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Application of microsurgery in periodontics.

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Abstract

Over the past several years, a therapeutic revolution has taken place in general surgery requiring the retraining of tens of thousands of surgeons and the retooling of their operating rooms. Microsurgery is not an independent discipline, but is a technique that can be applied to different surgical disciplines. Microsurgery is based on the fact that the human hand, by appropriate training is capable of performing finer movements than the naked eye is able to control.[2] It is an indispensable asset in medicine for many years and the recent application of its principle to periodontal surgery has been extremely valuable. Thus the aim of this article is to review Microsurgery application in Periodontics

Keywords: Microsurgery, Gingival Recession, Implant microsurgery, Crown Lengthening

Introduction

Over the past several years, a therapeutic revolution has taken place in general surgery requiring the retraining of tens of thousands of surgeons and the retooling of their operating rooms.[1] Microsurgery is not an independent discipline, but is a technique that can be applied to different surgical disciplines. Microsurgery is based on the fact that the human hand, by appropriate training is capable of performing finer movements than the naked eye is able to control.[2] It is an indispensable asset in medicine for many years and the recent application of its

principle to periodontal surgery has been extremely valuable.[3]

The development of microsurgery can be traced back to the invention of compound microscope by Zachariah Janssen in 1590. The advent of microscope influenced numerous field of modern medicine. In 1921 Nylen, who is considered Father of microsurgery, first used the monocular microscope in Clinical Otology. Subsequent techniques were developed for ophthalmology by Perritt in 1950 and for neurosurgery by Kurze in 1957.[4]

In 1993, Shanelec and Tibbetts presented a continuing education course on periodontal microsurgery at the annual meeting of American Academy of Periodontology James M. Belcher summarized the benefits and potential usages of the surgical microscope in periodontal therapy. Despite the positive results in prospective studies[21], the surgical microscope experiences a slow acceptance in prosthodontics, endodontics and periodontal surgery.[5]

In 1979, Microsurgery was broadly defined as, "Surgery performed under magnification provided by the microscope." In 1980, Serafin described microsurgery as a methodology – "A magnification & refinement of existing surgical techniques using magnification to improve visualization that had implications and applications to all specialties." The implication of this definition is that the reconstructive surgeons, either a physician or a dentist can use microsurgical techniques which have been proved to be superior to other methods.[6] Therefore, in a broader and more important sense, microsurgery implies an extension of those universally accepted surgical principles by which gentle handling of soft and hard tissue along with more accurate primary wound closure can be made possible through magnification, thereby making the surgical procedure well planned and well executed.[6,7,8]

In Periodontics today, microsurgery is at the same position it occupied in medicine in the recent past. Periodontal microsurgery shares attributes with medical microsurgery that will positively influence its professional acceptance. These include improved cosmetic results increased predictability, less pain and higher patient acceptance. On the other hand, factors such as insurance pressure and hospital peer review are irrelevant for periodontists.[8,9,10]

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. Microsurgery in Dentistry has benefited from the advances and application of microsurgical procedures and technology in Medicine. All surgical microscopes used in Medicine and Dentistry share the common characteristics of stereoscopic vision and coaxial lighting, which, together with the magnification, make it more convenient to perform clinical work since there is an increased range of vision. Furthermore, using an Operating Microscope means we are obliged to work in a correct position, leading to more increased physical comfort, and less tiredness, as well as avoiding the long-term problems with the spinal**.** 40× magnification, vascular micro surgeons routinely anastomose vessels with a diameter of < 1 mm. 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. 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 ×20, the accuracy of hand movement approaches 10 μ and visual resolution.

The microsurgical triad

The continuous development of operating microscopes, refinement of surgical instruments, production of improved suture materials and suitable training laboratories have played a decisive role for the world-wide establishment of microsurgical technique in many specialties.

Three elements

1) Magnification
2) Illumination
3) Instruments

are called the microsurgical triad (Kim et al 2001). The improvement of which is a prerequisite for improved accuracy in surgical intervention. Without any one of these, microsurgery is not possible.

