

Evaluation of impact of periodontal phenotype (PP) on the outcome of open flap debridement (OFD) in patients with chronic periodontitis: A comparative interventional study.

Dr. Mansi Sharma¹, Dr. Nayana Patel², Dr. Radha Vachhani³, Dr. Nisha Verlianey⁴, Dr. Gaurav Bakutra⁵, Dr. Vasistha Vyas⁶

¹(PG Student, Department of Periodontology and Implantology, Government Dental College and Hospital, Jamnagar, Gujarat, India)

²(Dean, HOD of Department of Periodontology and Implantology, Government Dental College and Hospital, Jamnagar, Gujarat, India)

³(Assistant Professor, Department of Periodontology and Implantology, Government Dental College and Hospital, Jamnagar, Gujarat, India)

⁴(Assistant Professor, Department of Periodontology and Implantology, Government Dental College and Hospital, Jamnagar, Gujarat, India)

⁵(Associate Professor, Department of Periodontology and Implantology, Government Dental College and Hospital, Jamnagar, Gujarat, India)

⁶(Tutor, Department of Periodontology and Implantology, Government Dental College and Hospital, Jamnagar, Gujarat, India)

Abstract:

Background: Periodontal phenotype (PP) is defined by gingival thickness, keratinized tissue width, and bone morphotype. Gingival thickness has been linked to the effectiveness of several procedures, including mucogingival therapy, guided tissue regeneration, crown lengthening, and implant dentistry. There is less literature on how PP affects the result of open flap debridement (OFD).

Aim: To determine the effect of periodontal phenotype on the outcome of open flap debridement.

Materials and Methods: 131 patients with chronic periodontitis were screened out of 66 patients not meeting the inclusion criteria were excluded. Remaining 65 patients received scaling and root planing (SRP) and were recalled for re-evaluation after 8 weeks. In 40 patients meeting the inclusion criteria, open flap debridement was done. At baseline, 3 months and 6 months clinical parameters i.e. Plaque index (PI), Gingival index (GI), Pocket depth (PD), Clinical attachment loss (CAL) and Gingival recession (GR) were recorded.

Statistical analysis used: The Shapiro-Wilk test was used to determine the data's normal distribution. The Mann-Whitney test was performed to compare thin and thick PP across time points. Friedman test will be used to compare means of clinical measurements across different time points.

Results: After intervention, 38 patients were re-evaluated and clinical parameters was improved in both the groups. Both groups showed statistically significant difference in all clinical parameters i.e. PI, GI, PPD, CAL AND Rec from baseline to 3 months and 6 months. Intergroup comparison failed to show any statistic difference during analysis of all clinical parameters.

Conclusion: PP may not be an important factor influencing clinical parameters in OFD.

Key Word: Periodontal Phenotype; Gingival Recession; Open Flap Debridement; Clinical Attachment Level; Pocket Depth; Chronic Periodontitis.

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I. Introduction

Each person has a different gingival character based on varying gingival architecture, including the thickness and width of labial gingiva, the term “periodontal biotype” or “gingival biotype” has been proposed. ¹ Periodontal phenotype (PP) is determined by gingival phenotype comprising of gingival thickness and keratinized tissue width and bone morphotype. ²

Periodontal therapy aims to remove the bacterial deposits and to prevent de novo plaque accumulations. In order to obtain access to subgingival plaque and to establish an anatomy in the dento-gingival

region which facilitates proper tooth cleaning, surgical elimination of pathologically deepened suprabony and infrabony pockets is often recommended.³

The effect of PP has been documented in the outcome of numerous interventions like scaling and root planing (SRP), crown lengthening, guided tissue regeneration, mucogingival procedure, and implant dentistry. However, few researches have examined how PP affects the result of open flap debridement (OFD). This study is aimed to assess how PP affects the outcome of OFD.

II. Material And Methods

A comparative interventional study was conducted in the Department of Periodontology and Implantology, Government Dental College and Hospital, Jamnagar, India. The study followed the ethical criteria established in the Declaration of Helsinki 1975, as updated in 2013. Ethical clearance was obtained from Research Ethics Committee of M.P. Shah Medical College, Jamnagar (EC/NEW/INST/2021/1896) (Ministry of Health and Family Welfare Department Research) with Project No. 24/01/2023(Ver.2.0). The study period was from 15 December 2022 to 15 January 2024.

