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Comparative Evaluation of Microsurgical and Conventional Instrumentation in Periodontal Surgery - A Clinical Study.

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Abstract

Background: Use of microsurgery in the field of periodontal therapy has been proposed to provide better clinical outcomes because of enhanced visual acuity and precision in working. It has been reported that high rate of tooth retention and improvements in clinical parameters is possible with microsurgery. However, limited data comparing microsurgical to conventional open flap debridement have been reported.

Aim: To evaluate and compare the healing response following micro surgical and conventional instrumentation in periodontal surgery.

Materials and Methods: A total of 130 sites (65 in each group) with chronic periodontitis, i.e., PPD ≥ 5mm and CAL ≥ 3mm were selected for a split-mouth study. Open flap debridement using conventional instruments was performed in control site and open flap debridement using microsurgical instruments was performed in test site. Clinical parameters included for the assessment were healing index, visual analogue scale, periodontal

probing depth and clinical attachment level at different time intervals following treatment.

Results: All the clinical parameters significantly improved after therapy within both the groups. On comparison between both the groups, better healing response and low VAS was observed in microsurgical group. But, PPD and CAL depicted no statistically significant difference. However, both PPD and CAL achieved after 6 months were comparatively more stable in microsurgical groups and slight increase in PPD and loss in CAL were seen in conventional group, although, it was statistically insignificant.

Conclusion: Better healing response and low pain perception was observed in microsurgical group. Also, though statistically nonsignificant but stable outcomes were observed in terms of both PPD and CAL in microsurgical group. Hence, microsurgery can be safely and effectively employed for treatment of chronic periodontitis.

Keywords: Periodontitis, Open flap debridement, Microsurgery

Introduction

The principal goal of periodontal therapy is elimination of the etiologic agents. Surgical therapy is part of periodontal therapy which acts as an adjunct to the cause-related therapy. The field of periodontics has and is going through a number of changes in terms of concepts as well as techniques. Microsurgery is one such concept which is slowly unfolding its potential. Optical magnification and visualization with the help of surgical loupes and microscopes has limited the amount of flap reflection required to access and visualise a defect. It also enhances root instrumentation preventing the unnecessary loss of tooth structure due to over-instrumentation. Delicate handling of the tissues with microsurgical instruments also enhances the overall outcome and improves the predictability of different periodontal procedures, providing better esthetic results and causing less post-operative discomfort.[1] This facilitates precise adaptation of the tissue to the teeth or the opposing flap in an edentulous area, thus eliminating the gaps and dead spaces circumventing the need for new tissue formation and enhancing periodontal regeneration.[2] However, despite having such benefits, in terms of clinical outcomes, except for enhanced healing and reduced pain and discomfort, comparable results were found for other clinical parameters.[3,4] Hence, the current study has been planned to evaluate and compare the response of periodontal tissue following conventional and microsurgical instruments during periodontal surgical procedures in the aspects of clinical parameters and patient perception.

Material and method

This study was a randomised control clinical trial using split mouth design. Ethical clearance for the study was obtained from the Institutional Ethics and Review Board of Kothiwal Dental College and Research Centre (Ref No.: KDCRC/IERB/11/2019/37). As the study is site-specific, the selection criteria were in pertinent to the selected sites. (Table1). 130 sites were selected for the study, satisfying the eligibility criteria and were randomly divided into two groups, A and B (each with 65 sites respectively) by chit method. Group A (Control group) – Sites treated with periodontal surgery using conventional periodontal surgical instruments. Group B (Test group) – Sites treated with periodontal surgery using microsurgical instruments.

Table 1: Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
Chronic periodontitis, as per the AAP classification 1999.[5]	Subjects taking any medication that can influence the gingival response during healing.
A. Subjects with ≥ 5mm of probing pocket depth	Subjects with any systemic disease affecting periodontium.
B. Clinical attachment loss ≥ 3mm	Pregnant women, lactating mothers, postmenopausal women.
C. Bleeding on probing	Smokers and tobacco chewers.
	Subjects who are unable to perform routine oral hygiene procedures, or not complying with oral hygiene instructions

Clinical parameters assessed

Pain index at – 1st, 3rd and 7th day.

Healing index at - 7th day

Periodontal probing depth- at baseline and on 3rd and 6th months

Clinical attachment levels – at baseline and on 3rd and 6th months

At Baseline

Initial therapy including scaling root planing, oral hygiene instructions and occlusal adjustments, wherever required, were performed. Periodontal probing depth (PPD) and clinical attachment levels (CAL) were assessed with the help of UNC 15 probe and occlusal stent prior to the surgical procedure.

