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Comparative Evaluation of Microsurgical and Open Flap Debridement: A Clinical Study

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ABSTRACT

Background/Aims: Open flap debridement (OFD) is a well-established surgical procedure in periodontal therapy. The incorporation of microsurgical techniques has been proposed to enhance clinical outcomes and patient comfort. This study aimed to compare the clinical efficacy of conventional open flap debridement with microsurgical-assisted open flap debridement.

Materials and Methods: A total of 30 systemically healthy subjects diagnosed with chronic periodontitis were enrolled and randomly assigned into two groups: Group A (control) underwent conventional OFD, while Group B (test) received OFD with microsurgical techniques. Clinical parameters including probing pocket depth (PPD), clinical attachment level (CAL), gingival recession (GR), gingival bleeding index (GBI), wound healing index (WHI), and visual analog scale (VAS) for pain assessment were recorded at baseline and at 3 months postoperatively.

Results: Both groups showed clinical improvement from baseline to 3 months. Statistically significant differences were observed in PPD and CAL between the two groups, with the test group showing superior outcomes ($p = 0.048$). The WHI improved significantly in both groups; however, the test group demonstrated better initial healing with a mean WHI of 2.00 ± 0.00 at baseline and 1.00 ± 0.00 at 3 months, compared to the control group which showed 2.93 ± 0.258 at baseline and 1.00 ± 0.00 at 3 months ($p = 0.00$). Subjective pain perception measured through VAS was lower in the test group, indicating enhanced patient comfort.

Conclusion: Microsurgical-assisted OFD demonstrated improved clinical outcomes and better patient-reported healing compared to conventional OFD. These findings support the clinical advantages of incorporating microsurgical techniques in periodontal therapy.

Keywords: *Microsurgery, open flap debridement, chronic periodontitis, periodontal surgery.*

1. INTRODUCTION

Periodontal disease is a chronic inflammatory disease caused by complex interrelationships between infectious agents such as bacteria and host factors. The treatment of such periodontal diseases leads to the disruption of the biofilm with the removal of subgingival plaque and calculus which initially involves the use of non- surgical periodontal therapy.[1] Mechanical therapy not only helps in the resolution of inflammation, but also helps in reduction of bacterial load. However, the complete removal of bacterial toxins from the root surfaces in the deep periodontal pockets is not always achieved by non-surgical periodontal therapy because instrumentation is not possible in inaccessible areas such as furcation, grooves and concavities. But in some cases, periodontopathogens persist in the plaque biofilm on the tooth surface. These pathogens adhere and enter the epithelial cells and can be the sources for recolonization and reinfection. So, to overcome these limitations of the conventional therapy various innovative adjunctive treatments have been developed to improve the clinical effectiveness of the periodontal health.[2] The application of microscopes in dentistry has brought on a major evolution in dental practice. Microsurgery, is described by Serafin as a methodology – modification and refinement of existing surgical techniques using magnification to improve visualization, with application to all specialties.[3] With microsurgical approach dental practitioner can easily amplify visual acuity, better ergonomics, accurate repositioning of tissues and improve precision of surgical skill. The importance of root debridement is recognized universally as an essential component of periodontal therapy.[4] Residual calculus persists not only on teeth treated by scaling alone but also on teeth treated by flap surgery followed by scaling and root planing, so the application of magnification in periodontal Open Flap Debridement (OFD) can improve the clinical outcomes of the procedure.[5] Operating surgeon must have a relaxed state of mind, good body comfort and posture, a well-supported hand, and a stable instrument-holding position.[6] To accomplish precise controlled movements of fingers, the ulnar surface of the forearm and wrist should be supported by resting on a flat surface, angled in a dorsiflexion position at approximately 20° to reduce muscle tremor originating from both the unintentional and intentional actions of the body. The operating surgeon must be seated upright (back straight and head erect) with both feet flat on floor so that thighs are parallel to the floor.[7] The most commonly advocated precision grip for microsurgical procedures is the pen grip or internal precision grip which provides a greater stability in comparison to any other hand grip due to the tripod formed by the fingers, while the middle finger holds the instrument.[8] The purported advantages of Microsurgery versus scalpel surgery have been enumerated by numerous authors and include less discomfort to the back and neck of the clinician, less tiredness of eyes. As constant adjustment is avoided, less patient anxiety, increased personal and professional satisfaction, better visualization, the ability to negotiate curvatures and folds within tissue contours, decreased swelling, edema and scarring, decreased post operative pain, faster healing response and increased patient acceptance can be achieved.[9] Microsurgical periodontal therapy eliminates pockets with minimal recession or repositioning of the gingival margin.[10] There are various studies in literature, in which, microsurgical technique was used as an adjunct to periodontal flap surgeries. Therefore, this study is planned to find out the treatment outcomes of microsurgery in the treatment of chronic periodontitis as an adjunct to mechanical debridement in periodontal flap surgeries.[11]