Study Design: Prospective comparative interventional study

Study Location: This was a teaching hospital based study done in Department of Periodontology and Implantology, Government Dental College and Hospital, Jamnagar, India.

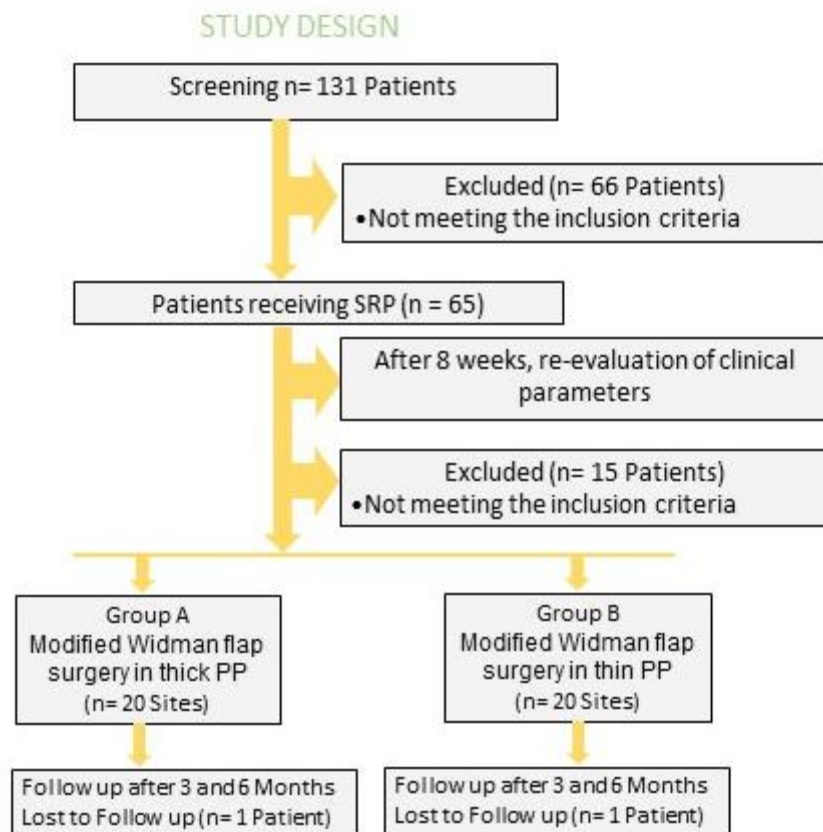
Study Duration: 15 December 2022 to 15 January 2024.

Sample size: 40 patients.

Sample size calculation: To detect a clinically significant change of 1 mm in clinical attachment level with a standard deviation of 1 mm, at $\alpha = 0.05$ and 80% power, at least 18 patients in each group were needed. As a result, the trial included 40 patients (20 in each group), with an expected 10% dropout rate.

Subjects & selection method: One hundred thirty-one patients with chronic periodontitis referred to the department were screened for recruitment based on inclusion and exclusion criteria. Initial periodontal therapy was given to 65 patients including SRP and motivation sessions for plaque control. Patients were recalled twice after SRP: first after the fourth week and again after eight weeks. Patients' surgical eligibility was established at their second recall appointment. Professional plaque control was achieved, and patients were motivated to maintain plaque management during these two visits. Forty patients who met the inclusion criteria were chosen for the study. Written informed consent was obtained from participants before being enrolled in the study.

FIGURE 1: STUDY DESIGN AND PATIENT FLOW



Inclusion criteria:

- 1) Age limit 18 to 55 years.
- 2) Pocket depth (PD) ≥ 4 mm and Gingival index (GI) ≥ 1 at ≥ 4 sites distributed over ≥ 2 anterior teeth.
- 3) Radiographic indication of horizontal bone loss.

Exclusion criteria:

- 1) Patients with vertical bone loss (infrabony defect or craters).
- 2) Premolars and molars.
- 3) Former smokers or currently user of tobacco in any form.
- 4) Patients who are currently using antibiotics or anti-inflammatory medications or who have previously taken drugs that influence periodontal healing such as calcium channel blockers, immunosuppressants, statins, glucocorticoids, phenytoin, bisphosphonates or any other host modulatory drug during the last 6 months.
- 5) Pregnant women, breastfeeding mothers, and women using oral contraception.
- 6) Patients who had received periodontal therapy within the six months preceding the study.
- 7) SRP resulted in Miller Grade II/III tooth mobility.
- 8) Patients with an average Plaque index (PI) of 1.5 or higher after phase 1 therapy.
- 9) Periapical infection in any tooth within the surgical treatment segment.