Surgical procedure

Phase II therapy included surgical procedures which were done using conventional instruments in control group and microsurgical instruments in test group.

Following the local anaesthetic administration, periodontal surgery was performed in both the groups. In conventional group, conventional Bard Parker blades were used to make incision on the diseased site only. Periosteal elevator was used to reflect the tissue. Subsequent to the elevation of flap debridement was performed with the curettes following scaling and root planing. Flaps were sutured with 3-0 silk sutures. For Microsurgical group dental loupes of 2.5x magnification was used for visual magnification. All the same steps were performed in microsurgical group using microsurgical instruments. Surgical flaps were sutured with 6-0 sutures. Periodontal dressing (Coe Pak) was then placed over the surgical site for each group.

Post-surgery, mechanical oral hygiene maintenance was avoided for 1 week at the surgical site. Oral hygiene was maintained by using 0.2% Chlorhexidine mouthwash.

Statistical analysis

The statistical software SPSS 16.0 is used for analysis of data. The descriptive statistics like mean, median, S.D of data were calculated. The normality of data was tested by Shapiro Wilks test and found data was not normally distributed. The significance difference of parameters between two groups (inter group comparison) was tested by non-parametric test Wilcoxon Rank Sum Test or Mann-Whitney U Test and within group (intra group comparison) was done by Wilcoxon Signed Rank Test The 95% C.I. and 5% level of significance was used for analysis of data. *Significant $p<0.05$, ** Highly significant $p<0.01$, *** Very highly significant $p<0.001$, NS not significant $p>0.05$.

Result

Recruitment and randomization of the participants was performed. Out of 65 patients in each group, 45 were male and 20 were female. Table 2 depicts intergroup comparison of Healing Index on 7th day post operatively. The mean ± SD of Healing index on 7th day of Group A and Group B were with mean difference was highly significant, p<0.01. Therefore, this significantly higher healing index depicted superior healing in Group B.

Intergroup comparison of VAS at 1st, 3rd and 7th day between Group A and Group B is tabulated in Table 3. The mean ± SD with mean difference of VAS on both 1st day and 3rd day of Group A and Group B, was highly significant, p<0.01. This depicts that more pain and discomfort to patient was observed in Group A as compared to Group B. However, at 7th day there was no significant difference, p>0.05 as discomfort and pain had subsided in both the groups.

Intragroup comparison of change in periodontal probing depth of Group A (Table 4) depicts, periodontal probing depth (PPD) from Baseline to 3months and 6months was significantly reduced. Whereas, difference mean between 3months and 6months was not significant statistically, p>0.05. This reflects that though there was slight increase in PPD at 6-month time interval from 3 months period, but it was not marked noticeable and insignificant statistically also. Similar outcomes were observed during intragroup comparison of change in periodontal probing depth of Group B between Baseline and 3months and between Baseline and 6months which were highly significant, p<0.01 and the difference mean between 3months and 6months was not significant, p>0.05.

Table 5 depicts intergroup comparison of PPD at baseline, 3 months and 6 months between Group A and Group B. The mean ±SD with Mean difference of Probing depth (PPD) at Baseline of Group A and Group B was not significant, p>0.05, depicting both the groups were comparable at baseline. Later, on both 3months follow up and 6months follow up, mean difference were not significant, p>0.05. Therefore, it is observed that though there was mean difference of PPD of Group A and Group B at different time intervals, it was not statistically significant, depicting both the groups showed similar efficiency in PPD reduction.

Table 6 depicts intergroup comparison of CAL at baseline, 3 months and 6 months between Group A and Group B which was not significant, p>0.05 This depicts that gain in CAL between two-time intervals of Group A and Group B were almost equal and both groups had similar efficiency in achieving new attachment. Also, between 3-6 months, mean ±SD of gain in CAL of Group A and Group B were not significant, p>0.05, depicting the gain in CAL was stable in both the groups over the observation period.

Discussion

The first description of a periodontal microsurgical procedure that was described as minimally invasive, was in 1995 by Harrel and Rees for removal of granulation tissue.[6] Since then, various authors[7-12] have applied the microsurgery along with varied regenerative materials to attain periodontal regeneration. But currently, limited studies comparing microsurgical to conventional open flap debridement have been reported, mainly in the form of case reports and two randomized clinical trials.[3- 4,13-14]

Our study included 45 males and 20 females with equal distribution of the sites in each group. Split mouth design of the study eliminated the subjects' healing response bias. To eliminated the operator's bias the same operator performed all the surgeries.

