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# Periodontal microsurgery: Magnification and beyond

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**Abstract**
**Background**: In clinical dentistry, new heights of precision have taken place with periodontal microsurgery. It enhances visual acuity, improves accessibility with better primary wound closure. Unlike macro surgical procedures, patient acceptance, post operative pain and esthetics were found to be better with the periodontal microsurgery. Microsurgery works on principles like, refinement of motor skills, minimal tissue trauma in order to achieve adequate wound healing. This paper emphasizes widely on the microsurgical concepts used in periodontics.

**Keywords:** Microsurgery, magnification, loupes, operating microscope

## Introduction
Periodontics has seen increasing refinement and consistency of procedures, requiring progressively more intricate surgical skills. Periodontal plastic surgery and dental implants demand clinical performance that challenges the technical skills of periodontists beyond the range of ordinary visual acuity [1]. Microsurgery is defined as surgery performed under magnification using surgical microscope. Periodontal microsurgery is a natural transition and extension of surgical principles and techniques by which exceedingly accurate preparation and delicate atraumatic handling of soft and hard tissues enhance primary wound closure through optical or video magnification [2].

## History
Microsurgery was first introduced after the development of a microscope for ophthalmic surgeries in the 19th century. Nylen (1924) [3] conducted the first surgical operation with a microscope in Sweden for the correction of otosclerotic deafness. In the 1950s, the first surgical microscope, OPMI 1 with an optional stereoscopic view, was developed and manufactured by the neurosurgeons, Jacobsen & Suarez (1960) and Donaghy & Yasargil (1967) [3]. Tibbetts & Shanelec (1993) [4, 5] introduced periodontal microsurgery at the annual meeting of the American academy of Periodontology. Leknius & Geissberger (1995); Friedman & Landesman (1997); Mora (1998) used the surgical microscope in the field of prosthetics. Carr (1992) demonstrated the use of microsurgery in endodontics [6].

## Microsurgical Concepts
The advancements of operating microscopes, development of much refined surgical instruments, and manufacturing of better quality suture materials have played a major role in establishing the microsurgical technique in various fields. Kim *et al*. (2001) [7] put forward the microsurgical triad comprising of three elements: magnification, illumination and instruments. The improvement of these elements is necessary so as to get greater accuracy while doing surgical interventions [7].

## Magnification
Visual perspicacity is the ability to perceive two closely lying objects separately and influenced by various anatomic and physiologic factors, like density of cells packed on the retina, electro physiologic process of the image on the retina and illumination of the area.

In periodontal practice, clinical procedures may be performed successfully using magnification improving precision and quality of work. Two basic magnification types commonly employed in dental microsurgery are; loupes and surgical microscopes [8].

**Loupes**

Magnification loupes are the most common magnification system used in the dentistry. It contains 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 [8].

Three types of commonly used loupes include a) simple b) compound c) prism loupes (Table 1).

**Table 1:** Classification of loupes with working principle

| Loupes | Working Principle |
|---|---|
| **Simple** | Simple loupes also known as single-element loupes consist of a pair of single, positive, side by side meniscus lenses. Such loupes tend to be primitive magnifiers, with limited capabalities. Each lens has two refracting surfaces, one through which the light enters and the other through which the light leaves.[162] |
| **Compound** | Compound loupe consists of multiple lenses with intervening air spaces, which allows adjustement of magnification, working distance, and depth of the field without excessive increase in size or weight. Compound loupes are commonly mounted in or on eyeglasses |
| **Prism** | Prism loupes are the most optically advanced type of loupe magnification presently available. These loupes actually contain Schidmt or roof 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.[161] |

