

Research Article

Comparing the Clinical Outcomes of Minimally Invasive Surgical Technique (MIST) with Papilla Preservation Flap (PPF) in Patients: A Quasi Experimental Trial

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ABSTRACT

Objective: This study aimed to compare the clinical outcomes of two different surgical techniques, papilla preservation flap (PPF) and minimal invasive surgical technique (MIST).

Methodology: This study was carried out from January 2024 to December 2024 in the department of Periodontology, Sardar Begum dental College & Hospital, Peshawar. The age range was 18-65years. A total of 72 patients having PPD more than 5mm with intrabony defect 3mm or more were selected. The patients were divided into two groups; Group A: Minimally invasive surgical technique(MIST) and Group B: Papilla preservation flap (PPF). The clinical outcomes were PPD, CAL, GR and GI. The data was analyzed through SPSS 22.0 version. Mann-Whitney *U* test was used for intergroup comparison and Friedman test was using for intragroup comparison. $p \leq 0.05$ was level of significance.

Results: 41.34 ± 16.75 years were the mean age. Female were dominant than males. A significant reduction was seen in PPD, CAL and GI. Gingival recession was greater in group A than group B. More pain was seen in group B than group A. Improved wound healing was seen in group A than group B.

Conclusion: The use of minimally invasive surgical technique (MIST) provides better clinical outcomes, less discomfort and early wound healing.

Keywords: Periodontal regeneration, intrabony defect, wound healing, pain

INTRODUCTION

Periodontitis is a chronic inflammatory disease that profoundly affects the supporting structures of the teeth leading to eventual decay and significant impairment of oral health and quality of life. The condition is mainly caused by an imbalance in the oral microbiome, resulting in the prevalence of harmful bacteria that provoke an inflammatory reaction, leading to increased tissue damage. The main cause of tooth loss worldwide is the periodontal disease, an inflammation of multifactorial origin. The aim of the periodontal therapy is to restore the lost structures, arrest infection and maintain healthy periodontium.¹ Clinically, periodontitis is manifested by the formation of periodontal pockets, loss of attachment and alveolar bone resorption, all contributing to tooth mobility and, if untreated, tooth loss. The periodontitis is a bacterial infection.² With an estimated 11.2% worldwide prevalence, periodontitis is one of the most prevalent conditions and a major contributor to the adult tooth loss.³ The periodontitis is now conceded as the unique

microbes colonizing in the subgingival biofilm on non-shedding regions of the oral cavity.⁴

It is the severity of periodontitis which dictate the treatment options which can be non-surgical followed by surgical intervention. The non-surgical is the initial and gold standard method of treatment.^{5,6} Aim of non-surgical periodontal therapy is to develop a healthy disease free periodontium having pocket depth of 3mm with no bleeding on probing. Periodontal surgery is essential in those cases which have residual and active periodontal pocket depth of more than 5mm despite good plaque control and compliance with regular supportive therapy. This condition may also be associated with intra-bony defect that cannot be resolved with non-surgical mode of therapy.⁷ Conventional flap, papilla preservation flap, microsurgery and new bioactive regenerative agents are the various surgical techniques used for residual and deep pockets.^{8,9} Open flap debridement involves reflection of full thickness flap including its papilla that reduces pocket depth at the expense of papilla loss and bone loss.⁸ Papilla

preservation flap on the other hand are used mostly in the aesthetic area as it preserves the papilla, helps in regeneration of periodontium hence improves clinical attachment gain papilla.¹⁰ New and improved methods of periodontal surgery includes loupes and microscopes that improves postoperative results with finer details of surgical field as well as the use of microsurgical instruments that allow operator to atraumatically and accurately manage soft and hard tissues of the periodontium. Recently, there has been a significant change in periodontal treatment due to the adoption of Minimally Invasive Surgical Techniques (MIST). MIST marks a noteworthy progress in periodontal surgery, concentrating on preserving tissue and reducing surgical damage.¹¹

Despite the availability of numerous surgical techniques, there is a lack of high quality experimental a trial that directly compares the effectiveness of two different surgical techniques, papilla preservation flap (PPF) and minimal invasive surgical technique (MIST) under standardized conditions. Most existing studies are limited by small sample sizes, heterogeneity in defect types, lack of long term follow up and inconsistent outcome measures. The gap in the literature underscores the need for well-designed comparative clinical trials to evaluate the efficacy and safety measures of these two different surgical modalities in managing periodontitis. The findings of this study are expected to provide robust clinical evidence on the comparative effectiveness these two techniques and will help periodontist in selecting the most appropriate surgical modality for their patients based on clinical indications and expected outcomes.

