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REVIEW ARTICLE

MINIMALLY INVASIVE TECHNIQUES FOR REGENERATION THERAPY

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ABSTRACT

The main objective of periodontal therapy is to achieve complete regeneration of loss of tissue due to periodontal disease. There are various modality of treatment available for the regeneration of periodontal tissue. Minimal invasive techniques are the procedures allow less tissue trauma and better result. In this article various minimally invasive techniques for regeneration of periodontal tissue has been described.

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INTRODUCTION

Minimally invasive dentistry is a treatment approach to preserves as possible as healthy dentition and supporting structures. Minimally invasive procedure allows less extensive manipulation of surrounding periodontal tissues than conventional procedures. The ultimate goal of periodontal therapy is to regeneration of lost periodontal tissue due to periodontal diseases. Periodontal regeneration of infrabony defects has been achieved with barrier membranes, demineralized freeze dried bone allograft a combination of barrier membranes and grafts and enamel matrix derivative (EMD). Harrel and Rees (1995) proposed the minimally invasive periodontal surgery (MIPS) approach with the aim of producing minimal wounds, minimal flap reflection and gentle handling of the soft and hard tissues (Harrel, 1999). MIPS techniques allows for minimization of soft tissue trauma and the removal of granulation tissue from periodontal defects with the use of a smaller surgical incision than that used in traditional surgical techniques. Periodontal microsurgical techniques have been described by Tibbetts and Shanelec in 1998 and have primarily concentrated on soft tissue regeneration and augmentation procedures with the use of microsurgical instruments where as visualization is improved with the use of a surgical operating microscope or magnifying loop with the aim to produce minimal wounds, minimal flap reflection, and gentle handling of the soft and hard tissues in periodontal surgery (Tibbetts and Shanelec, 1998).

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Objectives of MIPS

- Reduce surgical trauma
- Increase flap/wound stability
- Allow stable primary closure of the wound
- Reduce surgical chair time
- Minimize patient discomfort and side effects.

Indication of MIPS

- Isolated infrabony defect
- Bony defects that borders on an edentulous area

Contraindication

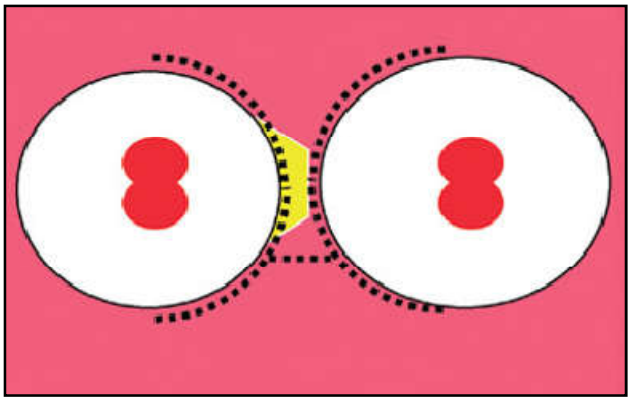
- Defect that extends to the buccal and/or lingual from the inter-proximal area.

MIPS vs. conventional periodontal surgery

MIPS is different from conventional therapy in many way including incision, instruments used for surgery, flap elevation, suture material and techniques.

Incision

The incisions for the MIPS are design to conserve as much of the soft tissue as possible. Incision is given intrasulcular on adjacent teeth where bony defect is present. Incision should be separated not continuous in the interproximal area. These incisions are connected with single horizontal incision which is placed 2-3 mm from crest of papilla (Fig. 1). In the area like maxillary incisors this horizontal incision is placed on palatal aspect of the papilla. In a non aesthetic area the horizontal incision can be placed either buccally or lingulally. This horizontal incision helps to preserve interproximal papilla and help to cover graft sites.



Tissue reflection / flap elevation

After the sharp dissection with the use of small Orban's knife, tissue is elevated with periosteal elevetor. Small Orban's knife is one third to one forth of their original size. Small Orban's knifes is easy to place between two intrasulcular incision. The papilla can be pulled to the buccal or lingual when the incision is made with small Orban's knife because of the stiffness of shaft. Sharp dissection helps to minimize tissue trauma and maintain blood supply to the tissue. In MIPS split thickness flap should be elevated so the periosteum left on the bone surface which helps in reflection of flap tension free and more coronally as well as less postsurgical bone loss and edema (Harrel, 1998).

Visualization

Visualization can be enhanced by the magnification and better light source during MIPS. Surgical microscope or magnifying loop is useful for magnification (Harrel, 1999). Disadvantage of surgical microscope is it is stationary and can't be moved easily during surgery. Surgical loop at least 3.5x is helpful to visualize the defect from different angle. Various light source also available for better visualization. High intensity halogen headlight mounted on a headband can be easily used. Fiber optic light probe also helpful, it can be placed directly in the defect.