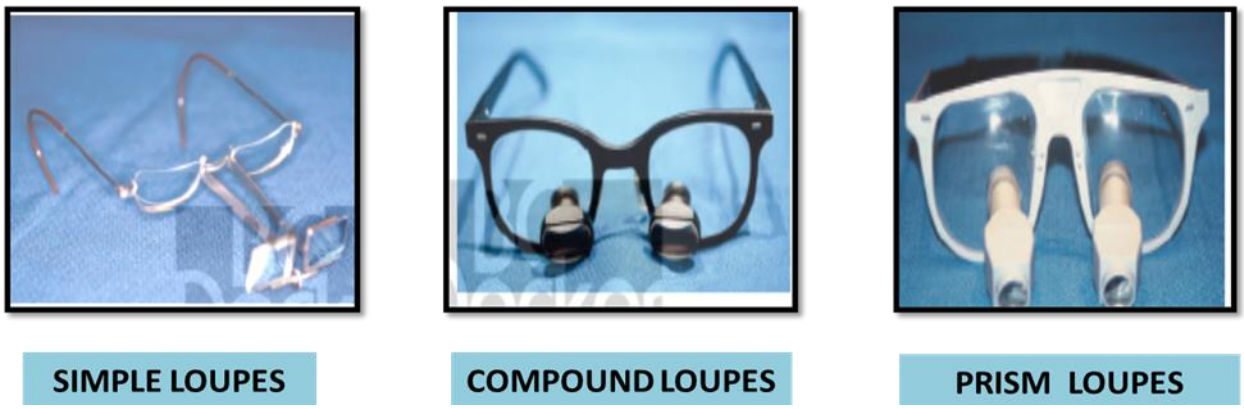


**Fig 1:** Classification of Loupes

**Operating Microscope**

Operating microscopes combine the magnification of loupes with a magnification changer and a binocular viewing system. The parallel binoculars protect against eye strain and fatigue. They incorporate fully coated optics and achromatic lenses with high resolution and high contrast stereoscopic vision. Operating microscope is designed on Galilean principles. For use in the various areas of the mouth, the microscope must have extrinsic horizontal and vertical maneuverability, whether it is mounted to a wall, ceiling or floor stand. Surgical microscopes use coaxial fiber-optic illumination. The microscope consists of the optical components, the lighting unit which produces adjustable, bright, uniformly illumination and the mounting system [8-9]. To avoid an unfavorable vibration of the microscope during use, the latter should be firmly attached to the wall, ceiling or floor stand. (Figure2).

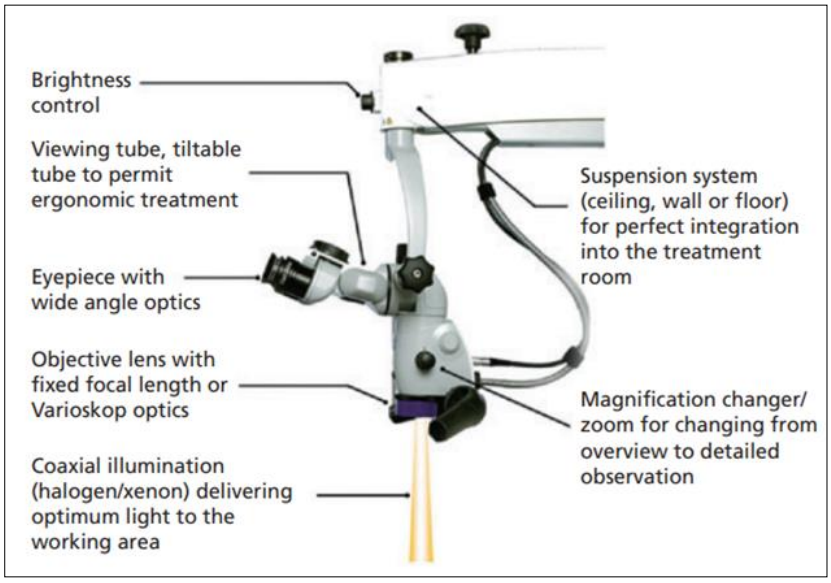


**Fig 2:** System Components of Operating Microscope

**Loupes vs. Operating Microscope**

Loupes are less expensive, easier to use, less cumbersome in the operating field and less likely to breach a clean operating field. Both the loupes and the operating microscope improve visual acuity and ergonomic comfort and efficiency by increasing the working distance (Figure 3). When dentists work at a distance of 13 inches or less to the patient without magnification or using an ill- fitted loupes, a multitude of eye, neck, shoulder and back problems increase in frequency. Its advantages include its versatility due to an extended range of variable magnification from 2.5 X to 20X and to excellent coaxial fiber-optic, shadow free-illumination wither better ergonomics [10].