Intergroup comparison of post-operative healing reflected that Group B has mean of 4.57 (near score 5;

excellent healing) of Healing Index on 7th day compared to mean of 3.8 (near score 4; very good healing) in Group A. This depicts healing of microsurgical group was superior to conventional group. This result is in accordance to the earlier studies done by Cortellini et al[15], Wachtel et al[16], Perumal et al[3], Reddy et al[14], Chacko NL et al[4]. Literature mentions that better soft tissue healing after microsurgical procedures can be attributed to minimal reflection of the tissues, delicate handling, better wound approximation and minimal trauma to the tissues with the use of small needles and fine sutures.

On the 1st day, after wearing away of the effect of local anaesthesia, the patient was asked to first score how much pain was felt and then take the analgesic if required. Almost all the patients in Group A required medication for the first two days, except for two patients who took analgesic even on the 3rd day post-operatively, however no patient in Group B required medication after 1st day of surgery. Post-operative pain and discomfort were comparatively low in Group B on both 1st and 3rd day post-operatively. This outcome was in accordance to earlier studies like Wachtel et al[16], Perumal et al[3], Reddy et al[14], Chacko NL et al[4]. This low or reduced pain perception in microsurgery can be attributed to two components i.e., reduced tissue damage along with primary closure of the wound and improved vascularization after microsurgical approach. These two components enhance healing after microsurgery which in turn reduces the inflammatory component[13], further reducing the pain and discomfort.

Post-operative changes in periodontal probing depth (PPD) for group A revealed the mean between baseline and 3-month and baseline and 6-month to be highly significant. Whereas, between 3 months and 6 months' time period, statistically no significant difference was seen. The result of this present study correlates with the outcome of studies performed by other investigators like Knowles et al[17], Lindhe et al[18], Pihl storm et al[19] and Isidor and Karring[20], who reported better PPD reduction in surgical pocket reduction group as compared to non-surgical group. Similar results are seen in case of intra-group comparison of change in periodontal probing depth in Group B. This reduction in periodontal probing depth in both the groups at different time intervals can be thought to be because of removal of the local irritants, as the inaccessible areas were thoroughly debrided after flap reflection and hence, the tissue after healing restricted penetration of probe into the healed tissue. This post-operative non-inflamed tissue offers such restriction because of tissue alterations that take place during healing.

However, on intergroup comparison at baseline, the mean difference between both the groups was not found to be statistically significant, depicting that the groups were comparable. On the 3 months and 6 months follow-up also, the mean difference between the two groups were not statistically significant. This portrays similar efficiency of both the surgical techniques in PPD reduction. This is in accordance with studies of Perumal et al[3] and Chacko NL et al[4]. However, Reddy et al[14] in a case series depicted improvement in clinical parameters in both the groups with slightly better results in microsurgical group. This comparability in efficiency was also confirmed by a histopathological and scanning electron microscopy study by Shetty S. et al[21] reported residual calculus was seen in both microsurgical and conventional open flap debridement group, when magnification used was 3x. However, Liao H et al[22], who used magnification of 10x while comparing the macro and microsurgical groups, mentioned that more normal surface structure was preserved or restored in

those treated under magnification than in those without magnification. In the present study, 2.5x magnification was used and it can be proposed that maybe the use of different magnification would have brought about a different outcome.

Intergroup comparison with reference to clinical attachment levels (CAL) depicts gain in CAL between baseline and 3months as well as between baseline and 6months in both the groups, but on comparison to each other, there was no statistically significant difference, depicting almost equal amount of attachment gain in both the groups. Similarly, the gain in CAL between 3 month and 6 month was not statistically significant. microsurgical group showed relatively stable levels of gain in clinical attachment level. These results have been in accordance to the studies performed by Perumal et al[3], Reddy et al[14], and Chacko et al[4], who all have reported statistically insignificant difference between CAL gain in both the groups. However, direct comparisons of mean did show better outcomes in microsurgical groups. Perumal et al[3] also mentioned of gingival recession which was statistically insignificant between both the groups, which was also in accordance to this study.

Wachtel et al[16] and Cortellini et al[15] have also mentioned that minimal loss of attachment is seen after microsurgery. These findings could possibly be because of atraumatic flap or soft tissue manipulation in microsurgery as compared to conventional instrumentation, preserving the regenerative and proliferative potential of the soft tissues. Also, during microsurgery, minimal reflection of flap and limited exposure of bone occur as compared to conventional group, which further restrict the resorption of bone post-surgery. This could be another proposed means by which more stable levels of gain in CAL were observed compared to conventional instrumentation. Stable levels of CAL gain can also be attributed to better and early healing which is seen in microsurgical group. Early presence of myofibroblasts as well as better preservation of the quality and quantity of fibroblast will ultimately governs the stability of the regenerative results achieved and minimal trauma and improved vascularisation post microsurgical approach can be thought to provide these outcomes.

