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A Revolution In Periodontal Managementwith Minimally Invasive Periodontal Therapy

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ABSTRACT

Periodontal disease is a multifactorial inflammatory disease that occurs due to host bacterial interactions. This leads to destruction of the underlying periodontal structures including the alveolar bone ultimately leading to loss of teeth. Periodontal surgical procedures aim to eradicate this disease by increasing access to the defects and regenerating the periodontium. Conventional periodontal surgery can delay wound healing, increase patient discomfort and may increase postoperative discomfort. Hence minimally invasive procedures came into existence and are being increasingly researched open these days.

Keywords: incision, papilla preservation flap, minimally invasive surgical technique,lasers.

I.Introduction

Periodontal surgery targets access to the underlying bony defect, pocket elimination, periodontal regeneration, and maintenance of healthy periodontium. Traditional periodontal surgical procedures used extensive flap operation to access underlying disease area which causes bone exposure. Any surgical procedure should be easy to perform from operator's side, less time taking, should have less pain and postoperative discomfort, less costly and more acceptable, and beneficial to the general population. Advanced periodontics has an increasing need for clinical procedures that require intricate surgical skills. Microsurgery establishes a minimally invasive surgical technique to periodontics, exemplified by fewer vertical incisions and smaller surgical sites.[1] Every field using these techniques has recognized the extent to which reduced incision size and less retraction directly correlates with reduced postoperative morbidity and rapid healing.Surgical technique that uses smaller incisions to perform a surgical procedure that previously required larger incisions and achieves equal or superior results compared with the traditional surgical approach.[2]

II.History

Wickham and Fitzpatric (1990) introduced the concept of minimally invasive surgery.[3] Hunter and Sackier in 1993 defined minimally invasive surgery as a procedure to miniaturize our eyes and extend our hands to perform microscopic and macroscopic operations that could previously be reached only by large incisions.[4]Microsurgery was introduced in periodontics at 1992 and Carl Nylen is considered to be "The Father of Microsurgery".[5]Tibbetts and Shanelec (1994, 1998) first described periodontal microsurgical instruments and technique. [6]Harrel and Ress (1995) suggested Minimally InvasivePeriodontal surgery in order to

minimize wounds and flap reflection.[7] Cortellini and Tonetti(2007) coined the terminology "Minimally Invasive Surgical Technique" (MIST)[8] and the same authors in 2009 described the "Modified Minimally Invasive Surgical Technique (M-MIST)."[9]

III.Philosophy of MIST

The philosophy of MIST revolves around 3 basic points which are enhanced motor skills for better surgical performance-by improved visual acuity and precise hand grip, Minimal tissue trauma-smaller incisions and reduced surgical fieldsand Primary passive wound closure- by micro suturing to eliminate gaps and dead spaces.

IV.Indicationsand contraindications

It is mainly indicated for isolated, interproximal bone defect, not extending beyond the interproximal site. It can also be used for periodontal defects that border on an edentulous area or a defect that extends from buccal/lingual from interproximal site. Multiple separate defect sites within a single quadrant can also be treated by minimally invasive surgeries. It is contraindicated in cases of generalized horizontal bone defects and multiple interconnected vertical defects, walls.

V.Application of mist in periodontics

Th importance of MIST in periodontics is mainly due to its reduced morbidity, cleaner incisions, closer wound apposition, reduced hemorrhage, and reduced trauma at the surgical site. Periodontal surgery viewed under the microscope reveals the coarseness of most surgical manipulation**.**[10]On the hand**,** wound healing studies show anastomosis of microsurgical wounds within 48 hours**.**Because surgical trauma is minimized during MIST, less cell damage and necrosis occurs enhancing faster wound healing.[6]

VI. Features of minimally invasive periodontal surgery

The principal functions of minimally invasive periodontal surgery include the following:

Incisions

The incisions for Minimally Invasive Periodontal Surgery (MIPS) are designed to conserve as much of the soft tissue as possible. Incisions used for an interproximal defect in the maxillary anterior, must be firstly designed as intrasulcular incisions made on the teeth adjacent to the defect. These incisions should be made as separate incisions and should not be continuous across the interproximal tissue as in most other routine periodontal surgical procedures.By not making these incisions continuous, more of the interproximal papillary tissue and tissue height can be retained. The 2 intrasulcular incisions are connected with a single horizontal incision that is placed 2–3 mm from the crest of the papilla.