Figure 1: the advantages of using a microscope in dentistry[29]

- Posture should be perfect, so as not to cause discomfort to the back and neck, protecting the spinal column from future problems.
- The microscope forces us to work at the same distance from the object at all times, avoiding tiring the eyes, as there is no need make constant adjustments.
- There is no need for the dentist to wear his or her prescription spectacles. If the eyes are different, all microscopic binoculars have corrective mechanisms to compensate for this.

Procedural

- Considerably improves manual abilities as the operating field is magnified.
- Lighting is magnificent, as it is always in the right place, without shadows.
- Collateral vision decreases, e.g. the area surrounding the visual field is dark as it is in the cinema, removing unnecessary visual information and improving sharpness of the vision.
- One can switch from one level of magnification to another (there are different scales ranging from 2x to 32x) very easily, without changing the position of the microscope.
- Recording operations means we can assess the techniques followed and detect procedural errors or problems.

Psychological

- Decreases occupational, physical and postural stresses.
- Increases personal and professional satisfaction when the improved quality of our surgical treatments is seen.
- Improves clinical results, with less post-operative discomfort to the patient.

Educational

- Makes it easy to gather clinical images and photographs, as a camera can be incorporated.
- Easier to make reports, whether these are reports made for referring to dentists, legal assessment reports

or damage valuation reports for insurance companies.

Makes it very much easier to record diagnostic sequences and treatment in video format (if the microscope has a built-in video camera) and shows a magnified image of the operating field on the monitor for the assistant or auxiliary worker. Allows this to be recorded on disc or tape.

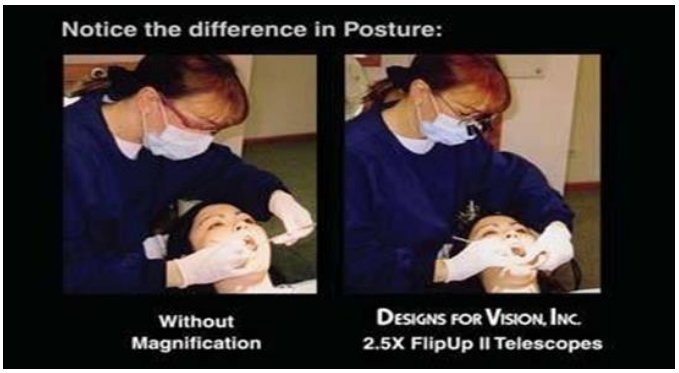

Figure 2 & 3: difference in posture

Figure 4: elbow support for doctor and assistant is mandatory to allow the necessary fine motor skills under constant magnification and muscular comfort throughout the day.

Benefits of microscopes in periodontics [8]

The surgical operating microscope, like all magnification, enhances visualacuity. This leads to:

1) Increased precision in delivery of surgical skills, which results in more accurate incisions via smaller instrumentation, less trauma, and quicker postoperative healing.

2) Precise repositioning of tissues with smaller needles and sutures.

3) Improved view of root surfaces, which permits more definitive removal of calculus and improved smoothness of root.

Microsurgery in periodontics

In recent years, periodontics has witnessed increasing refinement and consistency of procedures, requiring progressively more intricate surgical skills. Regenerative and respective osseous surgery, periodontal plastic surgery, and dental implants demand clinical performance that challenges the technical skills of periodontists beyond the range of ordinary visual acuity.

Periodontal microsurgery introduces the possibility for considerably less invasive surgical procedures in periodontics, exemplified by smaller, more precise surgical incisions for access and, consequently less need for vertical releasing incisions. Periodontists, like other micro surgeons, have been surprised by the extent to which reduced incision size is directly related to reduced post operative patient pain. mandibular dental canal).

Microsurgery in periodontics

The use of surgical prism loupes or the surgical microscopes has introduced the reality of considerable less invasive surgical incisions and flap reflection in periodontics, but the flap reflection must be adequate to the clinical situation. Schluger stated that the most common error committed in flap design was that the flap incision was too small. In periodontics, it is common to use dual or buccal and lingual flaps, which are often returned to postsurgical position different and secondary incisions in accordance with where it is perceived that the final flap placement will be to accommodate primary healing. from the preoperativeposition.

The key to successful periodontal flap surgery is the surgeon's ability to:

1) To diagnose the problems.

2) Plan the appropriate procedure.