2. MATERIALS AND METHODS

The study was carried out in the Department of Periodontology, Seema Dental College and Hospital, Rishikesh, Uttarakhand with the approval of the ethical committee. The subjects were selected from out- patient department and each patient was given detailed verbal and written description of the risk and benefit of the treatment with the consent to treatment agreement. Totally 30 subjects with the age criteria between 30-60 were randomly selected for the study.

Subjects Selection

Inclusion Criteria: A total of 30 chronic generalized periodontitis patients with similar horizontal bone loss and probing pocket depth (PPD) of ≥ 5mm were selected for the study.

Exclusion Criteria: Patients with any systemic disease or under antibiotics from past 6 months, smokers, pregnant or lactating mother and poor oral hygiene were excluded from the study.

Group A (15): **Control Group-** OFD

After giving Local Anesthesia (LA), crevicular incision with BP blade no. 15 was given from base of the pocket to the crest of the bone in the required surgical area, and then full thickness mucoperiosteal flap with the help of Molt #9 periosteal elevator was elevated. Granulation tissue was removed and root surfaces were scaled and planed with the help of Gracey Curettes. After proper irrigation with normal saline, the flaps were sutured with 3-0 black silk sutures and non- eugenol periodontal dressing (Coe-Pak) was placed.

Group B- **Test Group-** OFD with Microsurgery

Modified Flap Operation was performed using 3.5 optical magnification dental loupe. Crevicular/ sulcular incision was given under LA from base of the pocket to crest of the bone using microsurgical ophthalmic blades. Then full-thickness mucoperiosteal flap was elevated using microsurgical periosteal elevator. Granulation tissue adherent to the inner surface of flaps was removed with Gracey curettes. Remaining plaque and calculus were removed using hand instruments. The flap was sutured with 6-0 vicryl suture and non- eugenol periodontal dressing (Coe-Pak) was placed. Clinical parameters such as Probing Pocket Depth (PPD), Clinical Attachment Level (CAL), Gingival Bleeding Index (GBI), Gingival Recession (GR), Wound Healing Index, Visual Analog Scale (VAS) Scores were assessed at baseline and after 3 months.

Fig. 1. MICROSURGICAL LOUPE

Fig.2. 6-0 VICRYL SUTURE

Fig.3. ARMAMENTARIUM

Fig.4. BASELINE (PRE-OPERATIVE GROUP-A)

Fig.5. FLAP DEBRIDEMENT

Fig.6. AFTER 3 MONTHS

Fig. 7. CREVICULAR INCISION WITH OPTHTHALMIC KNIFE (GROUP B)

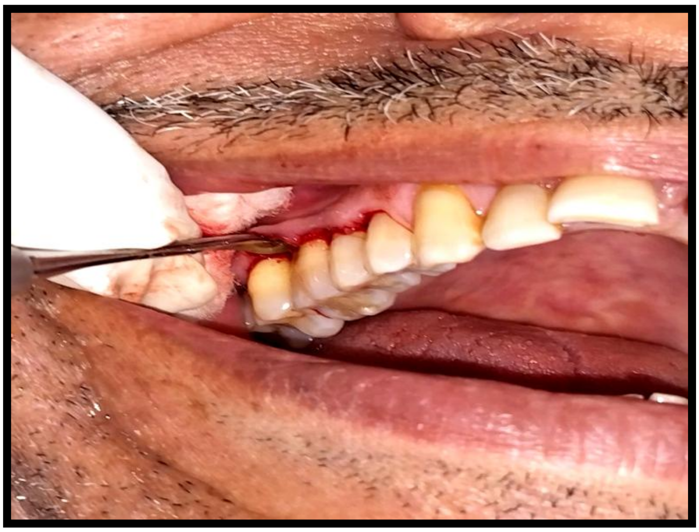


FIG. 8. FLAP DEBRIDEMENT (GROUP B)

