



Influence of Periodontal Phenotype on the Outcome of Non Surgical Periodontal Therapy

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KEYWORDS

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ABSTRACT:

Aim and Objectives: The present study was designed to examine and compare the influence of periodontal phenotype on the outcome of SRP done with manual and ultrasonic instruments.

Methodology: Forty patients with stage 1 and stage 2 periodontitis participated in this study. All patients underwent SRP either with hand or ultrasonic instruments. Study included 4 groups, viz., Patients with Thin Biotype undergoing SRP using hand instruments (TN-H) (n=10) and ultrasonic instruments (TN-U) (n=10) respectively. Patients with Thick Biotype who underwent SRP using hand instruments (TK-H) (n=10) and ultrasonic instruments (TK-U)(n=10) respectively. PPD and Gingival Shrinkage (GSH) of labial side of maxillary anterior teeth were evaluated at baseline and 3 months after SRP in all four groups. The results were statistically analysed using Analysis of variance followed by Pot-hoc analysis using Boferroni Test; and Paired-t-Test and Independent-t-Test.

Results: With regard to PPD, no difference was between groups. However GSH were statistically significant in the thin biotype group who underwent NSPT using ultrasonic instrument.

Conclusion: Thin gingival phenotype is more prone to gingival shrinkage when ultrasonic instrumentation is performed in comparison with hand scaling. However there was no statistically significant change in PPD.

INTRODUCTION:

In the era of esthetic driven dentistry it is mandatory that the clinician is well aware of all the factors that may influence the esthetic outcome of a treatment. Gingival

phenotype is one important factor that a clinician should consider before starting any dental treatment.



The term periodontal phenotype has been used in various disciplines of dentistry i.e; periodontics, orthodontics, restorative dentistry etc

- 1) The gingival phenotype defined by gingival thickness(GT) and the keratinized tissue width (KTW)
- 2) The bone morphotype is defined by thickness of labial bone plate
- 3) The tooth dimension

At the 2017 world workshop on the classification of periodontal and peri implant disease and conditions, the term biotype was replaced by periodontal phenotype¹. Since the phenotype indicates a dimension that changes through time being determined not only by gingival phenotype and the bone morphology but also by the tooth position and therapeutic interventions.

Various classifications have been proposed to describe the phenotype. Zweers et 2014 on a systematic review has classified phenotypes into 3 categories i.e.; thin scalloped and thick flat phenotype and thick scalloped phenotype² depending on the tooth form, cervical convexity, interproximal contacts and gingival contour.

Periodontal diseases are biofilm mediated chronic infectious disease that can result in increased probing depth, attachment loss, bone loss and finally the loss of tooth itself. Mechanical periodontal therapy remains the corner stone of periodontal therapy and is usually the first line of treatment for most periodontal infections and includes supra gingival scaling, sub gingival scaling and root debridement procedures^{3,4}.

Manual instrumentation using scalers and cures and ultrasonic instrumentation have been used by clinicians for scaling and root debridement procedures. Use of hand held instruments has been referred to as the “Gold standard” in mechanical periodontal therapy but is more time consuming requires more skill. On The contrary ,ultrasonic instruments improves patient compliance and requires less time for thorough debridement Both manual and ultrasonic scaling results in elimination of the bacterial load and reduction in pocket depth.⁵

Gingival shrinkage (GSH) is an inevitable phenomenon that occurs after SRP. The reduction in pocket depth after SRP can be partly attributed to the GSH. The healing tendencies of gingiva after SRP is dependent on the

periodontal phenotypes. A higher prevalence of GSH was reported with thin scalloped biotype and the result was further supported by a study demonstrating a increased susceptibility shrinkage in individuals with thin scalloped gingival architecture.^{6,7}

A flap thickness Of > 0.8mm was associated with a complete root coverage, while a flap of < 0.8mm thickness was associated with partial root coverage.⁸Tissue biotype is also an important factor in implant esthetics, preventing future mucosal recession and improving immediate implant success. A thick flat biotype showed a greater prevalence of the presence of papilla between an immediate implant and natural teeth than a thin scalloped biotype.^{9,10}

As mentioned previously, the outcome of periodontal therapy is largely influenced by periodontal phenotype. It is well known that gingival shrinkage in facial and interproximal are inevitable after SRP. Although GSH after SRP is a common complication in periodontal patients and several measurement methods like transgingival probing, probe transparency , visual inspection and ultra sonic devices have been used to determine the gingival thickness, few studies on periodontal phenotype have compared the alteration of the gingiva after SRP done using hand instruments with SRP using ultra sonic instruments.

