Original Article

Comparison of Conventional and Microsurgical Access Flap Procedure in Managing Chronic Periodontitis: A Randomized Controlled Trial

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Abstract

Aim: The aim of the study was to evaluate and compare the periodontal treatment outcomes in patients with periodontitis treated using conventional and microsurgical access flap procedure. **Materials and Methods:** Fifty chronic periodontitis patients were randomly assigned to conventional (Group I) and microsurgical (Group II) open flap debridement procedure. The parameters measured were probing pocket depth, clinical attachment loss (CAL), gingival recession (GR), bleeding on probing (BOP), wound healing, and postoperative pain. PD, CAL, GR, and BOP were assessed at pretreatment (baseline) and 3 months postoperatively. Wound healing was assessed using Landrey et al. healing index at 7th day and 3 months postoperatively and postoperative pain was assessed using number of analgesics taken for 7 days following surgery. **Results:** Healing Index score of 4 (very good healing) was found in 40% of sites of Group I and 95% of sites of Group II. Comparison of number of analgesics taken between groups on day 7 showed a statistically significant difference ($P < 0.01$), indicating that pain was significantly reduced in Group II compared to Group I. At 3 months postoperatively, there was no significant reduction in PD, CAL, GR, and BOP between the groups. **Conclusions:** In open flap debridement procedure, a microsurgical approach can substantially improve the early healing and induce less postoperative pain when compared to a conventional macroscopic approach.

Keywords: *Magnification loupes, microsurgery, open flap debridement, periodontitis, wound healing*

Introduction

Periodontitis is defined as "an inflammatory disease of the supporting tissues of the teeth caused by specific or group of specific microorganisms, resulting in progressive destruction of the periodontal ligament and alveolar bone with increased probing depth formation, recession, or both."[1] It results from the interaction between a predisposing host genetic profile and the presence of subgingival microbes. Periodontal therapy consists of treatment modalities aimed at arresting infection and restoring the lost periodontal structures. This is accomplished through the removal of subgingival tooth-borne accretions using nonsurgical and/or surgical treatment modalities. Periodontal surgical intervention should be considered for patients with critically deep pocket depths, persistent bleeding on probing (BOP), and attachment loss even after nonsurgical therapy.

Surgical techniques using periodontal flaps provide a means for visualization and instrumentation of residual calculus and its removal, thus controlling periodontopathogens from causing disease progression. The early descriptions of periodontal flap surgery were by Widman[2] in 1918 and Neumann[3] in 1920. This surgical technique was aimed at pocket elimination. Kirkland in 1931 described the first periodontal surgical procedure that was aimed at regeneration and reattachment to the root surface.[2] Most of the conventional periodontal surgical procedures are modifications of these early techniques.

In 1995, Harrel and Rees[4] introduced minimally invasive incisions for the debridement of periodontal defect. Now, minimally invasive surgery is replacing the traditional open flap surgical procedures. The application of magnification through microsurgical techniques in periodontics has tremendously refined the periodontal surgical care and has led to minimally invasive surgical intervention for

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periodontal disease. A magnified view of the surgical site facilitates better visualization of the subgingival tooth surfaces, which facilitates detection and removal of calculus and granulation tissue more precisely. Microsurgical technique in periodontal flap surgery can aid in gentle handling of tissues using microsurgical instruments, leading to less postsurgical complications such as pain, swelling, and flap dehiscence.

As of today, only few clinical studies have demonstrated the use and possible advantages of dental loupes in periodontal open flap debridement. Hence, the aim of the present randomized control trial (RCT) was to evaluate and compare the periodontal treatment outcomes in patients with chronic periodontitis treated using conventional and microsurgical access flap procedure.

Materials and Methods

The present RCT was conducted in the Department of Periodontics after getting approval from the Institutional Research and Development Committee and Institutional Human Ethics Committee. The study was registered under Clinical Trials Registry-India (CTRI/2019/01/017142). The procedures done were in accordance with the standards of ethical committee on human experimentation and with the Helsinki Declaration of 1975, revised in 2000.

Sample size determination

The sample size was determined considering reduction in pocket depth based on the study comparing the clinical outcomes of microsurgical and conventional open flap debridement.[5] Considering 5% margin of error (Type I error: $\alpha = 0.05$), 80% power (Type II error: $1- \beta = 0.80$), and 1:1 ratio, the minimum sample size (periodontitis patients) required was 25 in each group including a 10% loss to follow-up.

Inclusion and exclusion criteria

For the present study, nonsmoker, nonalcoholic patients diagnosed with chronic generalized periodontitis with age more than 18 years and without any contributory medical history were considered. Exclusion criteria included previous history of flap surgery, poor oral hygiene, pregnant or lactating women, and patients who had taken any medication, which could modify the results of periodontal treatment during the past 6 months.