FIG. 9. SUTURING WITH 6-0 VICRYL SUTURE (GROUP B)

3. RESULTS

On intragroup comparison the mean value of PPD in test group was 6.47 ± 0.516 at baseline and 3.00 ± 0.535 after 3 months. The difference was statistically significant (p-0.048) from baseline to 3 months. The PPD in control group was 6.13 ± 0.352 at baseline and 2.93 ± 0.704 after 3 months and the mean difference was statistically significant (p-0.015) [Table 1]. On intergroup comparison the mean difference of PPD in test and control group was 0.34 at baseline and 0.07 after 3 months which was statistically not significant (p-0.046) [Table 2, Graph 1]. On intragroup comparison the mean value of CAL in test group was 5.73 ± 1.033 at baseline and 3.00 ± 0.535 after 3 months. The difference was statistically significant (p-0.048) from baseline to 3 months. The CAL in control group was 5.33 ± 1.447 at baseline and 2.93 ± 0.704 after 3 months which was not statistically significant (p-0.869) [Table 3]. On intergroup comparison the mean difference of CAL in test and control group was 0.40 at baseline(p-0.34) and 0.07 after 3 months (p-0.18) which was not statistically significant [Table 4, Graph 2]. On intergroup comparison the mean difference of GR in test and control group was 0.00 at baseline and 0.00 after 3 months which was statistically significant [Table 5, Graph 3]. On intergroup comparison the mean difference of GBI in test and control group was 0.00 at baseline and 0.00 after 3 months which was statistically significant [Table 6]. On intragroup comparison the mean value of WHI in test group was 2.0± 0.00 at baseline and 1.00 ± 0.00 after 3 months and the mean value in control group was 2.93 ± 0.258 at baseline and 1.00 ± 0.00 after 3 months which was statistically significant (p-0.00) [Table 7]. On intergroup comparison the mean difference of WHI in test and control group was -0.93 at baseline and 0.00 after 3 months which was statistically significant (p-0.00) [Table 8, Graph 4]. A statistically significant reduction in the VAS scores was found for the test group (2.0± 0.926) as compared to the control group (4.93 ± 0.799), showing less postoperative pain for the microsurgical group [Table 9 & 10, Graph 5].

Table 1 – Intragroup comparison of PPD in test and control group in baseline and 3 months

Group		PPD baseline	PPD 3months	p- Value
Test	Mean ± Std. Deviation	6.47 ± 0.516	3.00 ± 0.535	**0.048***
Control	Mean ± Std. Deviation	6.13 ± 0.352	2.93 ± 0.704	**0.015***
Paired T- test. p- Value ≤ 0.05 – statistically significant				

Table 2 – Intergroup comparison of PPD in test and control group in baseline and 3 months

Group		PPD baseline	PPD 3months
Test	Mean ± Std. Deviation	6.47 ± 0.516	3.00 ± 0.535
Control	Mean ± Std. Deviation	6.13 ± 0.352	2.93 ± 0.704
p- Value		**0.046***	0.776
Independent T- test. p- Value ≤ 0.05 – statistically significant			

Table 3 – Intragroup comparison of CAL in test and control group in baseline and 3 months

Group		CAL baseline	CAL 3months	p- Value
Test (B)	Mean ± Std. Deviation	5.73 ± 1.033	3.00 ± 0.535	**0.048***
Control (A)	Mean ± Std. Deviation	5.33 ± 1.447	2.93 ± 0.704	0.869
Paired T- test. p- Value ≤ 0.05 – statistically significant				

