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MINIMAL INVASIVE SURGERY (MIS) WITH AND WITHOUT ADVANCED PLATELET-RICH FIBRIN (PRF) IN TREATMENT OF LOCALIZED PERIODONTITIS STAGE III GRADE B

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ABSTRACT

Objectives: The objective of this study was to evaluate and compare between minimal invasive surgical treatment (MIST) with and without platelet-rich fibrin (PRF) in patient with localized periodontitis stage III grade B. **Subjects and methods**: A total of twenty two patients were 10 females and 12 male in this study. The study was designed as Randomized, controlled, parallel, single- blinded clinical trial. The patients were divided into two groups using split mouth technique. The study protocol involved a screening appointment, initial phase therapy, surgical therapy, all patients followed up for 6 months. The defect-associated interdental papilla was surgically approached with modified papilla preservation technique MPPT Cortellini et al. 1995. **Results**: The results of the present study showed similar reductions in PPD at the deepest site in both groups after 6 months of follow-up (PPD, 3.18±1.12 mm in the MIS without PRF group and 3.23±0.61 mm in the M-MIST with PRF group), for CAL gain a higher mean value was recorded in the MIS with PRF group, with a mean 2.13±0.77, in comparison to 1.90±0.94 in control group (MIS without PRF), with no significant difference. **Conclusions**: The platelet-rich fibrin when combined with minimally invasive surgery, produces better outcomes compared to the open flap debridement alone.

KEYWORDS: Periodontitis; minimally invasive surgical procedures; Platelet-rich fibrin; periodontal surgery.

INTRODUCTION

The healthy periodontium provides the support necessary to maintain teeth in function. The four principal components: gingiva, periodontal ligament, cementum, and alveolar bone. Each of these periodontal components is distinct in its location, tissue architecture, biochemical composition, and chemical composition, but all of these components function together as a one unit [1].

Periodontal diseases are a group of the most common oral diseases since ages. Periodontitis is mostly a chronic disease of the periodontal tissue, caused by pathogenic bacterial strains present in the dental plaque that induce an inflammatory response of the alveolar bone and soft periodontal tissue. The inflammation cascade causes breakdown of periodontal soft and hard tissues and represents an important cause of tooth loss [2].

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Chronic periodontitis is most prevalent in adults, but it can also be observed in children; chronic periodontitis is associated and caused by accumulation of plaque and calculus; it generally has a slow to moderate rate of disease progression, but periods of more rapid destruction may also be observed. Increases in the rate of disease progression may be caused by the impact of local, systemic, environmental factors as predisposing factors that may influence the normal host-bacteria interaction. Local factors may influence plaque accumulation [3].

Prober diagnosis of periodontitis is based on multiple factors including clinical and radiographic parameters, all of which may not be required. In general, patients would have periodontitis when one or more sites had inflammation (bleeding on probing, BOP), radiographic bone loss, and increased probing depth (>3mm) or clinical attachment loss (CAL ≥ 1mm) [4].

The goal of periodontal therapy has always been to stop or eliminate the degeneration associated with progressive periodontal disease. In order to accomplish this goal, access to the periodontal defect for debridement has been a main integral part of surgical therapy [5].

Historically, periodontal surgery was used to treat patients with generalized disease and, because of this; the surgical approach technique was usually designed to treat multiple adjacent teeth. Conventional surgical techniques used extensive flap procedures to access diseased areas and treat the underlying bone damage [6].

The main concept of surgical approach for periodontal regeneration would be one that allowed access to the site to be regenerated without extending the surgical incision into adjacent healthy tissues. Surgical procedures in medicine have undergone radical changes in surgical access in the recent past [7].

Cortellini and Tonetti, with the minimally invasive surgical technique (MIST), stressed the aspects of wound and blood clot stability and primary wound closure for blood clot protection, further enforced with the modified minimally invasive surgical technique (M-MIST) that, additionally, incorporated also the concept of periodontal regeneration [8].

