Original Article

Correlation of Periodontal Phenotype with Periodontal Probing Depth in Maxillary Anterior Teeth: A Cross-Sectional Study Using Probe Transparency Method

Maha Maqbool, Usman Manzoor, Sadia Iqbal, Sittara Javed, Hania Ali, Zubair Ahmed Khan

ABSTRACT

Objective: To correlate periodontal phenotype with periodontal probing depth in maxillary anterior teeth in patients reporting to a tertiary care dental hospital for their routine periodontal care using probe transparency method

Methodology: This cross-sectional study was carried out at Lahore medical and dental college, Lahore over a period of six months. After ethical approval, 180 patients were included using a convenient non-probability sampling method and following the inclusion and exclusion criteria. The periodontal phenotype/gingival thickness was identified using the probe transparency method which involved placement of a probe inside the gingival sulcus and determining its transparency through the gingival sulcus. The periodontal probing depth was measured by determining the distance between the base of sulcus and gingival margin using a Michigan O periodontal probe with William's markings. Assessment of both periodontal phenotype and probing depth was done by the same examiner to minimize chances of any bias.

Results: In this study, patients' mean age was 30.95±6.08 years, 96(53.33%) patients were male. Thin phenotype was observed in 78(43.33%) patients and thick phenotype was observed in 102(56.67%) patients. A strong positive correlation was found between the average probing depth and phenotype of the patients. i.e., r=0.901.

Conclusion: This study concluded that a strong relationship exists between the periodontal phenotype with periodontal probing depth in maxillary anterior teeth in patients reporting to a tertiary care dental hospital for routine periodontal care using probe transparency method

KEYWORDS: Michigan O probe, Phenotype, Probing depth.

INTRODUCTION

The identification of periodontal phenotypes to predict clinical outcomes is an important and integral part of periodontal treatment planning. There is a significant difference in gingival thickness among various individuals.[1,2] Ochsenbein and Ross;[3] identified the presence of two different morphological types of the gingiva, namely 'thin-scalloped' and 'thick-flat'. Later, the term "periodontal biotype," was proposed by Siebert & Lindhe in 1989.[4]

A positive correlation has been found between the width of keratinized gingiva and periodontal phenotype thus making it less prone to recession. Thin phenotype is more prone to recession, bleeding, and inflammation.[4] Various methods can be used to measure gingival thickness, which include probe transparency method by Kan, Ultrasonic device, and Cone Beam Computed Tomography (CBCT) scans.[5] The most simple

Maha Maqbool,[1] *FCPS*
Senior Registrar
Usman Manzoor,[2] *FCPS*
Assistant Professor
Sadia Iqbal,[3] *M.Phil*
Professor
Sittara Javed,[4] *FCPS*
Senior Registrar
Hania Ali,[5] *M.Phil*
Assistant Professor
Zubair Ahmed Khan,[6] *MSc*
Associate Professor
[1,3]Lahore Medical and Dental College, LHR, PAK
[2]Bakhtawar Amin Medical and Dental College, MLT, PAK
[4]University of Lahore, LHR, PAK
[5]Aziz Fatimah Medical & Dental College, FSD, PAK
[6]Fatima Memorial Hospital College of Dentistry, LHR, PAK

Correspondence:
Hania Ali
drhania82@gmail.com

method used to demarcate thin from thick gingiva uses the transparency of the periodontal probe through the gingival margin.[3] No statistically significant difference has been found while assessing periodontal phenotype using the probe transparency method and direct method.[6]

Another important diagnostic and prognostic factor in periodontics are the periodontal probing depth. Increased probing depths are associated with a diseased state of periodontium.[7] The average probing depth of a clinically normal gingival sulcus in humans is 2 to 3 mm.[8] Seba et al. demonstrated increased probing depths (2.305+0.662) associated with thin biotype in comparison to those seen with thick biotype (1.288+ 0.452).[1] A study by Singh J et al. also suggested a negative correlation between probing depth and periodontal phenotype with shallower probing depths in individuals with thick biotype (1.0409mm) and greater values seen in thin biotype individuals (1.1014mm), V= 0.241.[3]