Table 4 – Intergroup comparison of CAL in test and control group in baseline and 3 months

Group		CAL baseline	CAL 3months
Test (B)	Mean ± Std. Deviation	5.73 ± 1.033	3.00 ± 0.535
Control (A)	Mean ± Std. Deviation	5.33 ± 1.447	2.93 ± 0.704
p- Value		0.340	0.188
Independent T- test. p- Value ≤ 0.05 – statistically significant			

Table 5 – Intergroup comparison of Gingival recession in test and control group in baseline and 3 months

Group		G R baseline	G R 3months
Test	Mean	100	0
Control	Mean	100	0
p- Value		1.000	1.000
Mann – Whitney U test. p- Value ≤ 0.05 – statistically significant			

Table 6 – Intergroup comparison of Gingival bleeding index in test and control group in baseline and 3 months

Group		GBI baseline	GBI 3months
Test	Mean	100	0
Control	Mean	100	0
Z value		0.000	0.000
p- Value		1.000	1.000

Table 7 – Intragroup comparison of Wound Healing Index in test and control group in baseline and 3 months

Group		WHI 7 days	WHI 3 months	p- Value
Test	Mean ± Std. Deviation	2.0± 0.00	1.00 ± 0.00	-
Control	Mean ± Std. Deviation	2.93 ± 0.258	1.00 ± 0.00	**0.000***
Paired T- test. p- Value ≤ 0.05 – statistically significant				

Table 8 – Intergroup comparison of Wound Healing Index in test and control group in baseline and 3 months

Group		WHI 7 days	WHI 3 months
Test	Mean ± Std. Deviation	2.0± 0.00	1.00 ± 0.00
Control	Mean ± Std. Deviation	2.93 ± 0.258	1.00 ± 0.00
p- Value		**0.000***	-
Independent T- test. p- Value ≤ 0.05 – statistically significant			

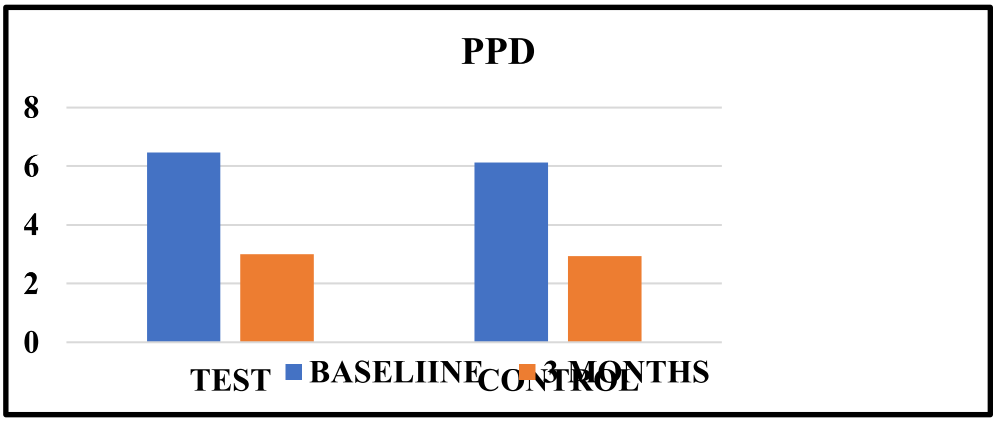
Table 9 – Intergroup comparison of Wound Healing Index in test and control group in baseline and 3 months

		VAS Score						p- Value
		1	2	3	4	5	6	
Group	Test	6	3	6	0	0	0	**0.000***
	Control	0	0	1	2	9	3	