3) Make the initial

4) A traumatically and gently reflect the flaps for passive procedural access.

5) Properly suture the flaps in the most advantageous position for the desiredresults and patient comfort. [3]

Imp1ortance of microsurgery in calculus removal

It is completely accepted in the literature that to treat Periodontal Disease, effective plaque and calculus removal from the root surface is a determining factor for the success of the treatment and the control of the disease. As a result, any new techniques or technologies such as microsurgery, spec- tacles, magnifying glasses, frontal cold light, etc. that make us able to see calculus more clearly during scaling and performing radicular isolation root planning maneuvers.[11]

figure 5: detection of subgingival calculus at 16x magnification

Lindhe and co-workers have suggested that a critical determinant of the success of periodontal therapy is the thoroughness of debridement of the root surface rather than the choice of grafting modality. Studies designed to evaluate the effectiveness of calculus removal after scaling and root planing, with and without surgical intervention, have noted that all calculus is seldom removed from the root surfaces.

Figure 6: preoperative view under normal vision.

Figure 7: post operative view under normal vision

Figure 8: post operative view after initial srp viewed at 16 magnification showing root surface irregularities

Microsurgery in treatment of gingival recession.

Jindal U et al[12] in (2015) compared the recession coverage outcomes when done macro surgically and micro surgically. Thirty Miller's Class I and II recession were treated using the subepithelial connective tissue graft from the palate. In 15 sites, the graft was placed at the recipient site with unaided eye (Group A) and in other 15 sites the graft was placed using surgical microscope (Group B). Clinical evaluation was done at baseline, 12 weeks and 24 weeks postoperatively using plaque index, gingival index, vertical recession (VR), probing depth, clinical attachment level (CAL), width of attached gingiva, papilla height (PH) and width, malalignment index (MI) and Esthetic appearance. Both the techniques demonstrated predictable mean root coverage (Group A 61.78% and Group B 67.58%) at 6 months post-surgery. CAL gain was slightly better in Group B patients when compared to Group A patients. A moderate positive correlation for Group A while a mild correlation in Group B was seen between the MI and VR.

Barbosa R A et al[13] in (2014) evaluated effect of smoking on the periodontal microsurgery technique on the treatment of gingival recession. At the end of the study, there were obtained an average percentage of 96.66% of root coverage on non-smokers and 82.49% on smokers (p=0.03). Complete root coverage was observed in 78.57% and 50% of patients, respectively. Therapy can benefit both groups, but smokers have less favourable outcomes to root coverage with periodontal micro surgeryusing the SCTG.

Treatment of Esthetic crown lengthening.

Riberio F V et al[14] in (2013) compare the clinical outcomes of open-flap (OF) and minimally-invasive flapless (FL) Esthetic crown lengthening (ECL) for the treatment of EGD. FL and OF surgeries produced stable and similar clinical results up to 12 months. FL ECL may be a predictable alternative approach for the treatment of EGD.

Augmentation of interdental papilla.

Norland W P, Sandhu H S[15] in (2008) described a microsurgical technique for augmentation of interdental papilla. One stage surgical procedure was done and normal tissue contour was obtained which was stable even after 3 years and 6 years of follow up.

Microsurgery in periodontal plastic surgery

Today's plastic periodontal surgery, evolving from mucogingival surgery, includes all surgical procedures performed to prevent or correct anatomic, developmental, traumatic or disease – induced defects of the gingiva, alveolar mucosa or bone (Proceedings of the World Workshop in Periodontics, 1996). Plastic surgery intervention with clearly defined landmarks for measurement, and thus well investigated in the literature, are the guided tissue regeneration procedure (Needleman et al 2006) and the coverage of buccal root recessions (Roccuzzo et al 2002; Oates et al 2003). While the former results in a reduction in probing depth, an improved attachment gain and less increase in gingival recession compared to open flap debridement, the latter yields a significant reduction in recession depth and also an improvement in clinical attachment level measures.[2] Plastic surgery is a clinical discipline in which surgical techniques are employed to reconstruct or repair bodily structure. They may be missing, defective or damaged through injury or disease. Plastic surgery relies on mobilization of flaps for advancement or retraction in combination with the addition or removal of tissue beneath the flap. Such techniques are capable of holding tissue to restore a lost part or improve function and aesthetic appearance. The application of plastic

surgical principles to periodontal tissue comprises the field of periodontal plastic surgery. Periodontal plastic surgery, with its emphasis on aesthetics, is an important aspect of periodontal practice .[8]

Types of periodontal plastic microsurgery

There are two basic periodontal procedure in which periodontal plastic microsurgery may be applied:

A) Those relative to the level of the dent gingival junction

B) Those relative to edentulous ridge.