METHODOLOGY

This cross-sectional study was conducted in the Periodontology department, Lahore Medical & Dental College from 01-07-2023 to 31-12-2023. Patients were recruited using a convenient non-probability sampling technique. A total of 180 medically healthy participants aged 18 to 50 years both males and females with no loss of attachment in the maxillary anterior presenting for routine dental check-ups were included in this study. The sample size was calculated according to the WHO sample size formula:

$$n = \left(\frac{Z^2 \,.\, p \,.\, (1 - p}{d^2}\right)$$

Where a 95% confidence interval was used (Z =1.96). Patients with missing teeth and / or tooth replacements in the anterior maxilla, periodontal disease, probing depths more than 3mm, gingival enlargement, history of periodontal surgery in the maxillary anterior region and / or those undergoing orthodontic therapy were excluded. Approval to carry out the study was sought from the Institutional Ethical Review Committee at Lahore Medical and Dental college, Lahore (Ref.No. FD/534/24). Informed written consent was obtained from all the participants regarding his / her participation in the study. Patients were selected according to inclusion and exclusion criteria following clinical examination and detailed history. Using the probe transparency method, periodontal phenotype (gingival thickness) was determined. The periodontal probing depth was determined by measuring the length between the base of sulcus and gingival margin using a Michigan O periodontal probe with William's markings. The resulting data was collected using a customized proforma by a single examiner which was used to record the patient's demographic data in addition to the study variables. The same examiner carried out measurement of both periodontal probing depth and the phenotype to minimize chances of any bias. All the confounders were controlled strictly by following the exclusion criteria.

Collected data was entered and analyzed in computer program SPSS version 22. Percentages and frequency were calculated for categorical variables like periodontal phenotype (thick, and thin) and gender of the patient. Mean ± standard deviation was calculated for numerical variables like age, probing depths using were performed to look for a correlation between periodontal phenotype and probing depths using spear's man correlation. Data was stratified for age and gender. Post stratification Spear's man correlation was used. P-value ≤ 0.05 is considered as significant.

RESULTS

A total of 180 patients were enrolled in this study. The distribution of gingival phenotype according to age and gender is depicted below.

Table 1: Distribution of age in our study population

Age (Years)	**n**	**180**
	Mean	30.95
	Std. Deviation	6.08
	Minimum	18.00
	Maximum	48.00

Figure 1: Gender distribution in our study population

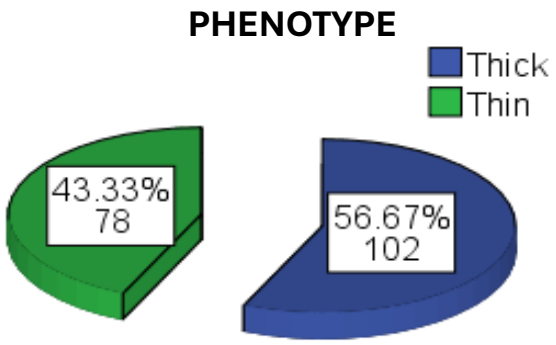

Figure 2: Distribution of periodontal phenotype

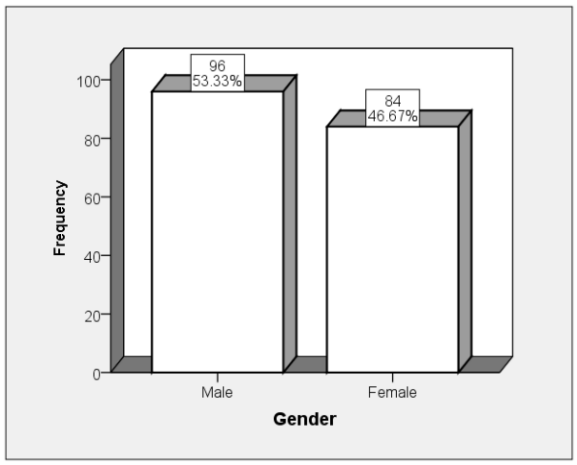

Figure 3: The scatter plot illustrates a strong positive linear correlation (r = 0.901) using Pearson's correlation test between the phenotype and average probing depth (in mm)