So, all these factors, provide us an idea that comparatively atraumatic and soft handling of the tissues, better visualization of root surface and minimal exposure of the bone during microsurgery, might be the reasons in the present study providing direct favourable results in terms of healing and pain perception.

Limitations

1. The duration of the study was short, so the long-term stability of results in terms of PPD and CAL cannot be predicted.
2. No histopathologic/radiographic analysis was done in this study, which would have provided the accurate idea about regeneration and repair of tissues post-surgery.
3. The VAS scale that was used to record pain was entirely subjective in nature.

Conclusion

It can be concluded that microsurgical open flap debridement presented better healing response reduced pain and discomfort post-surgically. Reduction in PPD and gain in CAL were also more stable in the microsurgical group as compared to the conventional group. This suggests that microsurgery has an upper hand in providing better patient related outcomes because of the minimal trauma caused during the surgical procedure. As far as surgery related outcomes are concerned both the procedures came out to be almost similar.

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Table 2: Inter group comparison of mean and SD of Healing Index on 7th day between two groups.

Parameter	Group	N	Mean±SD. Deviation	Mean difference±S.E.M	z value	p value
Healing Index 7th day	Group A	65	3.8735±0.83137	-0.69892±.12182	-5.381	0.000**
	Group B	65	4.5725±0.52287			

** p<0.01-Highly significant

Table 3: Inter group comparison of mean and SD of VAS at different time intervals between two groups.

Parameter	Group	N	Mean ±Std. Deviation	Mean difference ±S.E.M	z value	p value
VAS 1st day	Group A	65	3.46±1.359	1.538±0.223	-6.599	0.000**
	Group B	65	1.92±1.177			
VAS 3rd day	Group A	65	1.29±0.631	0.569±0.123	-5.735	0.000**
	Group B	65	0.72±0.761			
VAS 7th day	Group A	65	0.00±0.000	0.000	0.00	1.00^{NS}
	Group B	65	0.00±0.000			

** p<0.01-Highly significant, ^{NS} p>0.05 - Not significant.

Time	N	Group A		Group B		p value
		Mean ±Std. Deviation	Mean difference ±S.E.M	Mean ±Std. Deviation	Mean difference ±S.E.M	
Baseline	65	4.23±1.01	1.69±0.13	4.09±0.98	1.35±0.08	0.000**
3month	65	2.53±0.54		2.74±0.59		
Baseline	65	4.23±1.01	1.59±0.14	4.09±0.98	1.35±0.10	0.000**
6month	65	2.63±0.64		2.74±0.58		

3month	65	2.53±0.54	-0.09±0.05	2.74±0.59	-.004±0.03	0.093[NS]
6month	65	2.63±0.64		2.74±0.58		

Table 4: Intra group comparison of mean and SD of PPD of Group A and Group B between different time intervals.

* * p<0.01-Highly significant, [NS] p>0.05 - Not significant

Parameter	Group	N	Mean ±Std. Deviation	Mean difference ±S.E.M	z value	p value
PPD Baseline	Group A	65	4.23±1.01	0.13±0.17	-0.497	0.619[NS]
	Group B	65	4.09±0.98			
PPD 3months	Group A	65	2.53±0.54	-0.20±0.09	-1.624	0.104[NS]
	Group B	65	2.74±0.59			
PPD 6months	Group A	65	2.63±0.64	-0.10±0.10	-1.409	0.159[NS]
	Group B	65	2.74±0.58			

Table 5: Inter group comparison of mean and SD of PPD at different time intervals between two groups

[NS] p>0.05 - Not significant

Parameter	Group	N	Mean ±Std. Deviation	Mean difference ±S.E.M	% Difference		z value	p value
					Mean ±Std. Deviation	Mean difference ±S.E.M		
Baseline-3month	Group A	65	2.60±01.32	0.03±0.21	26.00±11.38	0.11±1.91	-0.245	0.807 [NS]
	Group B	65	2.57±1.131		25.89±10.47			
Baseline-6month	Group A	65	2.46±01.69	-0.15±0.25	24.19±16.10	-2.01±2.38	-0.550	0.582 [NS]
	Group B	65	2.62±1.19		26.21±10.44			
3month-6month	Group A	65	-.14±01.11	-0.18±0.16	-2.93±19.28	-3.03±2.59	-0.171	0.864 [NS]
	Group B	65	.05±0.67		0.10±8.02			

Table 6: Inter group comparison of mean and SD of CAL difference and CAL %difference between different time intervals among two groups.

[NS] p>0.05 - Not significant