Periodontal Microsurgery

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ABSTRACT

The purpose of this article is to introduce the history of microsurgery in the surgical disciplines. It reviews the benefits and potential applications of magnification and microsurgery in the specialty of periodontics. Esthetic procedures encompassing periodontal plastic microsurgery are described with an emphasis on clinical cases to demonstrate their application.

CLINICAL SIGNIFICANCE

The use of magnification, in particular the use of surgical operating microscopes, has increased in many areas of dentistry. This article demonstrates the usefulness of microscope-enhanced periodontal surgery and addresses many issues involved in its application to the surgical discipline of periodontics.

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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 history of microsurgery dates from 1922 when Nylen first performed eye surgery under a microscope.[1,2] By the 1960s microsurgery was standard in many specialties such as neurology and ophthalmology.[3,4] A factor in its acceptance was lessened morbidity associated with smaller wounds. Microsurgery has been practiced in endodontics since 1986.[5] It was introduced to the specialty of periodontics in 1992.[6]

MAGNIFICATION IN DENTISTRY

Loupes have long been used in dentistry, but it is only in the past decade that microscopes have been applied to clinical dentistry. It is now recognized that magnification has more to offer than corrective vision. Ergonomic benefits and improved clinical skills are well documented.[7–9] Why is the microscope not used routinely in dentistry? Those who use no magnification believe that normal vision is adequate to deal with clinical work. This is born of the ingrained certainty that the eye sees the world as it is. It is a perceptual bias deeply imprinted since childhood. Any challenge to visual reality is a fundamental challenge to the world as it is experienced and is not readily believable. Clinicians understand magnification, having been exposed to binoculars and cameras. However, the notion that improved hand skills derive from magnification has not yet been appreciated.

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ADVANTAGES OF THE MICROSCOPE IN PERIODONTICS

The surgical microscope allows high-level motor skills and accuracy in clinical care. This has been measured in many surgical disciplines but cannot be fully appreciated until a surgeon tries his or her hand under the microscope. At ×40 magnification, vascular microsurgeons routinely anastomose vessels with a diameter of < 1 mm.[10,11] At ×120 magnification, biologists perform subcellular operations on mitochondria and chromosomes. Periodontal microsurgery is commonly performed at ×10 to 20 magnification. With normal vision the highest possible visual resolution is 0.2 mm.[12] At this level of visual acuity, the greatest accuracy possible for the human hand movement is 1 mm.[13] Physiologic tremor can further reduce the accuracy of movement to 2 mm.[14] Under magnification of ×20, the accuracy of hand movement approaches 10 µ and visual resolution approaches 1 µ (Figure 1).[15] Proprioceptive guidance is of little value under the microscope.[16] Instead, visual guidance is used to accomplish mid-course correction of the hand to accomplish the finest movement with skill and dexterity.[17,18] This means incisions are accurately mapped, flaps are elevated with minimal damage, and the wound is closed precisely and without tension. For the patient this means that postoperative morbidity can potentially be substantially reduced (Figures 2–8).

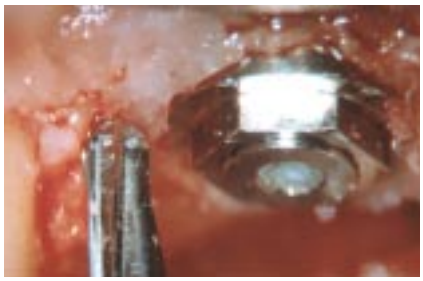

Figure 1. Microsurgical implant exposure with 557 bur.

Figure 2. Case 1. Miller Class I maxillary cuspid recession.

Figure 3. Case 1. Intrasulcular microincision using ophthalmic scalpel.

Figure 4. Case 1. Connective tissue graft positioned with the first stay suture.

Figure 5. Case 1. Connective tissue graft positioned with the second stay suture.

Figure 6. Case 1. Both stay sutures tied.

Figure 7. Case 1. Auxiliary microsutures to prevent micromovement of the graft.

Figure 8. Case 1. Postoperative healing at 2 weeks.

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 (Figures 9–11). 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 (Figure 12).

Periodontal surgery viewed under the microscope reveals the coarseness of most surgical manipulation.[19,20] What appears as gentle handling of tissues is discovered to be a gross crushing and tearing (Figure 13). 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 (Figures 14–16). 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.[6,21,22] Secondary wound healing is slower because new tissue formation is required to fill voids at the edge of the partially closed

Figure 9. Case 2. Miller Class I maxillary cuspid recession.

Figure 10. Case 2. Microsuturing.

Figure 11. Case 2. Postoperative healing at 2 weeks.