The aim of this study was to determine the clinical outcomes of two different surgical techniques, papilla preservation flap (PPF) and minimal invasive surgical technique(MIST) used for periodontal regeneration.

METHODOLOGY

A quasi experimental trial was carried out in the Department of Periodontology, Sardar Begum Dental College & Hospital, Peshawar from January 2024 to December 2024. The study was approved by ethical committee of the hospital. A total of 72 patients having probing pocket depth of 5mm or more with an intrabony component of 3mm or more using WHO formula for sample size were selected. The power of study was 80%, level of significance was 0.05 with equal allocation ratio (1:1) and expected periodontal pocket depth reduction was 2-3mm. Patients aged 18-65 years, residual periodontal pockets $\geq$

5mm after non-surgical therapy, bleeding on probing and radiographic evidence of intrabony defect were included in this study. Patients with poor oral hygiene, non-compliant with treatment procedure, systemic diseases, pregnancy, smoking or previous periodontal surgery were excluded in this study. The patients were divided into two groups; Group A: Minimal invasive surgical technique (MIST) and Group B: Papilla preservation flap (PPF). The primary outcome was changing in probing pocket depth (PPD). The secondary outcomes were changing in clinical attachment level (CAL), gingival recession (GR) and gingival bleeding. PPD, CAL, GR and GI were recorded at the baseline(before surgery) and and 9 months(after surgery) using UNC-15 graduated periodontal probe (Hu-Friedy, Chicago, USA). Additionally the visual analogue scale (VAS) and early wound-healing index (EHI) were assessed at 10 days postoperatively.

Surgical Procedure

Group A (MIST)

This group was treated with minimally invasive surgical technique. After administration of local anaesthesia containing lignocaine 2% with 1:00,000 epinephrine in the form of infiltration on buccal and palatal sides in maxilla and inferior dental nerve block in mandible. Interdental papilla width is measured at the base of defect associated papilla on buccal side. Depending on width of papilla, if its 2mm or more horizontal incision is given with no 15 surgical blade, if it's less than 2mm oblique incision is given at base of papilla. This is followed by intrasulcular incision on buccal or lingual side of each tooth adjacent to the defect. Using microsurgical periosteal elevator flap is elevated 2mm apical to the defect. Granulation tissue from intrabony defect is removed with micro and mini micro curettes followed by ultrasonic root surface instrumentation. Flap is sutured with 5-0 prolene single horizontal internal mattress suture at base of papilla. Procedure is performed under surgical loupes 3.5x.

Group B (PPF)

After giving local anesthesia, intrasulcular incision with help of no 15 surgical blade are given on buccal and palatal side of adjacent teeth have intrabony defect. This is followed by semilunar incision on palatal side of defect associated papilla 5mm from the tip of papilla. Periosteal elevator is used to reflect flap. Papilla is elevated with the buccal flap. Defect is degranulated with gracey curettes and root planed. Flap is reapproximated and sutured with double horizontal mattress suture on palatal side with 5-0 prolene.

In both groups patients were prescribed systemic antibiotics (amoxicilline) for 07 days, non-

steroidal anti-inflammatory medicine (Ibuprofen) for 03 days and patient was instructed to rinse with 0.2% Chlorhexadine gluconate mouthwash twice daily for 02 weeks. No mechanical cleaning or chewing at the surgical site till 2 weeks until sutures was removed. They are instructed to use mouthwash for another 1 week, followed by use of ultrasoft toothbrush for 6 weeks. Resume soft to medium toothbrush and chewing after 6 weeks. Patients were recalled at 3 months and 6 months to reinforce oral hygiene instruction.