Study design

Patients who reported to the department of periodontics, diagnosed as chronic localized periodontitis as per the American Academy of Periodontology–International Workshop for a Classification of Periodontal Diseases, 1999,[6] with probing pocket depth (PPD) between 5 and 7 mm and who satisfied the inclusion and exclusion criteria were selected for the study. These patients were informed about the study protocol in detail, and written consent was obtained from those patients who consented to participate in the study. Baseline data including patient's background characteristics and clinical parameters like probing pocket depth(PPD), clinical attachment loss (CAL), gingival recession (GR) and bleeding on probing (BOP) were collected using a proforma. Randomization using computer-generated table of random numbers was performed to assign patients into conventional (Group I) or microsurgical (Group II) groups till the required sample size was attained. All patients underwent Phase I therapy and were reevaluated after 4 weeks. After reevaluation, patients were posted for flap surgery.

Clinical methodology

All periodontal surgical procedures were performed on an outpatient basis under aseptic conditions. The open flap debridement procedure was done in the department using either conventional surgical technique or the microsurgical technique in the manner described below.

Open flap debridement by conventional technique

After achieving adequate anesthesia, in the control sites, crevicular incisions were made using number 15 BP blade and full-thickness mucoperiosteal flaps were elevated. After flap reflection, debridement was carried out to remove subgingival plaque, calculus, diseased granulation tissue, and pocket epithelium. The sites were irrigated with sterile saline and flaps were sutured to the presurgical level with 3-0 silk suture using interdental, direct suturing technique.

Microsurgical open flap debridement procedure

For microsurgery, ×3.5 optical magnification dental loupe was used. After local anesthetic administration, crevicular incisions were placed using number 15C BP blade. Buccal and lingual flaps were elevated using microsurgical periosteal elevators. After root surface debridement, sutures were placed with 5-0 silk using interdental, direct suturing technique.

Postoperative measures

For both the groups, noneugenol periodontal dressing with Coe-Pak® was placed and postoperative instructions were given. Antibiotic (amoxicillin 500 mg thrice daily for 5 days) and nonsteroidal anti-inflammatory drugs were prescribed to consume in accordance with experience of pain. All patients were advised to maintain oral hygiene and rinse twice a day with a 0.2% chlorhexidine gluconate solution for 2 weeks. The patients were instructed to record the number of analgesics taken from 1st day to 7th day after surgery in the record sheet provided from the department and was advised to bring the datasheet on the day of suture removal.

Patients were given follow-up appointments at 7th day and 3rd month following the procedure. Photographs of intraoral surgical site were taken and documented on the

7th day and 3rd month of surgery. Healing was assessed using Landry *et al*.[7] healing index on the 7th day and 3rd month of follow-up. The BOP assessed using Ainamo and Bay index[8] and other values of clinical parameters such as PPD, CAL, and GR were recorded using UNC 15 probe at 3rd month after surgery. The results were compared with baseline values [Figure 1].

Statistical analysis

The data collected were entered into Excel format. Statistical analyses were performed using a statistical software package SPSS, version 20.0* (*IBM SPSS Statistics, Chicago, Trial Version 20). Categorical and quantitative variables were expressed as frequency (percentage) and mean ± standard deviation, respectively. Paired *t*-test was used to compare quantitative parameters within group. Independent *t*-test was used to compare quantitative parameters between groups. Mann–Whitney *U*-test was used to compare ordinal parameters between groups. For all statistical interpretations, $P < 0.05$ was considered the threshold for statistical significance.

Results

The total sample for analysis was 50 patients, 25 patients from Group I and 25 patients from Group II with 26 males and 19 females aged between 24 and 47 years. The number of teeth in each sample was considered for the computation of difference in quantitative parameters within and between the groups. Hence, from 50 patients of Group I and Group II, 153 teeth were considered for analysis. There was no significant difference in mean age and gender distribution between the groups at baseline, indicating comparability between the groups. The clinical parameters recorded between the groups at baseline were comparable [Table 1].

