

# ‘Periodontal Therapy Simplified’- with the Aid of Technical Advancements and Minimally Invasive Procedures

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**Abstract:-** The success of periodontal therapy depends on proper diagnosis and treatment. The treatment outcomes are mainly influenced by clinician skills and knowledge. Minimally invasive dentistry has become popular in almost all the specialities. The aim of minimally invasive periodontal therapy is to develop an approach which will allow less manipulation of surrounding tissues than conventional procedures, while accomplishing the same objectives. This approach can be applied to non surgical periodontal procedures as well. In the present article various non surgical treatment modalities like use of LASERS and PDT (photodynamic therapy) and surgical periodontal procedures like minimally invasive surgery (MIS), Minimally invasive surgical techniques (MIST), modified MIST (M-MIST) etc are described which will guide the clinicians in performing day to day periodontal procedures like full mouth debridement, mucogingival surgeries, or esthetic management, in a minimally invasive manner.

**Keywords:-** *minimally invasive, papilla preservation, lasers, non surgical.*

## I. INTRODUCTION

Minimalism in today's world has been implicated in most of the aspects of life. In 1970 Kelly Johnson an engineer coined the term K.I.S.S principle, an acronym for keep it simple stupid or keep it short and simple which implies, simplicity should be the key goal in design and unnecessary complexity should be avoided. With the invention of technical advancements, minimalism has made its way in to modern therapies and has led to turn away from conventional techniques. Minimally invasive surgery (MIS), was first introduced into the periodontics to focus mainly on treating multiple and isolated periodontal intra-bony defects in 1995 [1]. It can as well be applied to the esthetic zone because the anterior region poses therapeutic dilemmas like preserving the interproximal soft tissues which has to be considered in the selection of the proper surgical technique without compromising the main goal of periodontal surgery.

The first line of treatment in periodontal therapy is ultrasonic scaling which was introduced in 1955 by Zinner[2] and since then the site specific, slimmer tips has taken over the bulky universal tips. Later in 1989 the concept of LASER assisted new attachment procedure /LANAP was introduced. LANAP is a minimally invasive surgical procedure, as indicated in the systematic review of the American Academy of Periodontology (AAP) Workshop[3] and in a recent review[4]. Off late many combinations of LASER and photosensitizers were tried with different parameters giving varying results. Periodontal surgery has shifted from a philosophy based on resection to one of regeneration of lost tissues since past 3 decades. The surgical techniques which includes small incisions as “Minimally Invasive Surgery” was described by Wickham and Fitzpatrick[5] and it was further refined by Hunter and Sackier[6] as “its capability to limit our eyes and expand our hands to carry out microscopic and macroscopic surgical procedures in places that could previously be reached only by large incisions”. Tibbetts and Shanelec[7] described periodontal microsurgical instruments and technique which further aided in performing less invasive procedures. In 1995, MIS for the removal of granulation tissue was introduced by Harrel and Ress[8], and in 2007, Cortellini and Tonetti proposed MIST and stressed more on primary wound closure by stabilizing the blood clot and thereby blending the concept of MIS and papilla preservation. Thereafter, it was further improvised by incorporating the concept of space provision for periodontal regeneration with the Modified Minimally Invasive Surgical Technique[9]. These procedures when performed using either high magnification surgical telescopes (loops) or a flexible fiber optic endoscope in a water filled environment, increases the surgical prognosis. Most MIST procedures are reported to have been performed using a surgical microscope[10].

In this review article we made an attempt to mention the minimally invasive procedures in non surgical periodontal therapy as well as surgical periodontal therapy and as per our knowledge this article is the first compilation

of various instruments, procedures and techniques used for a minimally invasive approach. Nonsurgical treatment is the keystone for a successful treatment of any patient with periodontal disease. Currently the below mentioned minimally invasive non surgical treatment modalities have to be considered as the first line of treatment options before proceeding with more invasive therapies.

➤ *MINST*

(Minimally Invasive Non Surgical Periodontal Therapy) has been introduced as a concept aiming to obtain extensive subgingival debridement with minimal tissue trauma. A retrospective analysis which was carried out in 35 consecutive intrabony defects treated by MINST in 23 non-smoking patients with radiographic intrabony component > 3 mm and the data available at baseline and 12 months after treatment, showed considerable clinical and radiographic improvements after MINST, this supported its efficacy for the treatment of intrabony defects in non-smokers [11].