The data was analyzed using SPSS 22.0 version. Friedman test was using for intragroup comparison while Mann-Whitney U/test was used for intergroup comparison. Level of significance was kept at $p \leq 0.05$.

RESULTS

The mean age presentation was 41.34 ± 16.75 years. Females were predominant in this study with 49(68.05%) than males 23(31.94%). Table

1 showed a statistically significant decrease in GI from baseline to 9months in MIST group. In MIST group PPD was 5.33 ± 0.36 mm at the baseline and after 09 months it decreases to 2.79 ± 0.36 mm. The decrease was statistically significant. CAL gain was significant from 4.28 ± 0.36 mm at the baseline to 2.74 ± 0.35 mm. GI was 63.77 ± 20.73 and after 09 months GI was 28.06 ± 11.91 . The GR after 09 months was 0.11 ± 0.30 in MIST group. In a control group the PPD significantly decreases from 4.93 ± 0.37 mm to 3.01 ± 0.36 mm. Though the decrease was statistically significant but a slight higher than the group A. In a group B (PPF) the decrease in CAL,GR and GI was also statistically significant. Table 3 showed statistically significant reduction was seen in VAS in MIST group (1.67 ± 0.67) than PPF group (4.35 ± 0.77) showing less operative pain in microsurgical technique. After comparison of wound healing, a significant better result was found in MIST group (1.45 ± 0.67) than PPF group (3.65 ± 0.77) as shown in table 4.

Table 1. Intragroup comparison of periodontal parameters at different time intervals.

Groups	Parameters	Baseline	09 months	P value	Mean Change (%)
MIST group	PPD(mm)	5.33 ± 0.36	2.79 ± 0.36	0.000*	47.65
	CAL(mm)	4.28 ± 0.36	2.74 ± 0.35	0.000*	35.98
	GR(mm)	0.00 ± 0.00	0.11 ± 0.30	0.000*	100.00
	GI	63.77 ± 20.73	28.06 ± 11.91	0.000*	55.99
PPF group	PPD(mm)	4.93 ± 0.37	3.01 ± 0.36	0.000*	38.94
	CAL(mm)	4.45 ± 0.36	3.20 ± 0.35	0.000*	28.08
	GR(mm)	0.00 ± 0.00	0.80 ± 0.30	0.000*	100.00
	GI	61.77 ± 20.73	30.06 ± 12.90	0.000*	51.34

PPD: periodontal pocketing depth, CAL: clinical attachment level, GR: Gingival recession, GI: gingival index *statistically significant, (Friedman test).

Table.2. Intergroup comparison of periodontal parameters at different time intervals.

Parameters	Time period	MIST group	PPF group	P value
PPD(mm)	Baseline	5.33 ± 0.36	4.93 ± 0.37	0.09
	09 months	2.79 ± 0.36	3.01 ± 0.36	0.05
CAL(mm)	Baseline	4.28 ± 0.36	4.45 ± 0.36	0.29
	09 months	2.74 ± 0.35	3.20 ± 0.35	0.02*
GR(mm)	Baseline	0.00 ± 0.00	0.00 ± 0.00	0.98
	09 months	0.11 ± 0.30	0.80 ± 0.30	0.01*
GI	Baseline	63.77 ± 20.73	61.77 ± 20.73	0.71
	09 months	28.06 ± 11.91	30.06 ± 12.90	0.24

*statistically significant(Mann-Whitney U test).

Table 3. Intergroup comparison of VAS score.

Parameter	MIST group	PPF group	P value
VAS	1.67 ± 0.67	4.35 ± 0.77	0.000*

*statistically significant(Mann-Whitney U test).

Table 4. Intergroup comparison of early wound healing index (EHI).

Parameter	MIST group	PPF group	P value
EHI	1.45 ± 0.67	3.65 ± 0.77	0.000*

*statistically significant(Mann-Whitney U test).