Procedure methodology:

The clinical parameters were assessed on the day of surgery (baseline) by a single calibrated investigator using periodontal probe (PCP-UNC 15): PD, Clinical attachment level (CAL), Gingival recession (GR), GI, and PI. PP was assessed using spreader No. 20 which was inserted 1 cm below the gingival margin at midfacial level and measured using periodontal probe (PCP-UNC 15), patient will be categorized into thin PP group and when measurement was less than or equal to 1mm, they were categorized into thick PP when measurement was more than 1mm.

OFD in the form of modified Widman flap (MWF) surgery was completed under local anaesthesia as described by Ramfjord and Nissle.⁴ Debridement was done with ultrasonic scalers and hand instruments. The flap was then approximated with figure of eight sutures in its original position using non-resorbable 4-0 silk suture. After 7 days patient was recalled for suture removal and evaluation of healing. Periodontal maintenance after intervention involved debriding all teeth with ultrasonic and manual devices every 1, 2, 3, and 6 months. Oral hygiene guidelines were reiterated at every appointment. Clinical measures were taken at three and six months.

FIGURE 2: ARMAMANTARIUM



FIGURE 3: PREOP, XRAY, SURGICAL PROCEDURE AND FOLLOW UP



Post-operative care:

1. Patients received both verbal and written instructions for post-operative care.
2. Patients were asked not to brush over the surgical area.

3. Antibiotics (amoxicillin 500 mg three times per day for five days) and analgesics (ibuprofen 400 mg thrice each day) were prescribed.
4. Patients were recommended to use 0.2% chlorhexidine mouth rinse for every 12 h for 2 weeks following 24 hours of surgery.
5. Patients were advised to follow a soft diet for upto one week.
6. Patients were recalled after 7 days for suture removal and the operated area was evaluated for healing.

Statistical analysis:

The data from 38 patients who had completed the research were summarized using mean and standard deviation. All statistical analysis was performed using statistical software (SPSS, Version 25.0 for Windows). Shapiro-Wilk test was used to assess the data's normal distribution. Data for PI, GI, PD, CAL and GR had a non-normal distribution. Mann Whitney test was performed to compare thin and thick PP at various points. Statistical significance level was set at $p \leq 0.05$.

III. Result

From 40 cases included in the study, final analysis was done in 38 cases i.e. 19 cases in thin PP group and 19 cases in thick PP group. Two cases were lost during the follow up period, one from each group. The distribution of male: female among the study population was 16 (42.1%): 22 (57.9%). The male to female ratio in the thin PP group was 9 (47.4%): 10 (52.6%) while in the thick PP group was 7 (36.8%): 12 (63.2%). There was no statistically significant variation in patient population's age and gender.

As shown in Table 1, statistically significant difference in PPD reduction at 3 and 6 months in both groups ($p < 0.05$) was seen. Both groups resulted in a statistically significant improvement in CAL gain at 3 and 6 months. Both groups showed improvement in values of PT and GI. Statistically significant difference was seen from baseline to 6 months in the facial site recession in both groups.

Table no 1: Clinical parameters at baseline, 3 months and 6 months of both groups (intragroup comparison).