When the surgery is being performed in an esthetic area, such as the maxillary anterior, this horizontal incision will usually be placed on the palatal aspect of the papilla.This will help to preserve the shape of the papilla as well as cover the grafted site with soft tissue. In a nonesthetic area, the horizontal incision can be placed either buccally or lingually as needed to better cover the grafted site with soft tissue.

Flap elevation

The tissue is elevated utilizing sharp dissection only. This is achieved by means of Orban knives that have been reshaped to one third to one fourth of their original size. It will allow the blade to be placed into the previously made intrasulcular incision and, with the tip of the knife angled toward the center of the papilla, perform a thinning and undermining incision.

The stiffness of the shaft of the Orban knife allows the papilla to be pulled to the buccal or lingual while the thinning incision is made. When blunt dissection has been used to elevate MIPS flapsblanching of the reflected tissue has been noted which is adarkened bruised appearance of the flap at the time of closure.

When this bruised appearance is present, an increased incidence of postsurgical flattening of the papilla, interproximal cratering, and loss of soft tissue height is observed compared with when only sharp dissection has been used. Use of sharp dissection minimizes trauma to the flap and preserves much of the blood supply to the soft tissue. The lack of embarrassment of the blood supply to the flap is a probable reason for the improved soft tissue healing and the minimization of postoperative soft tissue changes that have been reported following the use of MIST.[2]

It is recommended to achieve the incisions for flap elevation in the form of “splitting,” so that the periosteum tissue is left on the bone surface. By leaving the periosteum in its original position, a coronally tension free reflection of the flap will be more possible, and moreover, less postsurgical bone loss and edema are to be expected.

Management of periodontal flap

By using these techniques, flap margins and closure can best be controlled by dissection of a uniform thickness periodontal flap that has a scalloped butt-joint margin. This facilitates precise adaptation of the tissue to the teeth or the opposing flap in an edentulous area. To handle the soft tissues efficiently, miniaturised instruments are being widely used. Therefore, avoids traumatizing the tissue by stretching, distorting, or tearing a flap.

Suturing

After precision tailoring and gentle tissue manipulation, the final and critical element of minimally invasive surgery is achieving proper wound closure by proper suturing methods.

VII.Minimally invasive surgical techniques

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The commonly performed periodontal surgical techniques following the MIST principals and protocols include the papilla preservation techniques, minimally invasive techniques and minimally invasive surgery using lasers.

Papilla preservation flap

Specific surgical approaches have been reported to prevent or reduce an excessive apical displacement of the gingival margin in the treatment of periodontal defects. **Takei *et al*. in 1985** proposed a new surgical approach called the papilla preservation technique.[11] Hence the interdental papilla is elevated intact with one of the flaps in total, without splitting the papilla.

The The lingual/palatal flap design consists of a sulcular incision along the lingual or palatal aspect of each tooth, with a semi-lunar incision across each interdental papilla. This incision dips apically from the line angles of the tooth so that the papillary incision line is at least 5 mm from the gingival margin.The interdental tissue is dissected from the lingual/palatal aspect so that it can be elevated intact with the facial flap.After treatment of the bony defect, the buccal flap, buccal aspect of the flap is designed with a sulcular incision around each tooth, with no incisions made through the interdental papilla. including the palatal/lingual aspect of the papilla, is repositioned. The palatal/lingual papilla is sutured with the palatal/lingual flap.

Modified papilla preservation flap

Cortellini*et al*., [1995] published a modification of Takei's technique as a new approach for interproximal regenerative procedures called the modified papilla preservation technique.[12] This technique is applicable **in wide interdental spaces (2 mm)**, especially in the anterior dentition.This technique allows for achieving primary closure of the tissue and preserving the papilla in 75% of cases.[12]

A horizontal incision is performed on the buccal papillary tissue at the base of the papilla. A full-thickness palatal flap, which includes the interdental papilla, is elevated. A buccal full-thickness flap is elevated with vertical releasing incisions and/or periosteal incisions, when needed.A barrier membrane is positioned to cover the defect. The interdental tissues are repositioned and sutured to completely cover the membrane.