Defect debridement

In MIPS surgical opening is less which limits the instrumentation for removal of granulation tissue and debridement of root surface. Traditional curettes cannot be used in MIPS because they required wider opening. For successful MIPS specialized instrument required i.e. surgical spoon curettes. This spoon shape instrument inserted vertically into the defect with shank held parallel to the long axis of the tooth. If the curettes used horizontal to the long axis of the tooth, the shank may traumatize the gingival flap. The remaining granulation tissue can be broken up with ultrasonic scaler. A mechanical granulation tissue removal instrument is used to remove the fragmented granulation tissue (Harrel *et al*., 1995). This instrument consist of a sharpened tube that is used as a curettes, a vacuum which pulls the fragmented granulation tissue into tube and a rotating bur which cuts the granulation tissue. The cut granulation tissue is removed from the operative field by the vacuum. The vacuum helps to keep surgical field from blood and enhance visualization. It is often necessary to repeat all of the granulation tissue removal steps several times to adequately debride and degranulate the defect. Debridement and smoothing of the root surface is accomplished with ultrasonic scaler and Grecy curettes in a manner similar to root planning.

Placement of graft material

Several regenerative protocols using various grafting materials and membrane could successfully be used with MIPS. Root surfaces conditioned with citric acid solution with the use of cotton pellet. After conditioning the root surface, bone graft material is placed in to bony defect with the use of modified amalgam gun. The compacted bone graft is covered by a small piece of bioresorbable membrane. In MIPS primary function of surgical mesh is to provide wound stabilization and to help retain the graft material (Schallhorn and McClain, 1988). The membrane should be laid over the bone graft using cotton pliers and the margin of the membrane is placed under buccal and lingual flaps.

Wound closer

In MIPS smaller diameter suture i.e. 4-0, 5-0 or 6-0 plain gut can be used for the wound closer. Smaller diameter will cause fewer traumas to the tissue. The vertical mattress suture should be placed away from the tip of the papilla. This suture will pull the buccal and lingual tissue together at the base of the papilla. The tips of the papilla are approximated with wet gauze and finger pressure. Cortellini and Tonetti described a modification of the minimally invasive surgical technique (modified minimally invasive surgical technique, M-MIST) (Cortellini and Tonetti, 2001). In The M-MIST buccal incision is given at the defect associated papilla, according to the principles of the papilla preservation techniques. Only a buccal flap was raised while the interdental papilla was left undisplaced.

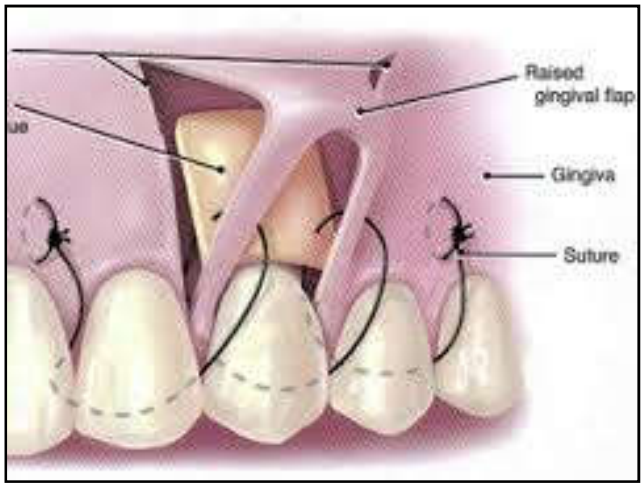
Minimally invasive technique for treatment of gingival recession

There various technique available for the management of gingival recession. Among that coronally advanced flap with connective tissue graft shows better results. For reduce patients morbidity there are various minimally invasive technique for management of gingival recession are follow:

1. The pouch and tunnel technique
2. Vista technique
3. Chao pinhole technique

The pouch and tunnel technique

In 1985 Raetzke, described a "Envelope technique" for single tooth recession[7]. Allen in 1994, in a modification of Raetzke's technique, described the "Tunnel or supraperiosteal envelope technique," for treatment of multiple adjacent gingival recessions (Allen, 1984). The use of tunnel procedure preserves the intermediate papilla and may accelerate the initial wound healing. The tunnelling also applies less traction and preserves the gingival height. Due to minimal trauma at the recipient site, the procedure may be of advantage in recessions as compared to the coronally repositioned flap. The limitations of this tunnel access technique include the technically challenging nature of intrasulcular tunnelling because of the need to obtain access through a small sulcular access point and the increased risk of traumatizing and perforating the sulcular tissues, yielding possible unfavourable healing outcomes.