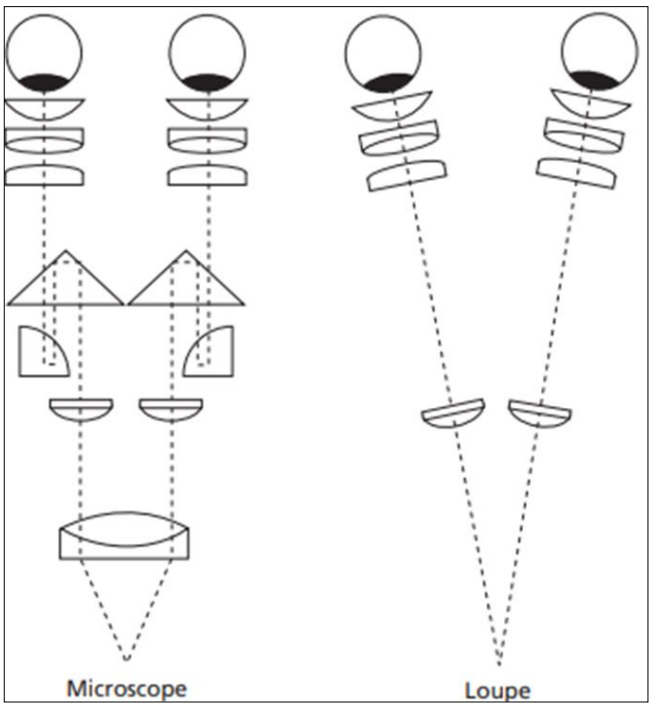


**Fig 3:** Vision enhancement by microscope and loupe

**Illumination**

Collateral lighting systems or suitable fixing options are helpful, particularly for higher magnification in the range of 4X and more. Certain essential considerations for selection of light source includes total weight, quality, and the brightness of the light, ease of focussing and directing the light within the field of view of the magnifiers and ease of transport between surgeries [8].

**Instruments**

Microsurgical instruments are made up of titanium and manufactured under magnification to high tolerances. They are resistant to distortion from repeated use and sterilization, are non-magnetized, and are lighter than surgical stainless steel instruments. It is approximately 18 cm long and lie on the saddle between the operator's thumb and the index finger [10]. (Figure 4).

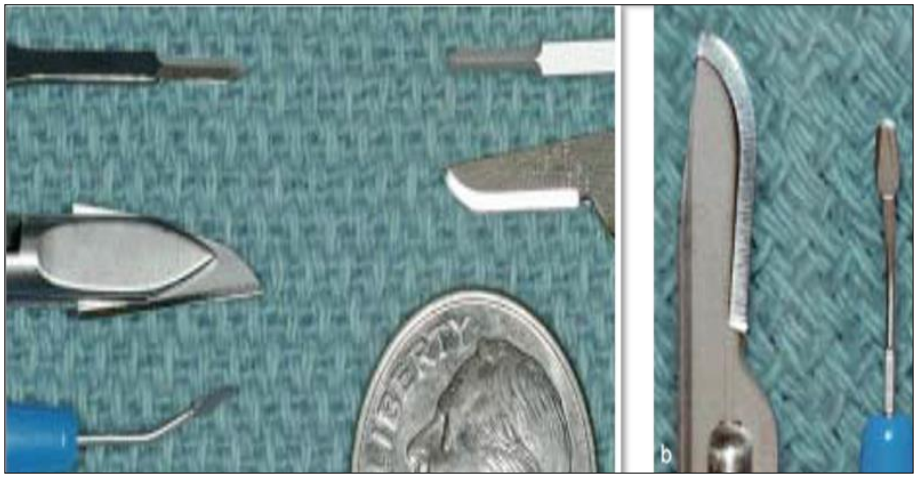


**Fig 4:** Microsurgical and Macro surgical blades

**Scalpel and Blades**

Another important characteristic of the microsurgical instruments is their ability to create incisions at 90° angles to the surface using a Castroviejo microsurgical scalpel. It prepares the wound for primary intention healing. Ophthalmic knives offer dual advantage of extreme sharpness and minimal size. They are chemically etched rather than ground, their sharper blades produces more precise wound edge. Following types of knife are used in periodontal microsurgeries:

**Blade breaker knife**: it has a handle on which a piece of an ophthalmic razor blade is affixed which is responsible for the infinite angulations of the blade. This knife is often used in place of a no. 15 blade [11].