Periodontal mucogingival or plastic surgery, by current meaning, now includes procedures to augment the dimensions of gingival tissue, to gain root coverage, to augment the edentulous ridge, to eliminate the aberrant frenulum, to prevent ridge collapse associated with tooth extraction in which unassisted wound healing would result in poor ridge morphology, to achieve lengthening of the clinical crown of tooth for restorative purposes and to restore aesthetically important interdental papillae that have been lost.

Figure 9: preoperative (a), graft placed (b), sutured graft (c), postoperative (d) view of connective tissue graft.

Figure 10: preoperative(a), sutured connective tissue graft (b), Postoperative(d) view of other typica microsurgical Ro

Microsurgery in treatment of intrabony defects.

Harrel S K[16] in (1998) used periodontally minimal invasive surgical technique for placement of bone grafts in periodontal defects. Thus, concluded that minimal invasive surgery provides better retention of graft material and maintenance of tissue height.

Harrel S K[17] in (1999) performed and observed a technique for periodontal bone grafting using a minimal invasive surgical approach. It was observed that periodontal regenerative surgery using minimal invasive surgical approach appears to produce similar results as regenerative surgery utilizing a traditional access incision.

Perumal MP et al[18] in (2015) compared the clinical outcomes of microsurgery with conventional open flap debridement in patients with chronic periodontitis. Thirteen chronic periodontitis patients were randomly assigned into test (microsurgical) and control (conventional) split mouth design. Clinical parameters were recorded at baseline, 3, 6 and 9 months. Thus it was observed that in open flap debridement procedure a microsurgical approach can substantially improve the early healing index and induce less postoperative pain compared with a conventional macroscopic approach.

Liu S et al[19] in (2016) conducted a meta-analysis of randomized clinical trials of patients with intra-bony defects to compare the clinical outcome of minimal invasive surgery with regenerative biomaterials or minimal invasive surgery alone. Thus the meta-analysis suggested no significant difference in treatment of intra-bony defects with minimal invasive surgery along with biomaterials and minimal invasive surgery.

In implant therapy

One of the novel applications of microsurgery is in the sinus lift procedure. The surgical microscope can aid in visualization of the sinus membrane. Magnification achieved by the surgical microscope is instrumental in implant site development and placement.

Minimal invasive surgery represents alternative approaches developed to allow less extensive manipulation of surrounding tissues than conventional procedures, while accomplishing the same objectives. A number of periodontal and implant reconstructive procedures can be performed using minimal invasive approaches.

Implant Microsurgery

Dennis Shanelec & L. S. Tibbets conducted a study of 100 implants placed over a 36-month period. 98 implants were approved for restoration at eight weeks and successfully restored. Two implants failed to integrate before restoration. These were removed and replaced, then provisionalized with bonded pontic Provisional's prior to restoration. The clinical success rate for implants placed using this protocol was 98 % based on the following parameters: absence of mobility, pain or sensitivity of the implant or surrounding tissues.[20]

Surgical Tooth Extraction

Microsurgery is a movement in medicine and dentistry toward minimal invasive alternatives to replace procedures that previously required extensive surgical incisions. Using a microscope for surgery greatly enhances visual acuity and improves surgical dexterity.[21]

According to Handtmann S et al (1985), Thomson PJ et al (1992) exodontia has been a traumatic procedure for centuries. Under a microscope, minimal invasive principles can be applied to tooth extraction. The aim of extraction microsurgery is to reduce trauma. Using a periotome luxator, a tooth root can be lifted vertically from the alveolar socket by carefully separating it from the surrounding ligament. This limits injury to the papilla and preserves natural gingival anatomy. The increased visibility provided under microscope allows a surgeon to detect subtle nuances in the direction of luxation which are not apparent through normal vision, thus avoiding damaging of the bone and gingival tissue.[22]