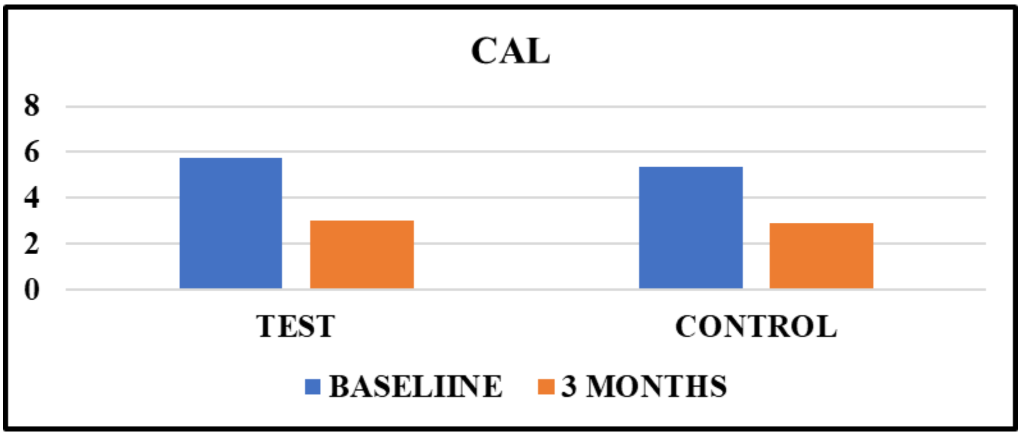
Table 10– Intergroup comparison of Wound Healing Index in test and control group in baseline and 3 months

Group	Test	Control	t value	p- Value
Mean ± Std. Deviation	2.0± 0.926	4.93 ± 0.799	- 9.291	**0.000***
Independent T- test. p- Value ≤ 0.05 – statistically significant				

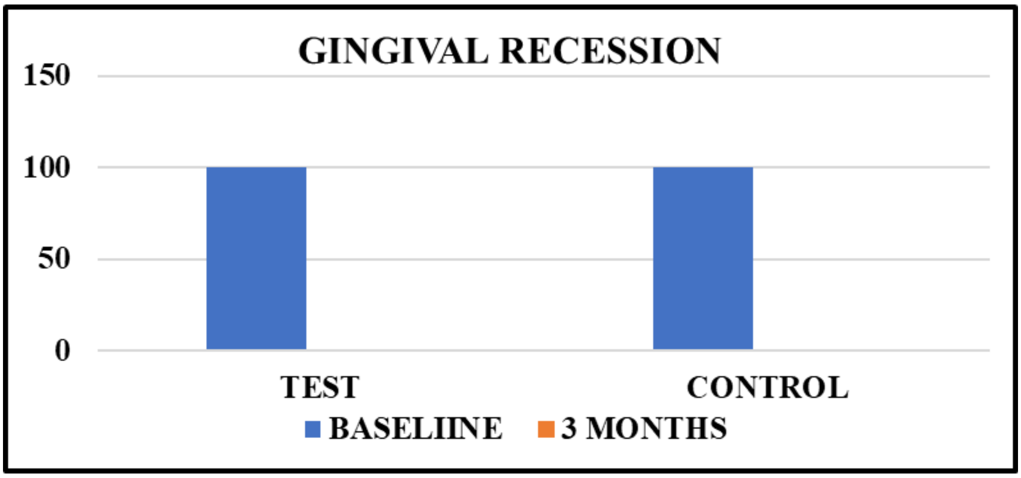
Graph -1 Intergroup comparison of PPD in test and control group in baseline and 3 months



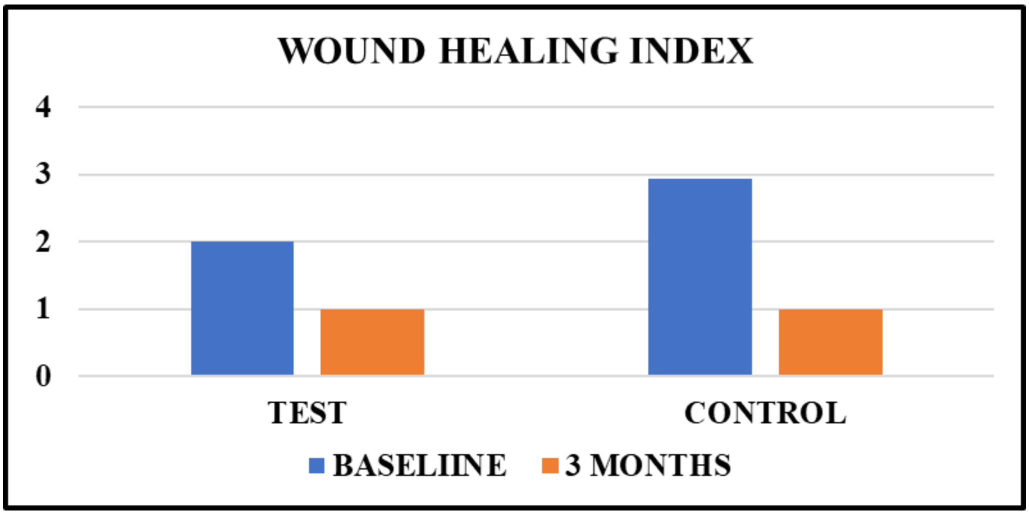
Graph-2 Intergroup comparison of CAL in test and control group in baseline and 3 months