➤ *The term 'FULL - MOUTH ULTRASONIC DEBRIDEMENT'*

(FMUD) is been described as the full-mouth non-surgical therapy treatment which is carried out using ultrasonic instruments along with a debridement [12]. Several studies [13,14] have compared this approach, comprising of full mouth traditional scaling and root planing (SRP) approach when compared to quadrant-wise scaling and root planing with local anaesthesia, over four visits. The treatment outcomes were similar in those cases, leading one author to conclude that, full mouth periodontal debridement may be assumed as a feasible approach to deal with severe chronic periodontitis cases [15].

It is very essential for the dentist to understand the different instruments used for specific procedures to achieve best results. It is always suggested that the hand instruments with edge retention properties be sharpened every 5 to 20 strokes to improve the efficiency during nonsurgical periodontal therapy [16]. Powered scalers are used which reduces operator fatigue and removes calculus more quickly.

➤ *Ultrasonic instruments with micro tips*

The Micro ultrasonics is a term coined in the early 1990s by the author Peggy Hawkins [17]. Micro ultrasonic instrumentation approximates the size of a periodontal probe with tips measuring 0.2–0.6 mm in diameter. These instruments combined with endoscopic debridement when used for supra and subgingival treatment can lessen the need for surgical intervention [18]. A study [19] done by Drago concluded that modified and thinned ultrasonic inserts, produced the greatest depth of instrument efficiency at 4.65 mm, compared to 3.13 mm for a standard ultrasonic insert and 3.45 mm for curettes. A study done comparing the efficacy of micro ultrasonics with traditional ultrasonics concluded bleeding on probing improved significantly with the slender tips [17]. Sugaya et al [20] demonstrated that grade two furcation involvement can be significantly improved by the ultrasonic furcation tips.

➤ *Periodontal Endoscope with Micro Ultrasonic Instruments*

Endoscopic periodontal debridement is a technology available for the treatment of periodontal diseases subgingivally, where minute details such as root fractures, perforations, resorption, biofilm, and calculus can be appreciated and addressed for complete removal. It has been studied, deposits of subgingival calculus have been shown to remain after conventional surgery [21]. Advent of periodontal endoscopy, has improved the ability to remove calculus with nonsurgical therapy as it shows up as gold, yellow or white due to the bright fiber-optic illumination [22]. Micro ultrasonic instruments combined with endoscopic debridement can be accomplished in a conservative, minimally invasive way.

➤ *De Granulator-*

Achieving complete removal of granulation tissue can increase the surgical time and requires adequate accessibility for efficient removal. A specialised equipment called de granulator is introduced to improve the debridement by curetting the site. It consists of a sharpened tube and a rotating bur. The tube pulls the fragmented granulation tissue and keeps the surgical field free of blood and the bur cuts the granulation tissue [23].

➤ *Antimicrobials in MINSPT-*

Various chemical irrigation like Povidone-iodine, dilute sodium hypochlorite and chlorhexidine gluconate have been used for pocket irrigation with root-debridement procedures. Locally applied antimicrobial systems comprising of minocycline, doxycycline, tetracycline, metronidazole and chlorhexidine will reduce the number of pathogenic organisms and also suppresses the formation of biofilms. Hanes & Purvis [24] in their meta analysis compared 19 studies and concluded that the use of sustained-release anti-infective agents has been shown to reduce clinical signs, similarly to that achieved by SRP alone. A statistically significant improvement in CAL was seen with adjunctive use of Atridox or the PerioChip combined with SRP [24] and Grossi et al [25] found improvements in clinical findings with the use of minocycline microspheres with a reduction of red complex bacteria in smokers with chronic periodontitis comparing with SRP alone.