| Parameter | Group | Baseline | 3 months | 6 months | p-value |
|-----------------|-------|-------------|-------------|-------------|---------|
| Age | Thick | 38.95 | - | - | - |
| | Thin | 44.68 | - | - | - |
| Gender – Male | Thick | 7 (36.8%) | - | - | - |
| | Thin | 9 (47.4%) | - | - | - |
| Gender - Female | Thick | 12 (63.2%) | - | - | - |
| | Thin | 10 (52.6%) | - | - | - |
| PI | Thick | 1.33 ± 0.26 | 0.99 ± 0.03 | 0.98 ± 0.03 | <0.0001 |
| | Thin | 1.43 ± 0.33 | 0.99 ± 0.04 | 0.98 ± 0.06 | <0.0001 |
| GI | Thick | 1.32 ± 0.16 | 0.97 ± 0.06 | 0.95 ± 0.07 | <0.0001 |
| | Thin | 1.4 ± 0.26 | 0.96 ± 0.07 | 0.9 ± 0.12 | <0.0001 |
| PPD (mm) | Thick | 3.8 ± 0.32 | 2.35 ± 0.19 | 2.29 ± 0.04 | <0.0001 |
| | Thin | 3.79 ± 0.37 | 2.33 ± 0.12 | 2.29 ± 0.09 | <0.0001 |
| CAL (mm) | Thick | 2.24 ± 0.66 | 0.97 ± 0.81 | 0.97 ± 0.91 | <0.0001 |
| | Thin | 2.09 ± 0.83 | 0.87 ± 0.93 | 0.82 ± 0.91 | <0.0001 |

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|-----------------|-------|---|-------------|-------------|---------------|
| Rec (mm) | Thick | 0 | 0.04 ± 0.04 | 0.04 ± 0.04 | 0.0003 |
| | Thin | 0 | 0.03 ± 0.04 | 0.03 ± 0.04 | 0.001 |

Table 2 shows that intergroup comparison does not show any statistically significant difference between both groups while comparing all the parameters i.e. PI, GI, PPD, CAL and Rec at different time intervals.

Table no 2: Clinical parameters at baseline, 3 months and 6 months of both groups (intergroup comparison)

| | | PI | GI | PPD | CAL | Rec |
|-----------------|---------|-------------|-------------|-------------|-------------|-------------|
| Baseline | Thick | 1.33 ± 0.26 | 1.32 ± 0.16 | 3.8 ± 0.31 | 2.24 ± 0.66 | 0 |
| | Thin | 1.43 ± 0.33 | 1.39 ± 0.26 | 3.79 ± 0.37 | 2.09 ± 0.83 | 0 |
| | p-value | 0.32 | 0.3 | 0.93 | 0.53 | - |
| 3 months | Thick | 0.99 ± 0.03 | 0.97 ± 0.06 | 2.35 ± 0.19 | 0.97 ± 0.81 | 0.04 ± 0.04 |
| | Thin | 0.99 ± 0.04 | 0.96 ± 0.07 | 2.33 ± 0.12 | 0.87 ± 0.93 | 0.04 ± 0.04 |
| | p-value | 0.75 | 0.58 | 0.58 | 0.7 | 0.71 |
| 6 months | Thick | 0.98 ± 0.06 | 0.95 ± 0.07 | 2.29 ± 0.04 | 0.97 ± 0.91 | 0.04 ± 0.04 |
| | Thin | 0.98 ± 0.06 | 0.9 ± 0.12 | 2.29 ± 0.09 | 0.82 ± 0.91 | 0.03 ± 0.04 |
| | p-value | 0.16 | 0.1 | 0.96 | 0.6 | 0.72 |

FIGURE 4: INTERGROUP COMPARISON OF CLINICAL PARAMETERS



IV. Discussion

Results of this comparative interventional study shows that periodontal phenotype may not have much influence on the clinical outcomes of open flap debridement. A similar study by Gumber et al. showed results that PD & PP were found to have positive correlation with CAL gain in ≥ 7 mm probing sites and attachment gain of >2 mm was observed in more percentage of sites in thick PP than in thin PP.⁵

Transgingival probing, transformer probe, ultrasonic measurement, probe visibility after its placement in the facial sulcus, radiographic measurement like parallel profile radiograph (PPRx) for measuring the dento-gingival unit on the buccal surfaces of anterior teeth, Soft Tissue Cone-Beam Computed Tomography, Laser Scanner, CAD/CAM Cameras as well as combination of techniques have been employed to determine thickness of gingiva.⁶ In present study we used transgingival probing method for determining the thickness of the gingiva.

PI did not differ substantially between the two groups at any time point. Patients were encouraged to maintain good dental hygiene and reminded to do so at each consultation. Professional plaque removal was done at each recall appointment.

PI and GI exhibit a negative correlation with improvement in clinical attachment level. However, PD as well as BOP influence CAL gain positively following MWF. This might be attributed to increased density of growth factors especially transforming growth factor- β (TGF- β) and vascular endothelial growth factor (VEGF) in chronically inflamed connective tissue near to base of pocket.^{7,8} The gingival index indicates inflammation in marginal gingival tissue while BOP indicates inflammation at the base of the periodontal pocket.