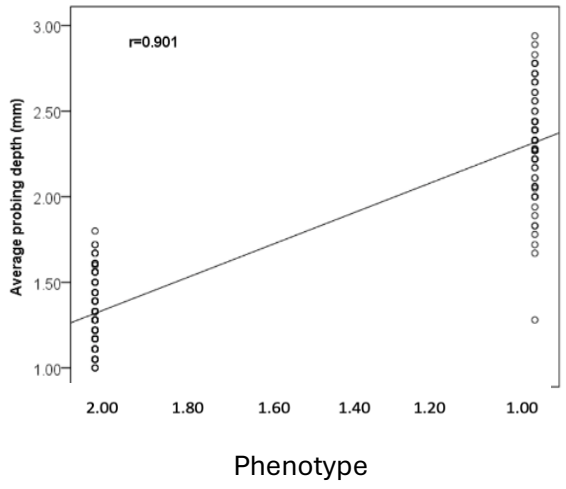

Table 2: Average probing depths recorded in our study population

Average probing depth (mm)	**n**	**180**
	Mean	1.75
	Std. Deviation	0.55
	Minimum	1.00
	Maximum	2.94

An Independent sample t-test was used to calculate the P value (<0.001) yielding a highly significant correlation between the two groups

Table 3: Comparison of Average Probing Depth between Periodontal Phenotypes.

		Phenotype		p-value
		Thick	**Thin**	
Average probing depth (mm)	**n**	**102**	**78**	<0.001
	Mean	1.32	2.31	
	Std. Deviation	0.18	0.29	

P value ≤ 0.05 taking significant

Table 4: Pearson correlation coefficient test was utilized to assess the correlation between phenotype and average probing depth within the specified age groups yielding statistically significant results. i.e, r = 0.890 & 0.888 respectively

Age groups	Phenotype and average probing depth (mm)	
≤ 35	Pearson Correlation (r)	0.890
	Sig. (2-tailed)	0.000
	N	139
>35	Pearson Correlation (r)	0.888
	Sig. (2-tailed)	0.000
	N	41

Table 5: The Pearson correlation coefficient test was employed to analyze the correlation between phenotype and average probing depth for both male and female participants yielding statistically significant results. i.e, r= 0.862 & 0.885 respectively

Gender	Phenotype and average probing depth (mm)	
Male	Pearson Correlation (r)	0.862
	Sig. (2-tailed)	0.000
	N	96
Female	Pearson Correlation (r)	0.885
	Sig. (2-tailed)	0.000
	n	84

DISCUSSION

The gingival phenotype/gingival thickness has a pivotal role in harmonizing ideal aesthetics, long term prognosis and oral function. Intraoral appearance of healthy periodontium is subject to individual variation and even among different tooth types. Gingival phenotype can either be thick or thin. Thick phenotype is fibrous in nature and is associated with a wide zone of attachment, this makes it dense and recession resistant.[9]

Whereas thin periodontal phenotype, owing to its delicate, highly scalloped soft tissue characteristic is more susceptible to inflammatory changes, bleeding tendency and recession. Therefore, correct recognition of the phenotype helps in better treatment planning, paying more attention to thinner phenotypes.[10] The presence and position of erupted teeth influence the gingival characteristics, particularly the shape and width of gingiva. The tooth shape also has an impact on the clinical appearance of the surrounding gingiva. Tooth morphology also dictates the underlying tooth supporting periodontal tissues.[11]

In this study, a strong positive correlation was found between the average probing depth and phenotype of the patients. i.e. r=0.901. Smriti Balaji et al[12] documented in their study that the Pearson's correlation exhibited a positive correlation between gingival width and gingival thickness (p 0.00) which was statistically significant. 83.1% of patients with thick periodontal phenotype had complete papillary fill whereas papillary fill in patients with thin periodontal phenotype was 68.2%.