Implant Placement In Extraction Sockets

Belser, Buser and Higginbottom et al (2004) showed that microsurgery can be utilized with a high degree of Esthetically reproducible parameters. The stability of soft tissue esthetics around single tooth implants has been studied. Significant regeneration of mesial and distal papilla was shown after a follow period of 1.5 years.[23]

Besler U, Schmid B, Higginbottom F, Buser D et al (2004) on the other hand, soft tissue buccal recession of 0.6mm was also shown after one year. This has lead to a consensus that a provisional restoration with adequate emergence profile should be used to guide and shape the peri implant tissue prior to final restoration.[24]

Restoring the edentulous ridge: Ridge Augmentation

Since the 1980s, the free connective tissue graft, which is widely used for the augmentation of edentulous ridge defects, 10, 11 appears to heal faster and cause less postoperative volume shrinkage when micro surgically modified. Several invasions are often necessary with type-III ridge defects (as classified by Seibert) to yield sufficient tissue volume. Using microsurgical techniques, however, operative invasion can often be limited to a single surgery. With proper lighting and visualization of the operation area, mucosal flaps can be prepared in equal thickness under the OPM without the danger of a perforation at the flap basis or at the

mucogingival junction. This is particularly important with double-split mucosal flaps, which traditionally place the highest demands on the surgeon.[25]

Implant placement

Priest et al[26] in (2003) proposed an Esthetic analysis based on soft tissue gingival height around dental implants. Combined data from these studies comprised 190 implants and showed a 95.9% survival rate of 100 consecutive implants. Magnification afforded by the microscope increases the precision of placement and initial stability during implant microsurgery, the minimal invasiveness and reduced surgical trauma of micro surgically place dental implants may contribute to rapid healing, lessened morbidity and successful osseointegration.

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Marin cola Met al[27] in (2015) reported a case report on treatment and five year follow up of patient suffering from aggressive periodontitis using minimal invasive surgical technique and implant system. Thus this method made it possible to achieve the immediate aesthetic and functional restoration of maxillary incisors in a case that would have otherwise required bone augmentation and extensive mucogingival surgery. Thus this technique represents a conservative and efficacious alternative to aesthetic and functional replacement of teeth compromised due to aggressive periodontitis.

Discussion

As recent developments in medicine have shown, magnification and microsurgery can greatly impact clinical practices.[1] Over the past several years, a therapeutic revolution has taken place in general surgery requiring the retaining of tens of thousands of surgeons and the re-tooling of their operating rooms. This startling change has come about due to the acceptance of microscopic and endoscopic surgical therapy, particularly laparoscopic removal of gall bladder and arthroscopic repair of the knee. These procedures were a natural evolution of microsurgical advances that took place in the early 1970s and culminated in modern medical microsurgery.[2] Microsurgery today is applied to a variety of medical operations ranging from limbs replantation to coronary artery bypass procedures and in dentistry, the general dental practitioners consider microsurgery is suitable for all clinical procedures except orthodontics and prosthodontics.[2] In common usage, microsurgery refers to a refinement in surgical technique by which normal vision is enhanced through magnification. An important factor in recent public and professional acceptance of microsurgery is the significant decrease in morbidity. The reduced trauma and relative painlessness that microsurgery offers, is an appealing alternative to major surgery.[8] Patients may not fully understand the medical reasons for their therapy, but they are firmly grounded in a belief that medicine and technology should advance in their behalf. They expect sound advice and careful treatment and readily appreciate advances that give more predictable, more cosmetic and safer results, to say nothing of lessening their inconvenience, anxiety and discomfort.[28] There is every reason to believe that the public experts will welcome and eventually demand advancement in the technology and procedures available for treating periodontal diseases.

A case in point is the growth and acceptance of technical diagnostics, non- surgical mechanical therapies and pharmaceutical therapies in Periodontics.