**Crescent knife:** it 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 receipient site, or to obtain the donor graft [12].

**Spoon knife:** is an often used to determine the lateral sulcular region in preparation 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 the bone [13].

**Scissors**: such as the micro-vannas tissue scissors are used for removal of small fragments of tissue.

**Needle holder**

The needle holder should be equipped with a precise working lock that should not exceed a locking force of 50 g (0.5 N). High locking forces generate tremor, and low locking forces reduce feeling for movement. The presence of teeth in the tungsten carbide inserts provides the greatest deterrent or either twisting or rotating of the needle between the needle holder jaws. Smooth jaws without teeth cause no demonstrable damage to 6-0 monofilament nylon sutures, whereas needle holder jaws with teeth markedly reduces the suture breaking strength [12].

**Suture and Suture needle**

The accepted protocol for microsurgical procedure is to use the smallest diameter suture for holding the wound tissue together. For periodontal microsurgical procedures, sutures ranging in size from 6-0 to 9-0 are used. Smaller the suture material and needle passed through the tissue, less trauma will be resulted [11, 12].

Unlike normal suture needles (10mm), spatula needles are used in microsurgeries which are 6.6 mm long and have a curvature of 140°.They enable precise closure of the mending tissues in more detailed procedures. These are reverse cutting needles with micro precision tips. (Figure 5)

For papillary sutures in the posterior area, needle lengths of 13-15mm are used where as in the anterior region, needle length varies from 10-12 mm. For closing a buccal releasing incision, needle lengths of 5-8mm are adequate. To guarantee a perpendicular penetration through soft tissue without tearing, an asymptomatic curved needle is advantageous [12]. (Figure 5)

**Magnification in Periodontics**

Development of microscopic magnifying devices has enhanced the surgical precision multiple times. Shanelec and Tibbetts introduced microsurgery into the field of Periodontology to improve motor skills, thereby enhancing surgical ability, emphasis on passive wound closure with apposition to the wound edge and application of microsurgical instrumentation and suturing reduce tissue trauma [61]. It gives superlative results in the cases of class I and class II gingival recession. Moreover, these microsurgical techniques played a significant role in papillary reconstructions thereby enhancing the esthetics. Use of loupes and microscopes always provided enhancing vision and accuracy in sinus lift surgeries during implant placement [5].

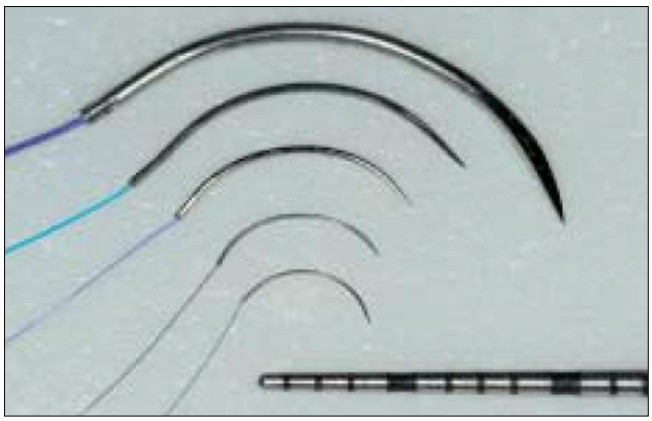

**Fig 5:** Surgical Needle And Suture: 4-0 Vicryl, 6-0 Polypropylene, 7-0 Pds-Ii,8-0 Nylon, 10-0 Nylon (Top To Bottom)

**Conclusion**

Periodontal microsurgery brings in the possibility for considerably less invasive surgical procedures, which can be characterized by reduced postoperative pain, better wound healing and superior esthetic outcome when compared to a macro surgical procedure.

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