Periodontal regeneration is selected to obtain an improvement in the periodontal attachment and bone of a severely compromised tooth, reduction in pocket depth, and a minimal or no increase in gingival recession. Periodontal regeneration has been shown effective in the treatment of 1- 2- and 3-wall bony defects or combination of there, from very deep to very shallow, from very wide to very narrow [9].

Importance has been given to the use of platelet rich fibrin (PRF) for predictably obtaining periodontal regeneration. PRF is an intimate assembly of growth factors, cytokines, glycan and structural glycoprotein which are enmeshed within a slowly polymerized fibrin network; it has the potential to accelerate soft and hard tissue healing [10].

The primary objective of this research was to evaluate and compare between the clinical effectiveness of M-MIST with PRF and without PRF in terms of clinical, radiographic and patient centered outcomes.

SUBJECTS AND METHODS

Study design: The study designed as Randomized, controlled, parallel, single- blinded clinical trial. All clinical assessment were carried out by a single masked trained examiner within the study period. The trained examiner didn't perform surgery and was unaware of the treatment assignments.

The selected participants fulfilled the following criteria:

The inclusion criteria:

Patients were medically free according to Modified Cornell medical index health questionnaire (Kerr & Millard). Patient should have localized

periodontitis stage III grade B with pocket depth from ≥ 5mm; indicated for periodontal surgery and indicated for intraoral flaps. Patients' agreement to the surgical procedure and clinical trial, providing informed consent. Age ranged between 35-55 years old. The tooth root did not have any non-carious cervical lesions, good compliance with the plaque control instructions following initial therapy.

Exclusion criteria:

Patient with generalized advanced periodontal diseases; patient with previous surgery on the same site of the procedure. Patient with malignant lesions or undergoing radiotherapy, patient not consenting to the procedure or study, presence of smoking habit, pregnant & lactating women, taking medications known to interfere with periodontal wound healing.

Patient Grouping and Randomization

The patients were divided into two groups using split mouth technique. Both Groups were randomly allocated with the use of a computer- generated randomization.

Study protocol:

The study protocol involved a screening appointment, initial phase therapy, surgical therapy, all patients followed up for 6 months.

Phase I therapy and Pre-surgical Assessment and protocol:

Initial periodontal therapy Full- mouth supra-gingival and sub-gingival scaling and root planning were performed 1 month prior to surgery. Patients received oral hygiene instructions (roll technique) with a soft- bristled toothbrush. In addition demonstration the use of interdental floss was done.

Ethical consideration: Nature of the study was explained to patients; enrolled patients should sign a written consent form.

Sample size: A total sample size of 20 patients +10% to compensate for drop-out (22 total) will be sufficient to detect an effect size of 0.56 at a power of 0.8 and using a two-sided hypothesis test and a significance level 0.05 for data.

Surgical procedures:

I. Minimal Invasive Surgery without PRF

a- Local anesthesia (4% ARTINIBSA containing Articaine hydrochloride Epinephrine (adrenaline) 1: 100.000 injection) administrations.

b- The defect between interdental papilla surgically approached with modified papilla preservation technique (MPPT Cortellini et al).

c- These incisions were strictly intra-sulcular to preserve the entire height and width of the gingiva, and their mesio-distal extension was kept at minimum (ideally, within the mid-buccal area of the involved teeth) to allow the reflection of a triangular buccal flap to expose the coronal edge of the buccal bone crest.

d- Finally, the flap was replaced at the original position, Fig. (1).

e- Tension-free primary closure of the interdental papilla was attained by means of an internal vertical matrass suture using monofilament material (Seralon® 6/0; Serag Wiessner, Nail, Germany).

II. Minimal Invasive Surgery with PRF

PRF preparation

PRF was prepared in accordance with the protocol developed by Choukroun et al [11].

***Surgical procedure*:**

a- The defect between interdental papilla was surgically approached with modified papilla preservation technique (MPPT Cortellini et al).

b- These incisions were strictly intra-sulcular to preserve the entire height and width of the gingiva, and their mesio-distal extension was kept at minimum (Ideally, within the mid-buccal area of the involved teeth) to allow the reflection of a triangular buccal flap to expose the coronal edge of the buccal bone crest.