Despite these advances in Periodontics over the past decade, much of the everyday practice of Periodontics still involves surgically treating periodontal anatomy altered by trauma or disease.[2] Aside from many potential promotional or marketing advantages, periodontal microsurgery offers an improvement in predictability, cosmetic results and patient comfort level over conventional periodontal surgical procedures.[8] This is especially true for regenerative procedures that apply materials and techniques that are difficult to use successfully and predictability within the confines of normal vision.

The specialty of microsurgery is not faced with a conceptual revolution in periodontal therapy but merely improving the accuracy and gentleness of what is already being done in everyday practice.[30] Every periodontal therapy can benefit from being done more carefully and gently, taking from simple scaling and root planning to regenerative and various cosmetic periodontal treatments. Secondly, a substantial number of Periodontists have already adopted the use of low magnification in their practices and recognized its value. What is lacking today among Periodontists is an understanding that the cognitive and motor skills currently used in their surgeries can be retained to function at much higher levels of accuracy than was ever imagined.[2]

In a fully developed microsurgical periodontal practice, perhaps 70-80% of typical periodontal microsurgical procedures could be performed with the surgical microscope at 10x-20x. The remainder of the procedure could be accomplished with loops under 6x-8x using enhanced motor skills learned and conditioned during microsurgery training sessions. Such enhanced motor skills operating on the outer borders of distinct visual acuity have been termed metascopic motor skills.[2]

Thus from since 1998 microsurgery in the field of Periodontology has seen a variety of application till date. These microsurgical techniques along with the minimal invasive surgical approach is applied for treatment of intrabony defects, root coverage procedures in case of gingival recession, Esthetic crown lengthening procedures, papilla reconstruction and also in the implant placement procedures. Thus the various Microsurgical approach in implant placement in anterior region by Shanelec D A in 2005 showed a success rate of 98%. Shanelec D A and Tibbetts L S in 2011 showed greater implant survival rate implant placement was done with a microsurgical approach using new SMILE technique. Thus this technique resulted in excellent esthetics as well as predictable success of dental implant osseointegration. Thus in spite of their significant cost, the relatively long learning curve associated with their use, frustrations during use, their occasional need for being. replaced and peculiar appearance to patients; procedures under magnification assist all types of clinical dentists in producing higher quality dentistry. Seeing better also means decreasing operating time. Microscopes also can improve posture during operating and reduce muscle pain in the shoulders, neck and back. Working under magnification is useful and clinicians should give strong consideration to adopting theconcept.[2]

Conclusion

The surgical operating microscope provides a microsurgical triad of illumination, magnification, and an environment in which surgical skills can be refined. Incorporation of smaller instrumentation, sutures, and needles into this environment should allow clinicians to increase the precision of their surgical skills. Important reason why microsurgery is likely to gain more rapid acceptance among periodontists is unrelated to improved outcome or lessened morbidity of the procedure. The

endpoint visual appearance of the typical microsurgical procedure is simply far superior to the end-point appearance of conventional surgery. Education through movement concentrates the mind and raises the neurobiology of learning to new levels of performance and new possibilities for achievement. As we progress into the twenty first century, such learning methods will come to occupy an increasingly important role in training periodontists for microsurgery as it moves into the mainstream of periodontal therapy. Although clinical studies are lacking and research is needed, the increase in visual acuity provided by the surgical operating microscope should enhance the delivery of surgical skills by a Periodontist.

Future directions

Periodontal microsurgery is still in its infancy but the scope for it in future is enormous. It is a skill that requires practice to achieve proficiency of the highest level in the area to which it is applied. The miniature world of microsurgery presents special challenges in dexterity and perception which when mastered increases the innovative methods of treatment for better results. Its execution is technique sensitive and is more demanding than the conventional periodontal procedures. As the benefits of the microscopes are realized, it will be applied more universally.

As public awareness of periodontal microsurgery increases, the conventional surgical approach with extensive incisions will become a less acceptable form of treatment. Microsurgery offers new knowledge and technology for periodontists that can dramatically improve the therapeutics results of many periodontal procedures like improved cosmetic results, rapid healing, and minimal discomfort and enhance patient acceptance. Dentistry of tomorrow will see increasing use of magnification in all areas of practice, including periodontics. Micro surgery will shift the focus of periodontal procedures from a macro to a micro field, thus achieving precise results with this technique seems a reality.

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