The present study was designed to examine and compare the influence of periodontal phenotype on the outcome of SRP done with manual and ultrasonic instruments.

MATERIALS AND METHODS:

The current study included clinical data of 40 patients (22 female and 18 male patients) who visited the Department of Periodontics , Rajas dental college and hospital. Patients with stage 1 and stage 2 periodontitis were included in the study.

The exclusion criteria were as follows

1. Prosthodontic crown
2. Pregnant and Lactating females
3. Maxillary anterior crowding
4. Medicines known to cause gingival enlargement
5. Gingival recession
6. PPD >6mm



The study was approved by the IRB of Rajas dental college and hospital, Tirunelveli district, Tamil Nadu (RDCH/PRL/IRB/D-0217/2024). Informed consent was obtained from all the study participants.

Clinical parameters:

The periodontal parameters PPD and GSH were assessed and clinical photographs were taken at baseline and after 3 months of SRP. All the patients were treated by the same examiner.

1. Gingival thickness (GT) was evaluated using probe transparency method.¹¹

To evaluate, we used the periodontal probe to observe its transparency through the gingival margin while probing the sulcus at the midfacial aspect of both central maxillary incisors. If the outline of the underlying periodontal probe was visible through the gingiva, it was classified as thin if not, it was classified as thick.

2. The PPD was measured to the nearest 0.5mm at the labial side of maxillary central incisor using periodontal probe at baseline immediately after SRP and at 3months follow up.

3. GSH calculated by subtracting the values of clinical crown length at baseline and 3months after SRP, at 3points

- i. Mesial papilla
- ii. Midfacial region
- iii. Distal papilla

PPD and GSH measurement were standardized using customized acrylic stents.

Group design:

Maxillary anterior teeth including central incisors and canine were included. The patients were divided into 4 groups as follows

1. Thin phenotype patient who have undergone hand scaling (TN – H)
2. Thin phenotype patient who have undergone ultrasonic scaling (TN – U)
3. Thick phenotype patient who have undergone hand scaling (TK – H)
4. Thick phenotype patient who have undergone ultrasonic scaling (TK – U)

PPD and GSH were evaluated in all four groups at baseline and 3months after SRP

Therapy

All the patients were provided single full mouth scaling either by hand or ultrasonic instruments, followed by oral hygiene instructions. Ultrasonic scaling was done using Woodpecker UDS-J Ultrasonic Scaler under medium power setting for all the patient in this study. Modified bass technique of brushing was advised for all the patients. Baseline measurements (PPD and clinical crown height) was measured after the SRP.

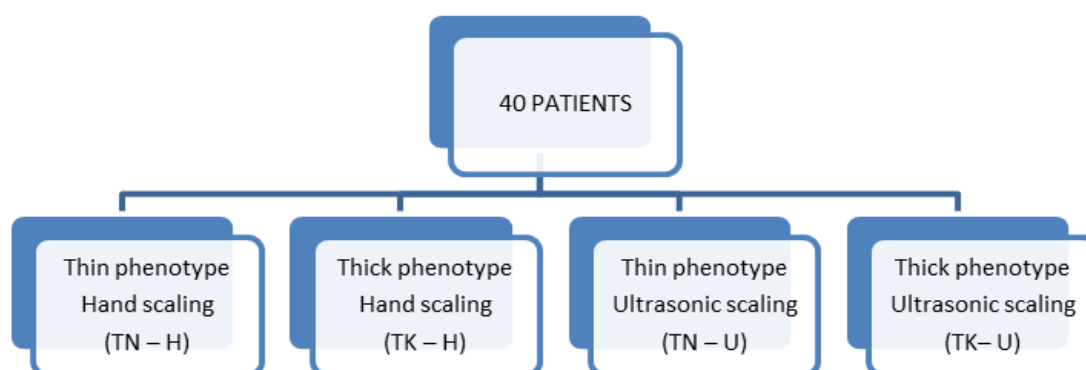


FIGURE 1: PATIENT ALLOCATION



FIGURE 2: THIN PHENOTYPE



FIGURE 3: THICK PHENOTYPE

RESULTS

The present study was designed to examine and compare the influence of periodontal phenotype on the outcome of SRP done with manual and ultrasonic instruments. For

all statistical interpretations, $p < 0.05$ was considered the threshold for statistical significance. Statistical analyses was performed by using a statistical software package SPSS, version 22. The statistical analysis are shown in the following tables