DISCUSSION

Periodontal regenerative procedures have evolved significantly over the last few decades, driven by the dual goals of optimizing clinical outcomes and minimizing patient morbidity. Among the most promising innovations are the the minimally invasive surgical technique (MIST) and papilla preservation flap (PPF). Both techniques aim to enhance the regenerative potential of periodontal therapy while reducing trauma to soft tissues and preserving esthetics. The present study compares the minimally invasive surgical technique (MIST) for periodontal regeneration to papilla preservation flap (PPF) in terms of clinical outcomes. A significant reduction in the PPD was seen in both groups though the improvement was greater in MIST group than PPF group. This study is consistent with the study done by Rathore et al¹². The reason could be that residual calculus can be seen in papilla preservation flap.¹³ Microsurgical results in better visualization and clinical outcomes. Rathore et al¹² also demonstrate that irrespective of the procedure a significant improvement was seen in GI which support this study. Perumal et al¹⁴ revealed that no significant difference was seen in the two groups which opposes this study.

In the present study a significant gain was seen in CAL in MIST group than PPF group. Although the a little bit GR was seen in both groups and it was greater in MIST group than PPF group. A statistically significant GR was seen in MIST group than PPF group which is similar to the study carried out by Rabbani et al¹³. The reason could be that magnified vision of surgical field may be related to more predictable outcomes. Becker et al and Kaldahl et al in their study demonstrated that a significant post-surgical recession was seen in those patients who underwent flap debridement, osseous surgery and root planning.^{15,16} A directly correlation was found between periodontal pocket and gingival recession, deeper the pocket results in more shrinkage of gingiva and may lead to greater gingival recession.¹⁶

This study revealed that a significant reduction pain (VAS score) and wound healing (EHI) was seen in MIST group than PPF group. This study is consistent with study done by Rathore et al¹¹. The reason could be that the use of microsurgical instruments and microsurgical sutures may lead to less discomfort and less post-operative pain.¹⁷ The use of microsurgery in periodontology do not change the treatment but it helps the periodontist to accurately and gently handle the tissues which may result in better clinical outcomes and patient satisfaction. This study

provides evidence about the most effective treatment in terms of clinical outcomes. The strengths of this study are the direct comparison of MIST and PPF which provides timely insights for clinicians making surgical decisions in regenerative periodontal therapy, standardized surgical protocol, multiple clinical outcomes, healing index, well matched defect morphology and inclusion of patient centered outcomes.

Despite the strengths, this study has some limitations. The primary limitation of this study is relatively short follow up period of 09 months which may not capture long term stability of clinical outcomes. The other limitations of this study are small sample size, single center and female predominancy. The broad age range could be another limitation. Variability in surgeon expertise is also the disadvantage of this study. The result couldn't be applied for those with systemic diseases. The lack of fixed position is the disadvantage of loupes surgery. Another limitation is the absence of radiograph or histologic evidence to confirm the regeneration. The findings of this study have important clinical implications for periodontal surgical practice. MIST, with its limited flap reflection, precision instrumentation and reduced post-operative morbidity is particularly suited for those intrabony defects where esthetic and patient comforts are priorities. The reduced gingival recession observed with MIST make it especially advantageous in those cases where esthetics are in high demand or in those patients where limited surgical trauma is needed i.e., medically compromised patients. Contrarily, PPF remains the valuable modality in managing interproximal defects particularly in anterior maxilla where preservation of papilla is necessary for esthetic success.

Future studies should involve larger sample size, multicenter trials, long-term follow up extending beyond 12-24 months, radiographic assessments, digital imaging cost-effectiveness and patient reported quality of life measures. Moreover, studies evaluating integration of biological agents (bone morphogenetic proteins, enamel matrix preservatives and platelet rich fibrin) with MIST or PPF which could provide better understandings of how surgical and regenerative materials synergize to enhance outcomes.

CONCLUSION

A statistically significant reduction in PPD was seen in both groups. The reduction was greater in MIST group than the PPF group. A slight increase in gingival recession was seen in PPF group than MIST group. Pain perception was less in MIST

group than PPF group. MIST group revealed better wound healing (EHI) than PPF group.

Recommendations

Clinicians are advised to perform thorough defect assessment and adopt case by case treatment planning approach taking into defect morphology, soft tissue biotype, esthetic demands and patient preferences.

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