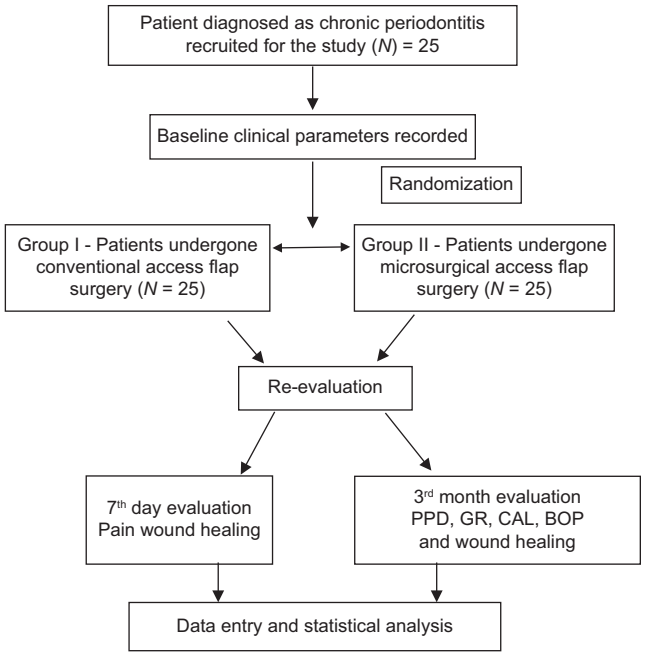


Figure 1: Flowchart showing study design

Tables 2 and 3 show the intragroup comparison of mean change in values of clinical parameters in Group I and Group II treated with conventional and microsurgical technique, respectively, from baseline to 3 months. A statistically significant improvement ($P < 0.001$) in gingival bleeding, PPD, CAL, and GR was observed from baseline to 3 months in both the groups.

Table 4 shows the intergroup comparison of mean change in values of clinical parameters between Group I and Group II treated from baseline to 3 months. No statistically significant difference in gingival bleeding, PPD, CAL,

Table 1: Comparison of baseline values of clinical parameters between groups

Group	BOP (%)	PPD (mm)	GR (mm)	CAL (mm)
Group I	65.8±10.0	4.29±0.98	0.3±0.3	4.64±1.2
Group II	65.0±11.4	4.34±1.23	0.4±0.3	4.74±1.4
P	0.784	0.816	0.097	0.283

*$P<0.05$ significant.[17] BOP: Bleeding on probing; PPD: Probing pocket depth; CAL: Clinical attachment loss; GR: Gingival recession

Table 2: Intragroup comparisons of clinical outcomes of Group I (conventional surgery)

Parameters	Period		Mean difference	*P*
	Baseline	3 month		
BOP (%)	65.8±10.0	11.8±10.4	54	<0.0001*
PPD (mm)	4.29±0.98	2.68±0.55	1.6	<0.0001*
GR (mm)	0.4±0.3	1.20±0.59	0.8	<0.0001*
CAL (mm)	4.64±1.16	3.75±0.98	0.89	<0.0001*

*$P<0.05$ significant.[17] BOP: Bleeding on probing; PPD: Probing pocket depth; CAL: Clinical attachment loss; GR: Gingival recession

Table 3: Intragroup comparisons of clinical outcomes of Group II (microsurgery surgery)

Parameters	Period		Mean difference	*P*
	Baseline	3 month		
BOP (%)	65.0±11.4	9.2±7.2	55.8	<0.0001*
PPD (mm)	4.34±1.23	2.55±0.68	1.79	<0.0001*
GR (mm)	0.34±0.3	1.06±0.53	0.8	<0.0001*
CAL (mm)	4.74±1.42	3.78±1.09	0.96	<0.0001*

*$P<0.05$ significant.[17] BOP: Bleeding on probing; PPD: Probing pocket depth; CAL: Clinical attachment loss; GR: Gingival recession

Table 4: Comparison of clinical outcome between groups

Parameters	Period		*t*	*P*
	Group I	Group II		
BOP (%)	11.8±10.4	9.2±7.2	0.97	0.336
PPD (mm)	2.68±0.5	2.55±0.7	1.1	0.275
GR (mm)	1.20±0.6	1.06±0.5	1.32	0.188
CAL (mm)	3.88±1.0	3.61±1.09	0.14	0.291

*$P<0.05$ significant.[17] BOP: Bleeding on probing; PPD: Probing pocket depth; CAL: Clinical attachment loss; GR: Gingival recession