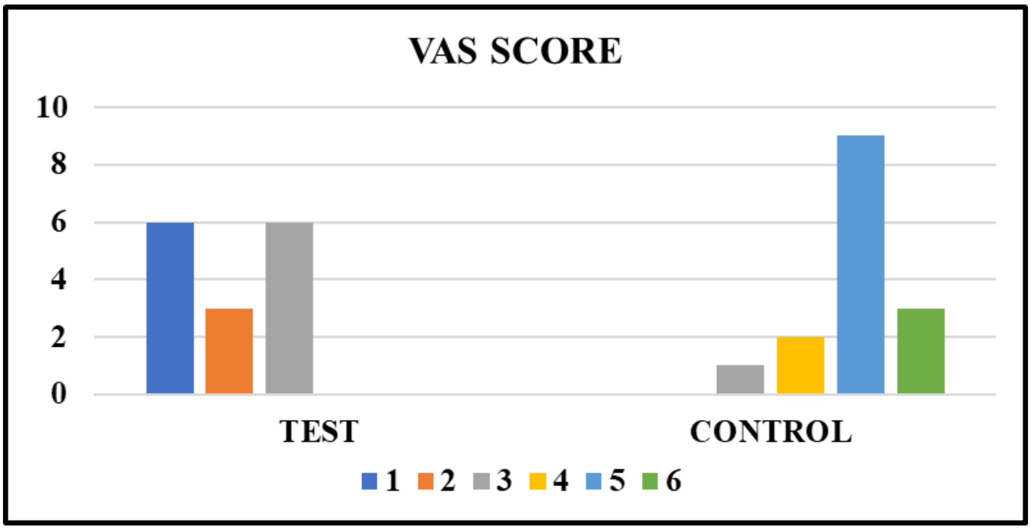
Graph-3 Intergroup comparison of GR in test and control group in baseline and 3 months



Graph-4 Intergroup comparison of WHI in test and control group in baseline and 3 months



Graph 5- Intergroup comparison of VAS score for test and control group during intervention



4. DISCUSSION

The periodontium acts as a supporting apparatus for the teeth and is a complex structure consisting of soft and hard tissues. Soft tissue includes the gingiva, mucosa, and periodontal ligament (PDL), and hard tissue includes the cementum and the alveolar bone.[11] Although scaling and root planning only temporarily alter the percentage of subgingival sites colonized by periodontal pathogens, nonsurgical treatment significantly lowers the overall mass/burden of the subgingival biofilm. Additionally, no bacterial eradication is to be expected in deep residual pockets.[12] In about 85% of patients, they are effective in avoiding tooth loss when combined with a post-treatment maintenance program.[13] The application of microsurgery has been carried out in various fields of periodontology, like root surface debridement, regenerative periodontal procedures, mucogingival surgery, implant therapy, crown lengthening procedures.[14,15] The intergroup comparison revealed a statistically significant reduction in PPD (p = 0.046) in the test group as compared to control group from baseline to 3 months. The test group had a mean PPD of 6.47 mm at baseline, which decreased to 3.00 mm, while the control group showed a reduction from 6.13 mm to 2.93 mm, with no significant difference at the 3-month follow-up (p = 0.776). This result aligns with findings from other studies, such as one by Pradeep et al. (2011),[16] which demonstrated that microsurgical techniques could enhance tissue healing and improve periodontal outcomes, including reducing probing pocket depths more effectively than conventional methods. The improved PPD reduction in the test group raises the possibility that microsurgery could help achieve more accurate and less stressful surgical intervention, which would enhance overall therapeutic results.[17] Intragroup Comparison: Comparing PPD changes within each group, it was found that both groups significantly improved (p=0.048 for the test group and p=0.015 for the control group). This result demonstrates the long-term efficacy of both therapies in lowering PPD.