FIG. (1): MIS without PRF

FIG. (2): MIS with PRF

c- PRF was applied into the defect, and slightly condensed Attention was paid not to overfill the defect.

d- Finally, the flap was replaced at the original position. Tension-free primary closure of the interdental papilla was attained by means of an internal vertical matrass suture using monofilament material (Seralon® 6/0; Serag Wiessner, Nail, Germany), Fig. (2).

Assessment:

Clinical Assessment:

For healing of surgical sites:

Pocket depth (PD), clinical attachment loss (CAL) and anatomical papilla were recorded. They could be assessed by William graduated periodontal probe pre-surgically, 3 months & 6 month post- surgically. (*Caton, Cairo et al., Santamaria et al)* [12].

1. **Plaque index (PI):** According to ***Silness & Loe*****,** 4 readings were recorded for each surface of the teeth (buccal, lingual, mesial and distal) and it is given a score from 0-3 [13].
2. **Gingival index (GI):** to assess gingivail bleeding (BOP), was recorded by ***Loe*** after giving score from 0-3 for each surface of the four surfaces of the tooth then divided by four to give gingival index of each tooth [14].
3. **Probing pocket depth (PPD):** was measured from the gingival margin to the base of periodontal pocket to the nearest mm. Probing

depth was measured at 6 points: mesio-buccal, mid-buccal, disto-buccal, mesio-lingual, mid-lingual and disto-lingual ***(Caton).***

4. **Clinical attachment level (CAL):** was measured from the cement-enamel junction to the base of the pocket to the nearest mm where CAL= PD+RH ***(Glavind & Loe)*** [15].
5. **Anatomical papilla height**: was measured as the vertical distance between the horizontal line joining the CEJ point angle (CPA) of the two adjacent teeth and the tip of the papilla ***(Zucchelli)*** [16].

Radiographic Assessments:

Cone Beam computed tomography (CBCT): was used for radiographic assessment for bone level in two time intervals (pre-surgically and post-surgically after 6 months). **Bone level** determined by two horizontal line. CBCT scans were taken using CBCT machine (planmeca Promax) using field of view (FOV) (10 x 10 cm), voxel size (0.200 mm), 12 mA and 90 Kvp at 12 Seconds Exposure time; then the post-operative image was obtained with software on the computer.

RESULTS

I-Comparison between groups

The mean value of PPD (mm) in different observations in both groups is presented in Table (1) and Fig. (3-5)

Pre-operatively, in the mesial tooth, a higher mean value was recorded in the MIS with PRF group with a mean 4.12±1.49, in comparison to 3.19±0.95 in control group (MIS without PRF), with a significant difference (p=0.042). In the distal tooth**,** a higher mean value was recorded in MIS with PRF group (4.23±1.67), in comparison to control group (MIS without PRF) with a mean 3.67±1.35, with no significant difference (p=0.376).

At 3 months, in the mesial tooth, a higher mean value was recorded in the MIS with PRF group, with a mean 3.22±.66 , in comparison to 3.20±1.13 in control group (MIS without PRF), with no significant difference (p=0.252). In the distal tooth**,** a higher mean value was recorded in MIS without PRF group (2.79±1.03), in comparison to MIS with PRF group, with a mean 2.73±1.01, with no significant difference (p=0.865).

At 6 months, in the mesial tooth, a higher mean value was recorded in the MIS with PRF group, with a mean 3.23±0.61 , in comparison to 3.18±1.12 in control group (MIS without PRF),, with a significant difference (p=0.017). In the distal tooth, the same mean value was recorded in both groups (2.71±0.92).

II-Comparison within the same group

In control group, in the mesial tooth, the mean value decreased by time, with no significant difference between different observations (p=0.091). In the distal group, the mean value decreased by time, with no significant difference between different observations (p=0.08).

In MIS with PRF group, in the mesial tooth, the mean value decreased by time, with a significant difference between different observations (p=0.005). In the distal group, the mean value decreased within time, a significant difference between different observations (p=0.0066).