Simplified papilla preservation flap

Initiated with an oblique incision across the defect-associated papilla, from the gingival margin at the buccal line angle of the involved tooth to the mid interproximal portion of the papilla under the contact point of the adjacent tooth.A full-thickness palatal flap, including the papilla, and a split-thickness buccal flap is then elevated.The interdental tissues are positioned and sutured to obtain primary closure of the interdental space.[13]

Whale's tail technique

In 2009, Bianchi and Bassetti described a new surgical technique – the "Whale's tail" technique, which was designed for the treatment of wide intrabony defects in the esthetic zone.This technique involved the elevation of a large flap from the buccal to the palatal side

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to facilitate access and visualization of the intrabony defect and it is especially created to perform regeneration while maintaining interdental tissue over grafting material.[14]In modifiedwhale's tail technique, two semilunar incisions below the mucogingival line on the buccal surface were used rather than using distinct horizontal and vertical incisions, which helped in better approximation of the flap margins.

Minimally invasive surgical technique

Cortellini and Tonetti proposed the minimally invasive surgical technique (MIST) in 2007.[8]In the MIST approach, the defect-associated interdental papilla is accessed either with the simplified papilla preservation flap (SPPF) in narrow interdental spaces or the modified papilla preservation technique (MPPT) in large interdental spaces.The suture technique is based on the application of a single modified internal mattress suture (the use of a 6-0 PTFE suture is suggested) to provide a primary intention closure of the interdental papilla. The primary intention seal can be improved by applying additional passing sutures (the use of 6-0 or 7-0 monofilaments is suggested), when needed.

Modified minimally invasive surgical technique (m-mist)

Cortellini and Tonetti[2009] proposed M-MIST. [9]The surgical approach consists of a tiny interdental access in which only buccal intrasulcular incisions are performed and connected with a buccal horizontal incision of the papilla performed as close as possible to the papilla tip.The residual bone crest is visualised through a tiny window created on the buccal aspect. The papillary tissues are left untouched, carefully preserving the supracrestal attachment apparatus to the root cementum of the crest-associated tooth. Access to the defect is gained through the tiny buccal "window." The soft tissue filling the defect is sharply dissected from the papillary supracrestal connective tissue and removed with mini-curettes.

Single-flap approach

It consists of a buccal envelope flap without vertical releasing incisions. It was proposed by **Trombelli in 2009.**[15]Sulcular incisions are performed following the gingival margin of the teeth included in the surgical area.The mesiodistal extension of the flap is kept limited while ensuring access for defect debridement and placement of any bone biomaterial or membrane.An oblique or horizontal, butt-joint incision is made after the profile of the underlying bone crest at the level of the interdental papilla overlying the intraosseous defect. Root and defect debridement are performed using hand and ultrasonic instruments.At wound closure, a horizontal internal mattress suture was placed between the buccal flap and the base of the attached oral papilla coronal to the mucogingival junction to ensure repositioning of the buccal flap. An additional internal mattress is placed between the most coronal portion of the flap and the oral papilla to enhance wound healing byprimary intention.

Videoscope-assisted mis (v-mis)

The original MIS approach that used surgical telescopes for visualization, a variation of this approach using the glass fibre endoscope for visualization, and the most recently described

technique of Videoscope-Assisted MIS (V-MIS). This is an MIS technique with each change in visualization technology, thereby allowing for smaller incisions and greater magnification. It was introduced by Harrel et al. in 2014.[16]Where possible, only a single lingual or palatal flap is raised.The videoscope can be placed directly into the lingual opening, which results in a clear view of the surgical site.The first incision is placed in the intrasulcular space from the line angle of each tooth extending into the interproximal area.The second incision should be a horizontal (mesio-distal) incision across the body of the papilla. The col should be preserved in place if at all possible. Split thickness dissection is performed to create the access flap by sharp dissection.A thorough debridement of the periodontal defect and adjacent tooth is necessary for optimal chances of regeneration.The debridement from the defect is performed using standard periodontal curettes. With V-MIS, when the mechanically debrided root surface is observed with the videoscope, there will often be "micro" islands of calculus remaining, which are not observable with telescopes or the surgical microscope.Calculus can be verydifficult to remove by mechanical means. The use of bio modification with either ethylene diamine tetra-acetic acid (EDTA) or citric acid will usually remove all of the remaining islands of calculus