Table 1: Intra-group Pair-wise Comparison

		N	Mean	Standard Deviation	p-value
Thick Biotype Hand Scaling	PPD Baseline	10	2.604	0.336	0.249
	PPD 3 Months	10	2.595	0.362	
	Crown Height Baseline	10	7.389	0.357	< 0.001*
	Crown Height 3 Months	10	7.525	0.340	
Thick Biotype Ultrasonic Scaling	PPD Baseline	10	2.613	0.325	0.961
	PPD 3 Months	10	2.611	0.325	
	Crown Height Baseline	10	7.438	0.344	< 0.001*
	Crown Height 3 Months	10	7.545	0.329	
Thin Biotype Hand Scaling	PPD Baseline	10	2.626	0.324	0.872
	PPD 3 Months	10	2.690	0.358	
	Crown Height Baseline	10	7.420	0.306	0.001*
	Crown Height 3 Months	10	7.599	0.339	
Thin Biotype Ultrasonic Scaling	PPD Baseline	10	2.510	0.276	0.752
	PPD 3 Months	10	2.625	0.277	
	Crown Height Baseline	10	7.351	0.323	< 0.001*



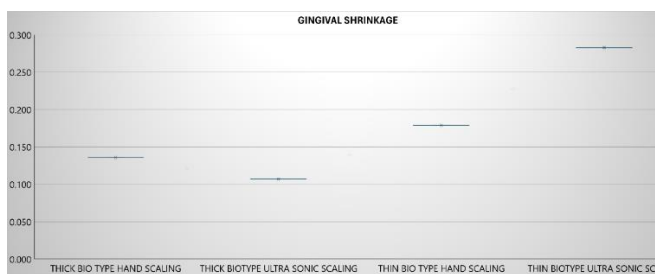
	Crown Height 3 Months	10	7.634	0.366	
p-value based on Paired-t-Test					
* = Statistically Significant (p < 0.05)					

Intra-group pairwise comparisons were conducted using the paired t-test, revealing statistically significant differences in crown height across all four groups from baseline to the third month.

Table 2: Individual Inter-Group Comparison

Gingival shrinkage		Mean Difference	p-value
Thick Biotype Hand Scaling	Thick Biotype Ultrasonic Scaling	0.027	1.000
	Thin Biotype Hand Scaling	0.043	1.000
	Thin Biotype Ultrasonic Scaling	0.536	1.000
Thick Biotype Ultrasonic Scaling	Thin Biotype Hand Scaling	0.070	0.315
	Thin Biotype Ultrasonic Scaling	0.563	1.000
Thin Biotype Hand Scaling	Thin Biotype Ultrasonic Scaling	0.493	0.016*
p-value based on Post-hoc analysis using Bonferroni Test after adjusted for multiple comparisons			
* = Statistically Significant (p < 0.05)			

Individual inter-group comparisons were conducted using post-hoc analysis with the Bonferroni Test. A statistically significant difference was found when comparing thin biotype treated with hand scaling versus ultrasonic scaling.



Graph 1

- From this graph it is evident that the gingival shrinkage is more for the thin biotype who have undergone ultrasonic scaling (TN – U) .

DISCUSSION

The present study was aimed to evaluate the influence of periodontal phenotypes on scaling using hand and ultrasonic instruments in gingivitis patient. Here we have analyzed periodontal phenotype, periodontal probing depth and gingival shrinkage. Patients were categorized into thick and thin phenotypes based on the probe transparency method of analysis, and then subjected to scaling using either hand or ultrasonic instruments. The result showed there was no statistically significant difference in PPD in all the four groups. However there was a statistically significant difference in gingival



shrinkage in thin phenotype group (TN-U) who underwent ultrasonic scaling when compared to other groups (TN-H, TK-U & TK-H).