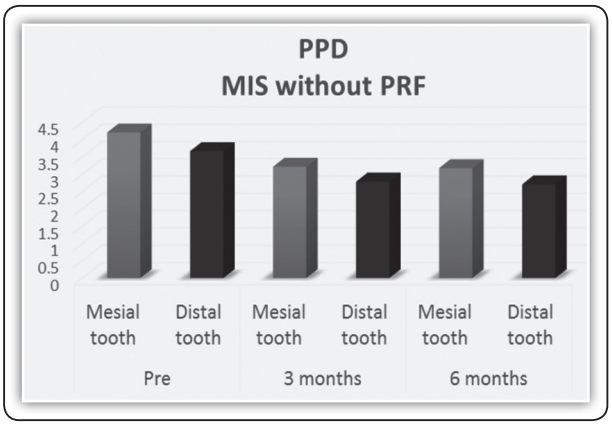

Fig. (3) Chart showing mean PPD (mm) in group I (MIS without PRF) in different observation times.

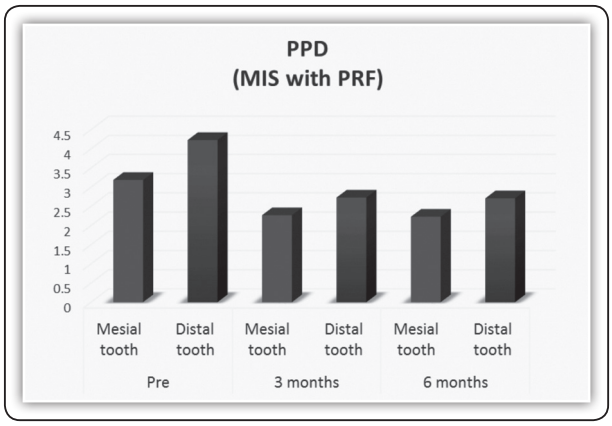

Fig. (4) Chart showing mean PPD (mm) in group II (MIS with PRF) in different observation times.

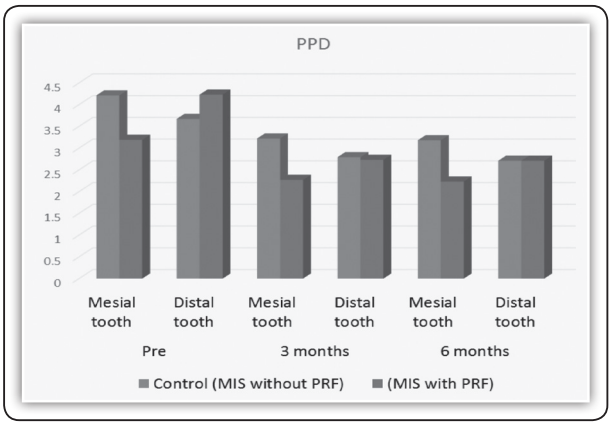

Fig. (5) Chart showing mean PPD (mm) in both groups in different observation times.

TABLE (1) Comparison of probing depth (PPD) (mm) within the same group (effect of time) and between groups at each observation

Groups	Value	Pre		3 months		6 months		P -value (Mesial tooth)	P -Value (Distal tooth)
		Mesial tooth	Distal tooth	Mesial tooth	Distal tooth	Mesial tooth	Distal tooth		
Control (MIS without PRF)	Mean	4.21	3.67	3.22	2.79	3.18	2.71	0.091ns	0.08 ns
	SD	1.49	1.35	1.13	1.03	1.12	0.93		
(MIS with PRF)	Mean	3.19	4.23	2.27	2.73	2.23	2.71	0.005*	0.0066*
	SD	0.95	1.67	0.66	1.01	0.61	0.92		
T		2.156	0.903	1.18	0.17	2.58	0	-------	
P		0.042*	0.376ns	0.252 ns	0.865 ns	0.017*	1ns		

*Significance level P≤0.05, *significant, ns=non-significant*

DISCUSSION

The main objective of this study to investigate the clinical effectiveness of M-MIST with PRF and M-MIST without PRF in terms of clinical, radiographic and patient centered outcomes.