Cortellini (2007, 2009) has reported that if the blood supply to the surgical site is well maintained, no regenerative materials are necessary with small incision surgery (MIST).[8,9]This is probably true when the lesion is relatively small and narrow and, therefore, supports the soft tissue. In most cases, the material used is either a 4-0 plain collagen or chromic suture. The suture is placed in this position so that tension can be placed on the suture without fear of damaging the papillary tissue in a manner that might cause postoperative recession. It is felt that this suturing technique that avoids trauma to the papillary tissue is one of the major reasons that no mean recession is reported following V-MIS/MIS.

Robot-assisted minimally invasive surgery

Robotically assisted MIS uses end effectors and manipulators of the robotic arms to perform the actual surgery on the patient.[17]These arms can either be controlled by a tele manipulator or through computer control.However, it is cumbersome to use, expensive, and needs expertise.

VII.Minimally invasive periodontal surgery using lasers:

Nonsurgical peri-implant therapy

Laser therapy has been introduced for the treatment of peri-implant disease. One concern with the use of lasers has been how a particular wavelength will affect the surface of the implant. A sampling of the literature illustrates the results of in vitro studies, namely: diode laser (at 809 and 980 nm) does not cause damage to the titanium surface. [18]Nd:YAG may or may not produce melting and erbium (Er:YAG and Er,Cr:YSGG) and CO2 lasers should be

used with low power parameters. Zirconia implants are increasing in popularity, and one study suggests that it is safe to irradiate the surface of implants made from zirconia only with diode lasers.

Minimally invasive flapless periodontal pocket surgery-Laser Assisted New Attachment Procedure (LANAP)

LANAP was developed by two dentists in California in the 1990s Gregg and Maccarthy, as an alternative to conventional periodontal surgery, especially for periodontally hopeless teeth. LANAP is a minimally invasive surgical procedure, as indicated in the systematic review of the American Academy of Periodontology Workshop by Kao et al. (2015) [19]and in a review by Aoki et al. (2015).[20]

Steps

After measurement of periodontal pocket using probe,laser radiation vaporizes bacteria, proteins, and diseased tissue, ultrasonic scalers and hand instruments ae used to remove root surface contaminants andthen Laser is used to for a gel-clot containing stem cells which allows reattachment of rete ridges to occur on clean rot surfaces, Occlusal corrections done and new attachment is regenerated.

Photobiomodulation (low-level laser therapy)

It delivers light energy (photons) to targeted tissue and produces specific, nonthermal and bio stimulative effects at the cellular level.Photobiomodulation(or low-level laser therapy) produces chemical and metabolic changes in tissue by light absorption without heat or temperature rise.Significant reductions of pocket depth and improvement in clinical attachment level and/or significantly greater improvement in plaque, gingival and bleeding indices have been reported with the adjunctive use of a photobiomodulation/ low-level laser therapy approach when compared with mechanical debridement alone.The photobiomodulation effect has also been shown to accelerate tissue repair and regeneration in nonsurgical therapy.[20]Reduction of operative and postoperative pain (analgesia), as well as a decrease in patient discomfort and mental stress.[21]

IX. Conclusion

As medicine and dentistry continue the pursuit of minimally invasive treatment, MIPT and its principles will emerge as the methodology to meet professional and public demand.The microscope provides a tremendous platform from which the microsurgical clinician can gather and observe detailed and precise amounts of information for the diagnosis and treatment of patients with skill and accuracy.Minimally invasive periodontal surgery leads to improved aesthetics, rapid healing, reduced morbidity, and enhanced patient acceptance.

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