Intergroup Comparison: The comparison showed no significant differences at the 3-month follow-up (p = 0.188). The test group had a baseline mean CAL of 5.73 mm, improving to 3.00 mm, while the control group showed a reduction from 5.33 mm to 2.93 mm. Although both groups demonstrated improvement in CAL, the lack of statistical significance suggests that the addition of microsurgery did not result in a clinically meaningful difference in attachment gain when compared to conventional OFD. These results are consistent with studies like Sanz et al. (2015),[18] who found that while microsurgical approaches can improve healing and tissue regeneration, the overall CAL gain was similar across various periodontal treatments. This implies that while microsurgery may improve certain parameters, it might not have a significant impact on CAL in comparison to conventional methods. Intragroup Comparison: Within the test group, the improvement in CAL was statistically significant (p = 0.048), which further supports the efficacy of OFD with microsurgery in improving clinical attachment. In contrast, the control group did not show a significant change in CAL (p = 0.869), suggesting that the conventional OFD approach may be less effective in achieving significant CAL improvement.[19] This finding may be explained by the fact that microsurgical techniques, which offer better precision, might be more effective in promoting better attachment levels, especially in more challenging clinical cases. The GR data revealed no significant changes in GR for either group, with both groups showing no GR at baseline and at 3 months. The p-values of 1.000 at both time points suggest that neither treatment method had an adverse effect on the gingival margin. This finding is supported by studies such as Löe (1993),[20] who emphasized that periodontal surgeries, when performed correctly, generally do not lead to significant GR. The absence of recession in both groups suggests that the surgical procedures were well-executed, preserving the gingival margin.[21] The intergroup comparison of the WHI showed that the test group demonstrated a significantly better healing response at the 7-day follow-up, with a mean WHI of 2.0 at baseline, improving to 1.0 at 3 months (p = 0.000). The control group showed a baseline WHI of 2.93, improving to 1.0 by 3 months. The statistically significant p-value for the test group suggests that microsurgical techniques contribute to faster and more effective early wound healing, which could be due to the more precise and less traumatic nature of the surgical approach. Intragroup Comparison: Both groups showed significant improvement in WHI from baseline to 3 months. The test group improved significantly in terms of healing (p = 0.000), while the control group also showed significant improvement (p = 0.000). The faster healing in the test group is consistent with Cortellini and Tonetti (2007),[22] who found that microsurgical techniques facilitate quicker revascularization and improved tissue regeneration, leading to better wound healing outcomes. The VAS pain scores during the intervention indicated that the test group experienced significantly less pain compared to the control group.[23] The p-value of 0.000 suggests a statistically significant difference between the two groups in terms of pain experienced during the procedure. This is consistent with Giannobile et al. (2003),[24] who reported that microsurgical techniques cause less postoperative pain due to the reduced tissue trauma and more precise handling of the tissues.[20] The lower pain scores in the test group suggest that patients undergoing OFD with microsurgery may experience a more comfortable post-surgical course.[21]

5. CONCLUSION

Within the limitations of this study, it can be concluded that both conventional OFD and OFD with microsurgery result in significant improvements in periodontal health, including reductions in PPD and CAL.[22,23] Despite the slightly better outcomes for the test group, the differences in PPD and CAL between the two groups were not statistically significant, although pain levels were notably higher during the intervention in OFD group. However, more studies with a larger sample size may be used to evaluate the benefits of OFD with microsurgery over conventional methods, particularly regarding pain management and long-term outcomes.[24]

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