A certain amount of heterogeneity can be found when the surgical procedures are analysed in detail. The term "minimally invasive" indicates very different procedures and has been used to describe both a single flap and a double flap. A slight difference among techniques used is also detectable when considering the mesiodistal extension of sulcular incisions performed [17].

However, based on a substantial homogeneity of the characteristics of the defects at baseline, results from systematic review on the effectiveness of MIPSs could be correlated with others from similar systematic reviews analysing the clinical

performance of a traditional periodontal surgery in the treatment of infrabony defects, both with or without the use of regenerative materials [18].

Differences in the clinical outcomes between MIPS and traditional surgery may be explained by the very high percentage of primary closure of the wound obtained with MIPS (Cortellini & Tonetti, Harrel et al), creating a safer environment for periodontal regeneration. In fact, space maintenance and clot stability are key factors in determining the success of regenerative therapy (Cortellini,). The precise management of the surgical site, obtained by the use of magnification instruments, could facilitate clot stability and maturation, good flap perfusion and space maintenance (Cortellini et al., Trombelli et al).

PRF had the property of promoting cellular migration through its fibrin scaffold, which is main advantage in wound healing. The leukocytes lockted in the PRF matrix are involved in the release of significant amounts of growth factors. The granules of platelets in PRF contain serotonin, von Willebrand factor, factor Vand osteonectin. Upon contact of platelets with the collagen of damaged blood vessels, degranulation and sequential release of cytokines take place, which further aid in hemostasis. Since it is autologous, PRF does not induce an inflammatory reaction at the site of delivery[19].

The results of the present study showed similar reductions in PPD at the deepest site in both groups after 6 months of follow-up (PPD, 3.18±1.12 mm in the MIS without PRF group and 3.23±0.61 mm in the M-MIST with PRF group). These results are in accordance with results of Mishra et al. who used a rhPDGF composed of 2 B subunits (rhPDGF-BB gel) with M-MIST (PPD, 3.8±0.9 in the M-MIST group and 4.2±0.6 in the M-MIST with rhPDGF-BB group), and slightly greater than those reported by Ribeiro et al. who applied EMD with MIST (PPD, 3.55±0.88 mm in the MIST group and 3.56±2.07 in the MIST with EMD group). Furthermore, a similar reduction in probing depth was reported by Cortellini and Tonetti, who compared an M-MIST alone group with an M-MIST and EMD group and an M-MIST with EMD and BMDX group (PPD, 4.4±1.6 mm in the M-MIST group, 4.4±1.2 mm in the M-MIST with EMD group, and 4.0±1.3 mm in the M-MIST with EMD and BMDX group).

A non-significant change in gingival margin position was observed in this study at 3 months and 6 months in both the test and control groups. The studies linked by Mishra et al. and Ribeiro et al. also showed a minimal increase in gingival recession. The remarkable stability of the marginal gingiva can be attributed to the unhampered blood supply to the papilla during the surgical treatment and the stability of blood clot inside the bony defect. It is very likely that both these factors act to prevent the collapse of the papilla into the intrabony defect.

Regarding radiographic changes (1.03±0.36 mm in the MIS with PRF group and .85±0.45 mm in the MIS without PRF group; in percentage a higher mean percent increase was recorded in the MIS with PRF group, with no statistically significant difference (p=0.739). Both groups in the present study demonstrated comparable improvements. Mishra et al. (LBG, 1.85±0.6 mm in the M-MIST group and 1.89±0.6 mm in the M-MIST with rhPDGF-BB group; %BF, 35.04%±10.99% in the M-MIST group and 36.02%±17.74% in the M-MIST with rh-PDGF-BB group) and Ribeiro et al. (CEJ-BD, 0.95 ± 0.72 mm in the MIST group and 1.52 ± 1.22 mm) in the MIST with EMD group) also reported similar results.

CONCLUSION

Minimally invasive surgery must considered a true reality in periodontal regeneration treatment. These clinical improvements are consistently associated with very limited morbidity to the patient during the surgical procedure as well as in the postoperative follow up. However, not indicated to all cases.

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