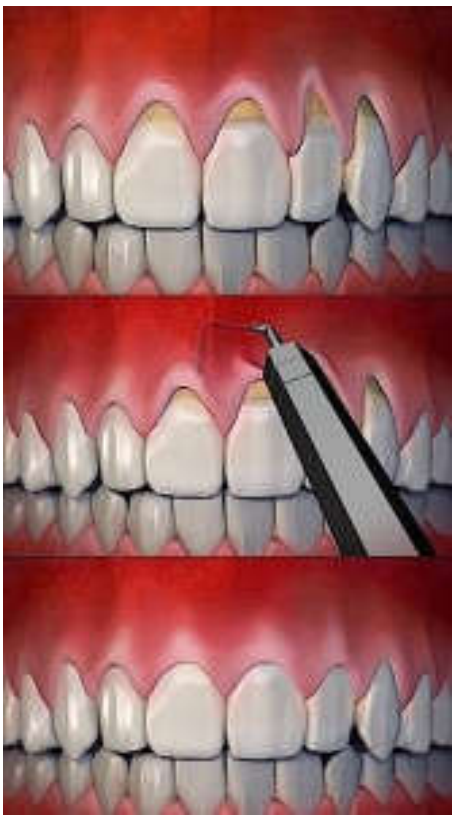


Vista technique

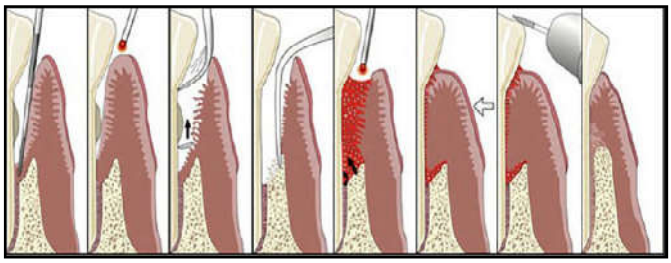
The vestibular incision subperiosteal tunnel access (VISTA) approach was introduced by Homayoun H. Zadeh in 2011 to avoid some of the complications of intrasulcular tunnelling techniques (Homayoun, 2011). This technique includes a single vestibular incision which provides access to an entire region. In this technique reflection of interdental papillae is avoided so the anatomical integrity of the interdental papillae is maintained. Placement of the vertical initial incision less likely disrupts the blood supply and a tunnel entrance within the maxillary fraenum results in healing without scar and better result. In this technique coronally anchored suture are given to minimizes micro motion of the gingival margin thus preventing scar formation. Other advantage of this technique is no requirement of secondary graft harvesting procedure.

Pinhole surgical technique

This technique introduced by Dr. John C. Chao. This is minimally invasive technique in which pinhole incision (2-3mm) in vestibule where the recession is present. After giving incision specially designed instrument (transmucosal papillae elevator) is used for evlevation and coronally extension (Fig. 3). The graft material is inserted through pinhole incision.



The advantage of pinhole surgical technique is smaller incision cause less trauma to the tissue, less postoperative pain, faster healing and better patient compliance. The limitation of this technique is special technical skill and special instruments are required. There are more chances of flap perforation because of the flap elevation is done from the inside of epithelium.



Laser

In recent year use of laser is increased in periodontal therapy. Laser Assisted New Attachment Procedure (LANAP) and photodynamic therapy along with scaling and root planning and periodontal surgery shows better result. LANAP is a minimally invasive surgical procedure. The steps of this LANAP protocol include (Fig 4) (Mizutani *et al*., 2000). A. Initial step of any periodontal therapy include scaling and root planning. Bone sounding is done under local anaesthesia to determine bony defect. B. Under local anaesthesia Nd:YAG laser is used at 100-150 µs pulse duration, 3.6–4.0 W average power and 20 Hz repetition rate optical fiber held parallel to

the pocket wall to remove the epithelium lining of the pocket without affecting the underlying connective tissue. C. Scaling and root planning is performed using ultrasonic scaler and hand scaler. D. The flap is further deepened to the alveolar bone by means of blunt dissection to modify the bone contour, obtain bleeding into the pocket and perform intramarrow penetration to release stem cells and growth factors from the cancellous bone and periodontal ligament. No granulation tissue is purposely removed during LANAP. E. The Nd:YAG laser is then used at a longer pulse duration (550–650 ls) to heat the blood in the pocket to obtain a sticky, thick fibrin clot. F. Extensive occlusal adjustment is then performed to eliminate any heavy, grabbing or depressive contacts and fremitus, and to allow for passive eruption. G. Anticipated healing.

Conclusion

The MIPS can be a choice of procedure in managing isolated infrabony defect and in gingival recession as it give better result and less patient morbidity compare to traditional surgical technique. It has limitation due to use of additional instruments, surgical skills and less evidences are present regarding the effectiveness of procedure compare to traditional technique.

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