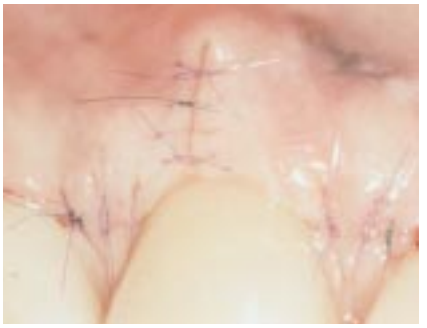

Figure 12. Example of the geometry of microsuturing.

Figure 13. Example of conventional surgery suturing later viewed under a microscope.

Figure 14. Case 3. Preoperative Miller Class I maxillary cuspid recession.

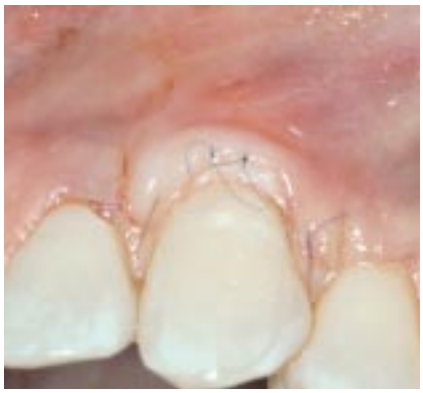

Figure 15. Case 3. Microsurgical closure.

Figure 16. Case 3. Postoperative healing at 2 weeks.

wound. Because surgical trauma is minimized during microsurgery, less cell damage and necrosis occurs. This means less inflammation and reduced pain (Figures 17–19).

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.

Periodontal Plastic Surgery

Plastic surgery is a clinical discipline in which surgical techniques are employed to reconstruct or repair bodily structures. These may be missing, defective, or damaged through injury or disease. Plastic surgery relies on mobilization of soft tissue flaps for advancement or retraction in combination with the addition or removal of tissue beneath the flap. Such techniques are capable of molding tissues to restore a lost part or improve function and esthetic appearance. The application of plastic surgical principles to periodontal tissues comprises the field of periodontal plastic surgery. Periodontal plastic surgery, with its emphasis on esthetics, is an important aspect of periodontal practice.[23,24]

Types of Periodontal Plastic Microsurgery. There are two basic periodontal procedures in which periodontal plastic microsurgery may be applied: those relative to

Figure 17. Case 4. Miller Class I mandibular cuspid recession.

Figure 18. Case 4. Microsurgery with intrasulcular incisions.

Figure 19. Case 4. Postoperative view at 1 week with microsutures in place.

the level of the dentogingival junction and those relative to the edentulous ridge. With regard to the dentogingival junction, microsurgery can be employed to add gingival tissue where it is absent or to remove gingival tissue where it is excessive. Periodontal plastic microsurgery of the edentulous ridge most often involves the addition of bone and or soft tissue.

Correcting Gingival Recession. Periodontal plastic microsurgical reconstruction of gingival tissue over denuded roots can be routine and predictable using subepithelial connective tissue grafting. The color match and esthetic appearance of such grafts is greatly improved over the original free gingival graft technique. When carefully closed, palatal donor sites can heal by primary intention without a painful period of open granulation. This greatly reduces postoperative morbidity.

Establishing an Esthetic Smile Line. An abnormal smile line may result from a number of causes, including gingival recession, abnormal eruptive patterns, incisal wear, and excessive tissue growth of various etiologies. The creation of an ideal esthetic smile with harmonious gingival contours involves many factors. Foremost among these are symmetry, lip position, and relative gingival levels of adjacent teeth. Complex periodontal plastic microsurgery involving removal of tissue on some teeth and replacement on others may be required.

Restoring the Edentulous Ridge. Ridge augmentation can involve a variety of techniques, including guided bone regeneration, block and particulate grafts, soft tissue grafts, and a combination of these. In addition to establishing adequate vertical height, sufficient soft tissue thickness must be created to provide an emergence profile for pontics or a dental implant prosthesis. Papilla reconstruction may be viewed conceptually as a microsurgical variation of ridge augmentation periodontal plastic microsurgery between two adjacent teeth (Figures 20–22).[25,26]

CONCLUSIONS

Periodontal microsurgery is in its infancy but will play a role in the future.[27,28] 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 peri-

Figure 20. Case 5. Papilla loss owing to periodontal surgical misadventure.

Figure 21. Case 5. Papilla reconstruction via a microsurgical procedure.

Figure 22. Case 5. Papilla reconstruction at 4 weeks postoperatively.

odontics. 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.

DISCLOSURE

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