➤ *LASERS in MINST-*

LASERS are employed as an adjunct or alternative to conventional mechanical instruments. Conventionally, the Nd:YAG laser, with its thin flexible fiber delivery, has been mainly employed for debridement of periodontal pocket. Qadri et al [26] clearly demonstrated that SRP in combination with water cooled Nd:YAG laser, significantly improved clinical signs and radiographic examination compared with SRP alone. Additionally interleukin-1beta and matrix metalloproteinase-8 levels in gingival crevice fluid were significantly reduced after 1 week. Eltas et al [27] reported similar results. Gomez et al [28] compared SRP with SRP plus Nd:YAG laser and reported that the levels of interleukin-1beta and tumor necrosis factor-alpha in gingival crevice fluid were significantly lower after SRP plus

Nd:YAG laser treatment than after SRP alone, but no significant improvement in clinical parameters. In a recent review paper incorporating a meta-analysis published in 2012, Sgolastra et al [29] reported that no superior results were seen between Er:YAG laser and SRP treatments in any of the clinical parameters investigated. Erbium lasers are capable of ablating subgingival calculus effectively without causing significant thermal damage on the root surface if proper irradiation conditions are observed.

➤ *LASER assisted new attachment procedure (LANAP)*

prospective study of 9 month clinical case series treated using LANAP protocol on eight patients saw a PPD reduction in 88% of sites (from 6.5mm to 2.1mm) and CAL (clinical attachment level) gain in 74% sites (7.4mm to 5.8mm) in pockets  $\geq 5$ mm [30].

➤ *LASER assisted comprehensive pocket therapy (LCPT) using erbium lasers*

Aoki et al [4,31] proposed this concept as an effective, minimally invasive, flapless therapeutic approach which reduces the necessity for subsequent conventional flap surgery. Several clinical trials were successful with this therapy which has shown bone regeneration in the vertical bone defects [4,32].

➤ *Photodynamic therapy (PDT)*

It is an effective and innovative microbicidal method which has better access to sites that are inaccessible like furcation areas and it also selectively acts on periodontal pathogens. Decrease in Tumor necrosis factor- $\alpha$  (TNF) and the ligand for receptor activator of NF- $\kappa$ B (RANKL) levels and clinical findings has resulted when PDT is used as a monotherapy in aggressive periodontitis compared with SRP [33].

➤ *Minimally Invasive Surgery*

MIS was the first technical proposal in periodontal surgery [34,35]. Many authors suggested performing MIS using bone graft covered with a bioresorbable Vicryl mesh to treat intrabony defects [35,36]. A study done by applying the features of MIS using EMD (emdogain) was evaluated for one and six years post operatively showed mean improvements in all clinical parameters [37].

➤ *Features of MIS*

- Incisions should be very small and split thickness
- In the area of bone loss the dissection should be sharp with no use of blunt dissection,
- Periosteum should be preserved in order to preserve blood supply to periodontal tissue,
- Soft tissue should be replaced at or coronal to the pre-surgical height, and the closure of the flap using minimal suturing.

A study done to assess the level of growth factors in sites treated with MIS concluded that higher growth factor (GF) levels were associated with sites treated with MIS which has an impact on improved soft-tissue parameters of the periodontal defects [38].

*MIST –*

Cortellini and Tonetti [34] proposed MIST blending the concept of MIS with the application of papilla preservation techniques and passive internal mattress suturing.

➤ *Surgical considerations of MIST in addition to features of MIS*

- In the esthetic zone, Papilla is preserved by giving horizontal incision palatally.
- The incisions given are sharp using small orbans knife and are not continuous in order to retain interproximal tissue and tissue height.
- Only the defect associated tooth is treated.
- If the defect is deep and cant be accessed the incision can be extended to the adjacent tooth.
- Vertical releasing incision is avoided but if there is excess tension, very short verticle releasing incision is given within attached gingiva.
- Passive internal mattress suture is advised for MIST.
- Use of magnifying loupes ,makes the procedure less invasive, shorter in time and less demanding. The healing process is faster due to wound stability maintained by minimally mobilized flaps, hence less postoperative morbidity

Ribeiro et al reported a drastic decline in the extent of root hypersensitivity, post surgical haematoma, edema, suppuration, flap dehiscence, presence of granulation tissue in sites treated with MIST [39].

➤ *Modified minimally invasive surgical technique (M-MIST)*

Proposed by Cortellini and Tonetti [9] has shown better results when used with EMD (enamel matrix derivative) in the treatment of deep isolated infrabony defects.