Recession observed in thick PP postoperatively at 6 months in this study is consistent with the postoperative change in gingival margin following MWF surgery.^{9,10} Magnitude of change in the gingival margin may be influenced by shrinkage of gingiva associated with resolution of inflammation.¹¹

Sin et al. found that the impact of gingival biotype on gingival shrinkage and probing pocket depth after scaling and root planing was unclear in periodontitis. There was no significant correlation between gingival shrinkage and PPD by biotype in gingiva with a PPD of over 3 mm. Gingiva with a PPD of less than 3 mm exhibited greater shrinkage in the thin biotype compared to the thick biotype. The interdental and middle sites of each group also did not show any particular tendency according to gingival biotype.¹²

According to Hughes and coworkers, thorough scaling and root planing along with proper oral hygiene in patients with severe gingival inflammation lead to decrease in pocket depth, a gain in attachment level, gingival recession, and a decrease in width of the keratinized tissue within 1 week to 1 month.¹¹

A study done by Claffey concluded that probing attachment loss is seen at sites with non-bleeding, shallow pocket i.e. less than or equal to 3.5 mm and thin gingival biotype at 3 months follow up of non-surgical periodontal therapy.¹³

Lindhe et al. concluded that attachment loss occurs in sites with initial probing depth of less than 4 mm, while attachment gain occurred in sites with deeper probing depth after oral hygiene instructions, scaling and root planing and Modified Widman flap. The level of oral hygiene established during healing and maintenance is more critical for resulting probing depths and attachment levels than the mode of initial therapy used.¹⁴

Ramfjord et al. found that with a probing depth of 1-3 mm, scaling and root planing, as well as subgingival curettage, resulted in much less attachment loss than pocket elimination and modified Widman flap surgery. Scaling and root planing, as well as curettage, provided better attachment results for 4-6 mm pockets than pocket eradication surgery. For the 7-12 mm pockets there was no statistically significant difference among the results following the various procedures like scaling and root planing, subgingival curettage, surgical pocket elimination and modified Widman flap surgery.¹⁵

Becker and co-workers concluded that repeated instrumentation of healthy sulci will result in clinical attachment loss. Proper oral hygiene along with frequent maintenance can maintain periodontal health with minimal tooth loss.⁹

Pontoriero and Carnevale¹⁶ & Arora and coworkers¹⁷ in their study showed that more amount of coronal soft tissue rebound was seen in patients with thick gingival biotype as compared to thin gingival biotype after crown lengthening surgery. This tissue rebound can be attributed in part to the availability of nutrients via blood flow in critical places during healing, which is more prevalent in thick GB. The blood supply to gingiva

comes from supraperiosteal blood vessels, alveolar bone, and the periodontal ligament. Intrasulcular incision disrupts blood supply to the crest and periodontal ligament. So, the residual vasculature is from supraperiosteal blood vessels.¹⁸

If a regenerative procedure requires the defect to be covered by a membrane for guided tissue regeneration (GTR), then the thickness of the soft tissue can affect the frequency and extent of gingival recession. Thinner soft tissue is associated with more recession compared to thicker soft tissue.¹⁹ Baldi et al. reported better attachment gain after coronally advanced flap (CAF) in >0.8 mm thick gingiva.²⁰

The findings of the current study apply to a systemically healthy non-smoking population. The majority of the factors known to have a negative impact on periodontal healing were excluded due to stringent eligibility requirements. The study's strengths include strict inclusion and exclusion criteria that reduce confounding variables and patients with comparable demographic data at baseline. The study's shortcomings include a brief follow-up period and no histological examination after surgery. Large multi-center clinical trials with longer follow-up periods are necessary to confirm the current study's findings.

V. Conclusion

The current study found that periodontal phenotype is not a significant factor determining the outcome of OFD in individuals with chronic periodontitis. The key interpretations of the study include:

- Sites with deep probing pocket depth show attachment gains of 2 mm or more when compared to those with shallow probing pockets.
- Probing pocket depth and periodontal inflammation as measured by bleeding on probing have a positive influence on clinical attachment gain after MWF surgery.

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