown in opposite directions. The first double throw is less likely to loosen when performing the second throw, making it is easier to control tissue apposition [2].

Microsurgical Needles

The needle diameter is ideally slightly larger than the suture size. Sutures used in microsurgery are swaged, making the needle and the suture continuous [2,17].

Microsurgical Sutures

The suture of choice in microsurgery is a monofilament suture material such as polypropylene or polydioxanone. These materials are bacteriostatic and noninflammatory, hold a knot extremely well, and are easily removed. Monofilament materials are preferred as polyfilament threads are characterized by a high capillarity and wicking effect. In periodontal microsurgery the suture size ranges from 6-0 (diameter of a human hair) to 9-0 [1,2,11,12,17].

Periodontal Microsurgery

The three basic microsurgical principles comprises of precision tailoring, delicate tissue manipulation, and passive primary wound closure. The specific geometry of the suturing requirements includes:

1. Angle of entry and angle of exit: The needle should penetrate the tissue at a 90-degree angle, perpendicular to the tissue surface.

2. Bite size: Bite size should be between 1 and 1.5 times the tissue thickness.

3. Direction of passage: needle must exit the opposing side of the wound with a direction of passage perpendicular to the incision line.

4. Tension: Suturing should be accomplished with minimal tension.

5. Symmetry: The distance between the bite sizes on either side of the wound edge should be the symmetrical as should the distance between sutures.

6. Frequency: Smaller suture material and smaller bite size makes it necessary to place more microsutures at frequent intervals along the wound edge [1,9,17]

Microsurgical Indications In Periodontal Surgery

Ridge augmentation [2,17] Mucogingival surgeries [2,16-20] Flap surgeries [1,2,17] Visualisation of root surfaces and calculus removal [1,2] Implant surgery [2,17,21,22]



CONCLUSION

The advent of microsurgery in the field of Periodontology is a boon. The three basic philosophies, i.e. enhanced motor skills, minimal tissue trauma and primary wound closure are an important element of microsurgery. The triad in periodontal microsurgery includes illumination, magnification and increased precision. Microsurgery facilitates enhanced vision and ergonomics, thus resulting in better therapeutic outcome.

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CONFLICT OF INTEREST:

The authors declare that they have no conflict of interest.

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