Seba et al. demonstrated increased probing depths (2.305 + 0.662) associated with thin phenotype in comparison to those seen with thick phenotype (1.288+ 0.452).[1]

Another study by Muller et al in 2000 stated that subjects with thicker gingiva had exhibited significantly lesser probing depth.[13]

Goaslind et al in 1977[14] also found a positive relationship between probing depth and gingival thickness of free gingiva (r=0.73) which also coincided with the data presented in a study by Olsson et al. in 1993.[15] In a study done by Olsson et al. in 1993, there was found to be a strong relationship between gingival thickness and width of keratinized tissue.[15] Another study done by Cook et al. in 2011 found a partial positive correlation between periodontal thickness and width of keratinized tissue.[16]

A study by Singh J et al. also suggested a negative correlation between probing depth and gingival phenotype with shallower probing depths in indiviuals with thick phenotype (1.0409mm) and greater values seen in thin phenotype indiviuals (1.1014mm), V= 0.241.[3]

Bienz et al[17] demonstrated a greater thickness of peri-implant mucosa in patients with thick gingival phenotype as compared to patients who had a thinner phenotype. Thin gingival tissues had a translucent appearance and delicate characteristics which led to undesirable and unesthetic visibility of metal copings through the tissue. The result was a grayish and discoloured gingival margin.[18]

On the other hand, De Rouck et al. in 2009 could not demonstrate significant changes in pocket depth in relation to gingival phenotype because periodontally healthy patients were a part of their study.[4]

To attain more predictable treatment outcomes, determining the gingival phenotype is an important pre-treatment parameter. This can help to improve treatment strategies and the resulting periodontal management.[19,20]

As controversy exist between our study and few of previously published studies, so it is suggested that in future further studies should be done with larger sample size and with better methodology to evaluate the findings of our study. It is further suggested that in future data should be taken from multicentre to control the bias.

CONCLUSION

This study concluded that a strong relationship exists between the gingival biotype with gingival probing depth in maxillary anterior teeth in subjects

reporting to a tertiary care dental hospital for routine periodontal care using the probe transparency method.