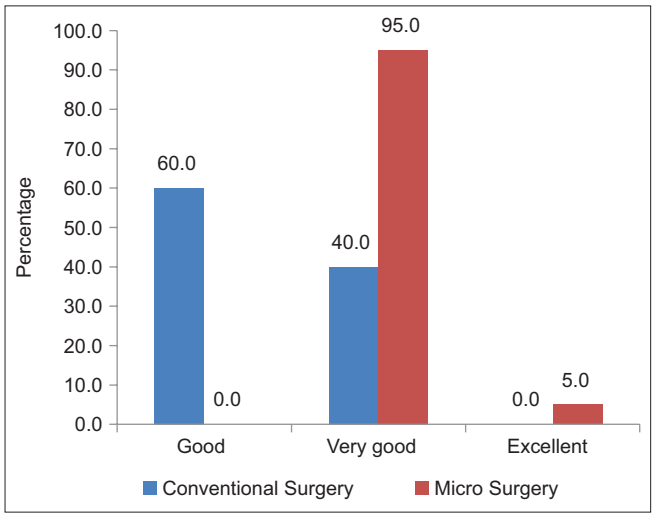
and GR was observed between the groups. Graph 1 shows the comparison of healing index between groups on day 7. At 7th day of surgery, the percentage of wound healing as per Landrey *et al*.[7] healing index for Group I was 60% with good healing and 10% with very good healing, and for Group II, 95% with very good healing and 5% with excellent healing. Intergroup comparison showed a statistically significant difference ($P < 0.01$), indicating better healing index in microsurgery group compared to conventional surgery on 7th day. At 3 months of surgery, 100% of patients of both conventional and microsurgical group had excellent healing that showed statistically insignificant difference between the groups. Graph 2 shows comparison of number of analgesics taken between groups. All the patients of Group I took 3 or more number of analgesics for pain relief, whereas 60% of patients of Group II took only 2 number of analgesics, 30% took 3 analgesics, and 10% took only 1 analgesic drug postoperatively. Intergroup comparison showed a statistically significant difference ($P < 0.01$), indicating that the number of analgesics taken was significantly reduced in microsurgical group compared to conventional group.

Discussion

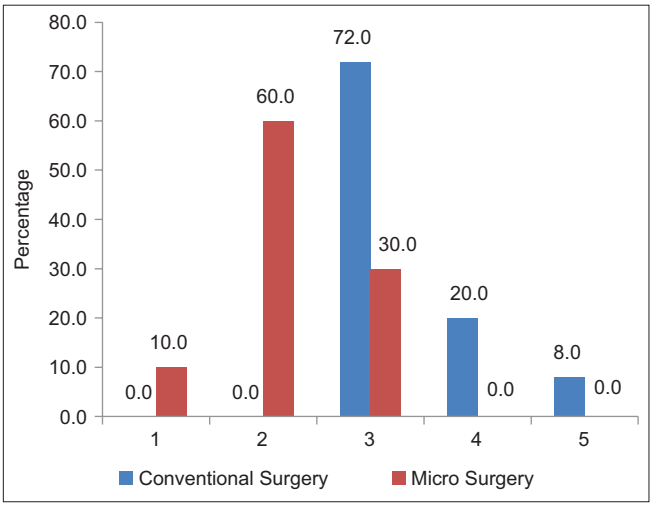
Periodontal access flap surgery is the most widely used therapy for surgical management of periodontal pocket. Surgical techniques using periodontal flaps provide a means for visualization and instrumentation of residual calculus and its removal, thus controlling periodontopathogens from causing disease progression. Microsurgery was introduced as a part of minimally invasive surgery for adequate visualization of the surgical site, promoting precise handling of tissue and to ensure better quality for the treatment performed. Several studies have documented the use of microsurgery in various root coverage procedures, interdental papillae preservation techniques, and periodontal regeneration procedures in intrabony defects. Despite the apparent advantages, there is still a lack of "high level of evidence" in the form of controlled clinical trials to estimate the magnitude of the real benefits of the microsurgical approach over the conventional approach in periodontal access flap surgical procedures. Hence, the aim of the present RCT was to evaluate and compare the periodontal treatment outcomes in patients with periodontitis treated using conventional and microsurgical access flap procedure.

In the present study, open flap debridement procedure was carried out using full-thickness flap reflected with the help of crevicular incision and debridement was carried out to remove subgingival plaque, calculus, diseased granulation tissue, and pocket epithelium. After thorough debridement, the surgical flaps were sutured to the presurgical level using sutures. In the control group, conventional technique utilizing number 15BP blade, conventional instruments, and 3-0 silk suture were used for surgery. In the test group, surgical loupe of ×3.5 optical magnification, number 15C BP blade, microsurgical instruments, and 5-0 silk sutures were used. Clinical parameters including PPD, CAL, GR, and BOP were measured and compared at baseline and 3 months postoperatively within the group and between the groups. The postoperative pain recorded at 7th day and wound healing recorded at 7th day and 3 months following surgery were compared between the groups.