➤ *Surgical Technique of M-MIST*

- The idea is to Minimalise the access to the defect by not elevating palatal flap and only giving buccal intrasulcular incisions, connecting with a buccal horizontal incision of the papilla performed as close as possible to the papilla tip.
- The granulation tissue is carefully dissected through a small surgical window and separated from the underlying supra-crestal interdental fibres. Root instrumentation and application of the regenerative material should be done and single internal modified mattress suture is given to attain primary closure of the flaps.
- Results were better in the surgical technique performed with the aid of an operating microscope and microsurgical instruments.

Evian et al [40] stressed on preserving the interdental papilla and Takei et al (1985) introduced this concept in detail and named it as Papilla Preservation Flap (PPF) [41]. The technique of PPF and its modifications is mentioned below.

➤ **SURGICAL TECHNIQUES**

PPF	This method uses sulcular incisions around each tooth labially and lingually, preserving interdental papilla. Palatally a semilunar incision was given from the line angles of the tooth so that the papillary incision line is at least 5 mm from the gingival margin allowing the interdental tissues to be dissected from the lingual or palatal aspect such that it can be elevated intact with facial flap[41].
M-PPF	Primary intrasulcular incision (buccal and interproximal) is given involving the defect. A horizontal incision is given at the base of the papilla in the interdental space. It is connected with the primary incision and a full thickness buccal flap was elevated to the level of the buccal alveolar crest. An interproximal supracrestal connective tissue, coronal to the bone crest, is dissected and the papilla is elevated towards palatal aspect. The thickness of papilla is reduced and if coronal advancement is indicated, Vertical releasing incision can be placed in the interproximal spaces neighboring the defect[42].
S-PPF	An oblique incision is made across the defect associated papilla which continues intrasulcularly in the buccal aspect of the teeth neighbouring the defect and extended to partially dissect the papillae of the adjacent interdental spaces allowing the elevation of a buccal flap with 2-3 mm exposure of alveolar bone. Intrasulcular incisions are continued in the palatal aspects of the two teeth neighbouring the defect and extended into the interdental papilla of adjacent interdental spaces, following which a full thickness palatal flap including the interdental papilla is elevated[43].

Both the modifications of PPF, require a suturing technique which relieves tension from the flap, permits positioning the flap coronally and passively closes the interdental tissues, hence horizontal and/or vertical internal mattress sutures is indicated. It has specific clinical indications, whenever regenerative therapy is considered[44]. These techniques accompanied by microsurgical loupes and instruments will not only contribute to improved visual, tactile perception, a precise incision but also give a flawless outcome. Operating microscope and microsurgical instruments was used in a study involving 26 patients with one intrabony defect treated with papilla preservation flaps which resulted in improved clinical parameters like CAL, probing depth reduction and high ability to obtain and maintain primary closure of the interdental tissues over barrier membranes[45]. Single Flap Approach (SFA) is a less invasive surgical approach demonstrated by Prof. Leonardo Trombelli and colleagues[46,47]. The basic principle with this approach is limited elevation of mucoperiosteal flap to allow access to the defect from the buccal aspect only. A study done on deep intraosseous periodontal defects, accessed with the SFA or conventional papilla preservation techniques concluded that it can be effectively treated with combination of composite graft of

rhPDGF-BB (recombinant platelet derived growth factor) and beta tri calcium phosphate and it has also resulted in less compared to the use of traditional papilla preservation techniques[48]. Video scope assisted minimally invasive procedure are performed only for isolated defects and when Single palatal or lingual flap is preferred hence gingival recession with negative esthetic consequences can be avoided[49]. Incisions can be very small in the videoscope as it gives direct visualization with magnification upto 60x which is more than the telescopes and surgical microscopes.

**II. CONCLUSION**

Aforementioned treatment modalities can improve periodontal conditions if practiced skilfully with the help of advanced technical aids. A surgical management based on evidence and on clinical experience has been designed to plan a conservative approach to periodontal defects. Considering the width of interdental space if 2mm or less, SPPF is advantageous and if its more, MPPF technique gives better results. If the defect is 2 or 3 walled then M-MIST approach were the degranulation can be done from a small buccal window using amelogenins or other materials for regeneration is planned. Barrier membrane, fillers can be placed while PPF surgery is done. Minimally invasive surgery has proven its efficacy during the surgical procedure, as well as in the postoperative period. The use of magnifying loupes will make the visualisation very fine and hence get optimum outcome.

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