Ochsenbein and Ross in the year 1969 mentioned that there are two main types of gingiva morphology, namely the scalloped and thin or flat and thick gingiva¹². Later Seibert and Lindhe differentiated gingiva into “thick-flat” and “thin-scalloped” biotypes.¹³ Quantitative differentiation into thick ≥ 2 mm and thin < 1.5 mm was given by Claffey and Shanley.¹⁴ Different techniques have been advocated over the years to assess gingival thickness, including direct measurements, probe transparency (TRAN), ultrasonic devices, and cone-beam computed tomography (CBCT). The simplest non-invasive method was described by Kan et al. based on transparency of a periodontal probe through the gingival margin and has shown the highest predictability an being visible for a gingival thickness (GT) < 0.6 mm (thin GP) and being less or not visible for > 1.0 mm (thick GP).¹¹ Cosyn J et al in a 5-year clinical trial on soft tissue aesthetics of single immediate implants where he have used probe transparency method to evaluate the gingival thickness and observed an increased incidence of esthetic complications in thin gingival phenotypes.¹⁵ De Rouck T, et al in his study he concluded that probe transparency method simple and reproducible method for gingival thickness assessment.¹⁶ It has already been proven that there were no statistically significant differences between radiographic and clinical measurements of both bone and labial soft tissue thickness except in the palatal soft tissue measurements which might be due to errors such as misangulation of the caliper or overcompression of the soft tissue. So in this study we have only taken the labial gingival thickness in order to avoid the same. Eventhough use of Cone beam computerized tomography (CBCT) is superior in diagnosing but this procedure requires technical expertise and is expensive as well with higher radiographic exposure to the patient. Hence, a simple method like periodontal probe transparency is more feasible for routine dental practice.

Influence of phenotype on periodontal surgical treatment outcome have been long documented. But there are only few reports regarding the influence of phenotype on non-surgical therapy, especially scaling which now a days termed as PMPR (Professional Mechanical Plaque

Removal) performed using manual or ultrasonic instruments. Several studies have reported the influence of periodontal phenotype on SRP in periodontitis patient. Sin et al have reported that PPD changes after SRP were not affected by gingival biotype with either shallow or deep periodontal pockets.⁸ GSH also showed equal outcomes in all the groups without normal gingival crevices. The results of SRP seem not to differ according to gingival biotype. In contrary it is widely believed that mechanical trauma results in greater shrinkage in thin gingiva compared to thick gingiva. Furthermore, Fu et al. in 2011 proposed that different biotypes exhibit distinct tissue reactions to trauma: thick gingiva is more likely to develop a periodontal pocket, whereas thin gingiva tends to experience gingival shrinkage (GSH).¹⁷ Our study is in line with the above mentioned study showing greater shrinkage in thin phenotype group compared to the thick phenotype group. Comparing TN-U and TN-H groups’ significant difference in GSH was seen in TN-U group. The plausible reason could be due to the phenomenon of ‘sonoporation’ i.e acoustic microstreaming resulting in enhanced permeability of molecules passing through the cell membrane. The occurrence of sonoporation is contingent upon the microbubble’s size and its proximity to the cell. Irreversible sonoporation is more likely when the distance between the microbubble and the cell is reduced, as well as when the microbubble’s diameter is increased. Hu et al. found that the size of the generated pore influenced the reversibility of sonoporation. Membrane perforations smaller than $30 \mu\text{m}^2$ closed within 1 minute after ultrasound treatment, while pores larger than $100 \mu\text{m}^2$ remained open for up to half an hour.¹⁸ Hence ultrasonic instrumentation in thin phenotype patient should be done cautiously with reduced tissue contact time so as to avoid tissue shrinkage especially in aesthetic regions.

CONCLUSION

This study demonstrates the effect of ultrasonic and hand instrumentation on different gingival phenotypes in which we have inferred that the thin gingival phenotype is more prone to gingival shrinkage when ultrasonic instrumentation is performed in comparison with hand scaling. However there was no statistically significant change in PPD. The limitation of this study includes minimal sample size, more accurate measurement could have been done using CBCT and may be observational



bias. Further research is necessary to validate these findings. Future studies should focus on exploring the duration, power, and frequency of ultrasound instrumentation, particularly in relation to their benefits and side effects on thin gingival phenotype.

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