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REFERENCES

1. Abraham S, Athira P. Correlation of gingival tissue biotypes with age, gender and tooth morphology: A cross-sectional study using probe transparency method. IOSR J Dent Med Sci 2015;(14):64-69.
2. De Araújo LN, Borges SB, Dos Santos MT, Lima KC, Gurgel BC. Assessment of gingival phenotype through periodontal and crown characteristics: a cluster analysis. J Int Acad Periodontol. 2020;22(1):21-28. PMID: 31896104.
3. Singh J, Rathod VJ, Rao PR, Patil AA, Langade DG, Singh RK. Correlation of gingival thickness with gingival width, probing depth, and papillary fill in maxillary anterior teeth in students of a dental college in Navi Mumbai. Contemp Clin Dent. 2016;7(4):535-538.doi: 10.4103/0976-237X.194117.
4. De Rouck T, Eghbali R, Collys K, De Bruyn H, Cosyn J. The gingival biotype revisited: transparency of the periodontal probe through the gingival margin as a method to discriminate thin from thick gingiva. J Clin Periodontol. 2009 May;36(5):428-433. doi: 10.1111/j.1600-051X.2009.01398.x.
5. Fischer KR, Büchel J, Testori T, Rasperini G, Attin T, Schmidlin P. Gingival phenotype assessment methods and classifications revisited: a preclinical study. Clin Oral Invest. 2021;(25):5513-5518. doi:10.1007/s00784-021-03860-5.
6. Malpartida-Carrillo V, Tinedo-Lopez PL, GuerreroMe, Amaya -Pajares SP, Özcan M, Rösing CK. Periodontal phenotype: a review of historical and current classifications evaluating different methods and characteristics. J Esthet Restor Dent. 2021; 33(3): 432-445. doi:10.1111/jerd.12661
7. Babayiğit O, Yarkaç FU, Atay ÜT, Şen DÖ, Öncü E. Evaluation of relationship between gingival phenotype and periodontal status. Pharmacophore. 2022;13(1-2022):72-78.: http://www. pharmacophorejournal.com
8. Magnusson I, Listgarten M. Histological evaluation of probing depth following periodontal treatment. J Clin Periodontol. 1980;7(1):26-31. doi:10.1111/j.1600-051x.1980.tb01946.x.
9. Vlachodimou E, Fragkioudakis I, Vouros I. Is there an association between the gingival phenotype and the width of keratinized gingiva? A systematic review. Dent J. 2021;9(3):34. https://doi.org/10.3390/dj9030034
10. Kim DM, Bassir SH, Nguyen TT. Effect of gingival phenotype on the maintenance of periodontal health: An American Academy of Periodontology best evidence review. J Clin Periodontol. 1980;7(1):26-31.doi:10.1111/j.1600-051x.1980.tb01946.x.
11. Collins JR, Pannuti CM, Veras K, Ogando G, Brache M. Gingival phenotype and its relationship with different clinical parameters: a study in a Dominican adult sample. Clin Oral Investig. 2021;25(8):4967-4973. doi: 10.1007/s00784-021-03806-x.
12. Balaji S, Gajendran P. Correlation of gingival thickness with gingival width, probing depth and papillary fill in mandibular anterior teeth. Research Journal of Pharmacy and Technology 2018;11(9):3918-3922. Doi:10.5958/0974-360x.2018.00719.9
13. Müller HP, Schaller N, Eger T, Heinecke A. Thickness of masticatory mucosa. J Clin Periodontol. 2000;27(6):431-6. doi: 10.1034/j.1600-051x.2000.027006431.x.
14. Goaslind G, Robertson P, Mahan C, Morrison W, Olson J. Thickness of facial gingiva. J Periodontol. 1977;48(12):768-771. doi: 10.1902/jop.1977.48.12.768.
15. Olssoin M, Lindhe J, Marinello C. On the relationship between crown form and clinical features of the gingiva in adolescents. J Clin Periodontol. 1993;20(8):570-577. doi: 10.1111/j.1600-051x.1993.tb00773.x
16. Cook DR, Mealey BL, Verrett RG, Mills MP, Noujeim ME, Lasho DJ et al. Relationship between clinical periodontal biotype and labial plate thickness: an in vivo study. Int J Periodontics Restorative Dent. 2011;31(4):345-354.
17. Bienz SP, Pirc M, Papageorgiou SN, Jung RE, Thoma DS. The influence of thin as compared to thick peri-implant soft tissues on aesthetic outcomes: a systematic review and meta-analysis. Clin Oral Implants Res. 2022;33 Suppl 23(Suppl 23):56-71. doi: 10.1111/clr.13789.
18. Wang IC, Barootchi S, Tavelli L, Wang HL. The peri-implant phenotype and implant esthetic complications. Contemporary overview. J Esthet Restor Dent. 2021;33(1):212-223. doi: 10.1111/jerd.12709.
19. Tavelli L, Barootchi S, Avila-Ortiz G, Urban IA, Giannobile WV, Wang HL. Peri-implant soft tissue phenotype modification and its impact on peri-implant health: a systematic review and network meta-analysis. J Periodontol. 2021;92(1):21-44.doi: 10.1002/JPER.19-0716.
20. Malpartida-Carrillo V, Tinedo-Lopez PL, Guerrero ME, Amaya-Pajares SP, Özcan M, Rösing CK. Periodontal phenotype: A review of historical and current classifications evaluating different methods and characteristics. J Esthet Restor Dent. 2021;33(3):432-445.doi: 10.1111/jerd.12661.

Author Contributions:

Maha Maqbool: conceived the study designed, carried out the data collection and statistical analysis and drafted the manuscripts.

Usman Manzoor: Participated in its design and coordination. drafted, read and approved the final manuscript.

Sadia Iqbal: Participated in its design and coordination. Statistical analysis, drafted, read and approved the final manuscript.

All authors are equally accountable for research work

Sittara Javed: Participated in its design and coordination. Statistical analysis, drafted, read and approved the final manuscript.

Hania Ali: Participated in its design and coordination. Statistical analysis, drafted, read and approved the final manuscript.

Zubair Ahmed Khan: Participated in its design and coordination. Statistical analysis, drafted, read and approved the final manuscript.

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