The microsurgical approach involves delicate handling of tissues and precise wound closure which accounts for the favorable early wound healing as reported from studies by Wachtel *et al*. in 2003[9] and Fickl in 2009.[10] Burkhardt and Lang[11] in an angiographic evaluation study compared the wound healing following mucogingival surgery using macro- and microsurgical techniques. They concluded that magnification provided by the microscope helps to split a flap in a well-defined thickness, decreases vessel injury, and markedly improves vascularization. In the present



Graph 1: Comparison of healing index between groups on day 7



Graph 2: Comparison of number of analgesics taken between groups

study when post operative wound healing was compared at 7th day, 95% of the areas of microsugically treated sites showed very good healing where as in patients treated conventionally only 40% of the areas showed very good healing. Intergroup comparison showed a statistically significant difference, indicating better healing index in microsurgery group compared to conventional surgery on 7th day. The results of the present study were in accordance with the results of the comparative study conducted by Perumal *et al*.[5] on thirteen chronic periodontitis patients utilizing conventional and microsurgical technique.

In the present study, pain was assessed on 7th day postoperatively, using the number of analgesics taken. Intergroup comparison showed that patients who had undergone microsurgery experienced lesser pain compared to conventional group. A comparative descriptive study undertaken by Parvez and Manjunat[12] in 2018 on the intensity and duration of pain immediately after conventional scaling and curettage and with the same procedure performed with magnification loupes showed a significant difference between groups with mild pain seen in microsurgical group for all subjects and moderate pain seen for all subjects in conventional group.

In the present study, gingival BOP was assessed using Ainamo and Bay index,[8] where the number of bleeding positive sites was recorded and expressed as the percentage of number of sites examined. The mean gingival BOP at 3 months in Group I and Group II was 11.8 ± 10.4 and 9.2 ± 7.2, respectively. Even though microsurgical group showed more decrease in BOP than the conventional group, the values were not statistically significant. Decrease in BOP is associated with decrease in inflammatory components which are removed during debridement procedure.

PPD is one of the most important parameters that determines whether to go for surgical therapy or not. The critical probing depth value for scaling and root planing (2.9 mm) was significantly smaller than the corresponding value for scaling and root planing used in combination with flap surgery (4.2 mm).[13] Patients presenting residual pockets with PPD ≥5 mm exhibit a higher risk for disease progression and eventually incidence of tooth loss and teeth with probing depth of 7 mm or more are at a significantly higher risk for tooth loss compared with shallow PPD.[14] In the present study, intragroup comparison in both conventional surgery and microsurgery showed a statistically significant decrease in PPD following 3 months after surgery. Intergroup comparison of efficacy of microsurgery over conventional flap surgery in terms of PPD reduction showed statistically insignificant results.

Microsurgical studies were done by Cortellini and Tonetti in 2001[15] utilizing periodontal regeneration technique using guided tissue regeneration (GTR) membrane and Wachtel *et al*. in 2003[9] using application of GTR principle utilizing enamel matrix derivative (EMD). Both the studies showed minimal GR with microsurgery due to atraumatic manipulation during surgery and excellent soft tissue preservation. A clinical trial by Fickl *et al*.[10] revealed that when an EMD was used along with a microsurgical approach, 0.7 mm of GR has to be expected 12 months after the surgical intervention. In our study, the values for GR (distance between the gingival margin and the cementoenamel junction [CEJ]) were measured at baseline and at 3 months following surgery in all the six surfaces of each involved tooth. Even though microsurgical group showed less GR than conventional group, the values were not statistically significant.

CAL is measured from the CEJ to the bottom of gingival sulcus using UNC-15 probe in millimeters. In our study, the values for CAL were measured at baseline and at 3 months following surgery in all the six surfaces of each involved tooth. Intragroup comparison showed a statistically significant decrease in CAL. The decrease in CAL in other words "clinical attachment gain" was not statistically significant between conventional and microsurgical group. Cortellini and Tonetti[15,16] through two case series with a total of 53 deep intrabony defects cases showed that a minimal invasive, high-power magnification assisted surgical technique using EMD yielded clinically significant improvement in CAL gains of 4.8 ± 1.9 mm

Limitations

The limitations of the present study were the small sample size and the short term postsurgical follow-up period of 3 months. This period is too short to evaluate the long-term stability of the hard and soft tissue changes.

Conclusions

The present RCT attempted to evaluate and compare the periodontal treatment outcomes in patients with periodontitis treated using conventional and microsurgical open flap debridement procedure. Within the limitations of the study, it can be concluded that a microsurgical approach can substantially improve the early healing index and induce less postoperative pain compared to a conventional macroscopic approach in open flap debridement procedure. Both conventional and microsurgical approaches were equally effective in improving clinical parameters such as gingival bleeding, PPD, GR, and CAL. Further long-term studies with larger sample size are warranted to evaluate the long-term stability of the treatment outcomes.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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