Does Gingival Biotype Affect the Prevalence of Gingival Recession Among Patients At a Tertiary Hospital In Nigeria?

Alade GO[1], Umanah A[2]

Correspondence: Alade GO

Email: *grace.alade@uniport.edu.ng*

[1]*Department of Community Dentistry and Periodontology, Faculty of Dentistry, College of Health Sciences, University of Port Harcourt, Rivers State-Nigeria*

[2]*Department of Conservative and Prosthodontics Dentistry, Faculty of Dentistry, College of Health Sciences, University of Port Harcourt, Rivers State-Nigeria*

Key words: Gingival biotype, Gingival recession, Patients, Prevalence

ABSTRACT

Objectives: To investigate the type of gingival biotype present among participants who attended the Periodontology clinic of the University of Port Harcourt Teaching Hospital (UPTH), Rivers State, and to assess the association between gingival biotype and the prevalence of gingival recession.

Materials and Methods: This was a cross-sectional study conducted among patients who attended the Periodontology clinic at the University of Port Harcourt Teaching Hospital (UPTH). Ethical approval was obtained from the Health Research and Ethics Committee of the Institution. Participants' consents were obtained before the study commenced. Convenience sampling method was employed in participants' selection and data was collected using semi-structured, self-administered questionnaire. The questionnaire had three sections: section A included information on socio-demographic characteristics, section B included information about oral hygiene practices of the participants, while section C included intraoral examination to determine the type of gingival biotype and presence of gingival recession on the six maxillary anterior teeth at the mid-buccal area of the tooth. The gingival biotype was determined using the probe transparency method, based on the visibility of the underlying Williams probe through the gingiva tissue.

Statistical analysis was done using the Statistical Product and Service Solution, SPSS version 25.0 (IBM SPSS Inc. Chicago, Illinois). Statistical significance was considered at $p \leq 0.05$.

Results:

Ninety-eight participants participated in the study: fifty-five (56.1%) were females while 43 (43.9%) were males. Sixty-seven (68.4%) of participants cleaned their teeth once daily.

The prevalence of gingival recession of anterior teeth was 23.47%. Majority (82.7%) of the participants had thick gingival biotype, while 17.3% had thin gingival biotype. Majority of the younger participants had thick gingival biotype, while the elderly participants had thin gingival biotype, ($p=0.026$). Based on gender, 47 (85.5%) and 34 (79.1%) of females and males respectively had thick gingival biotype ($p=0.407$). Concerning the type of toothbrush been used, 10 (38.5%) and 7 (33.3%) of the participants, who use hard textured toothbrush and soft textured toothbrush respectively, presented with gingival recession, while 44 (88%) who use medium textured toothbrush did not have gingival recession, ($p=0.039$). 10 (22.2%) of the participants who use horizontal brushing technique presented with gingival recession, while 4 (80.0%) of the participants who brush with the vertical brushing technique had gingival recession; this finding is statistically significant ($p=0.032$). About 18.5% of participants with thick gingival biotype presented with gingival recession while 47.1%

of participants with thin gingival biotype had gingival recession, (p=0.012).

Conclusion:

Majority of the participants presented with thick gingival biotype. The prevalence of gingival recession in this study was statistically associated with the age of the participants, type of gingival biotype, type of toothbrush, and tooth brushing method used. Gingival recession was more common in participants with thin gingival biotype.

Running Title: Gingival biotype and prevalence of gingival recession

INTRODUCTION

Gingival recession is one of the most common aesthetic concerns of patients with regard to periodontal tissues.[1] It is the displacement of the gingival margin apical to the cemento-enamel junction resulting in the exposure of the root surface, leading to risk for dentine hypersensitivity, root caries, abrasion/erosion of roots and so on.[2] It has been reported to affect oral health related quality of life (OHQol) of patients in Brazil, as it results in individual's dental functional limitation, physical pain and psychological discomfort.[3]

There are a number of factors considered in the aetiology of gingival recession, these can be grouped into inflammatory, iatrogenic, traumatic and anatomical factors.[4,5] Inflammatory factors include dental plaque and subsequent periodontal disease.[6] Dental treatments that lead to recession such as restorative, orthodontic,[7] periodontic or prosthetic treatments are considered as iatrogenic factors,[8,9] examples of traumatic factors are oral piercing,[8] while alveolar bone dehiscence, high frenal attachment, occlusal trauma, thin gingival biotype are considered as part of anatomical factors.[10]

Gingival biotype as an anatomical etiologic factor of gingival recession, is defined as the thickness of the gingiva in the faciopalatal/faciolingual dimension.[1] It is important not just in the aetiology of gingival recession but also in the long-term success of the regenerative surgery, implant therapy and aesthetic restorations.[11] It is therefore imperative to identify the differences in the gingival tissues during treatment planning. Gingival biotype was classified by Ochsenbien et al,[12] into two types; these are scalloped and thin or flat and thick gingiva. Some authors assign 1.5mm as the average gingival biotype, however, this is usually challenging to determine. Hence, gingival biotype is often classified as thick or thin biotype.[13]

Thick gingival biotype usually presents a broad zone of keratinized tissue with flat gingival contour, square form of teeth, well defined contact point and wide, and short interdental papillae. On the other hand, thin gingival biotype is related with a thin band of keratinized tissue and scalloped gingival contour, narrow rectangular teeth, thin and narrow interdental papillae. The effect of inflammation, restorative, trauma and parafunctional habits on the thin and thick gingival biotypes also differs.[14] Inflammation of the periodontium results in increased pocket formation in a thick gingival tissue, while inflammation in a thin gingival biotype leads to gingival recession.[15] Thick gingival biotype shows greater dimensional stability during remodeling compared to thin biotypes.[16] It is assumed that in thick biotypes, the presence of lamina bone adjacent to the outer cortical plate provides the foundation for metabolic support for the cortical bone, hence its stability and sustainability. However, in thin biotype, the lamina bone is scarce or absent, hence the cortical bone is subject to rapid resorption.[16] Other factors such as tooth size, shape and position were reported to affect the type of gingival biotypes seen in patients.[17] Koppolu et al,[18] reported an association between gingival biotype and width of keratinized tissue.

Different methods have been proposed to measure the gingival biotype. They can be invasive or non-invasive. Invasive method includes direct measurement or bone sounding,[19] while examples of non-invasive method are probe transparency method (TRAN),[20] ultrasonic devices,[21] and cone-beam computed tomography scan (CBCT).[22] In the direct method, the tissue thickness is measured using a periodontal probe/endodontic spreader/needle with a

rubber stop after the gingiva is anaesthetised with a topical local anaesthetic gel. The probe is inserted at a midpoint of the gingival margin and mucogingival junction in a perpendicular direction and dimension is recorded using a digital caliper. When the thickness is greater than 1.5mm, it is categorised as thick biotype and if less than 1.5mm, it is considered a thin biotype. This method is invasive and it is limited by the precision of the probe, the angulation of the probe during measurement, and tissue distortion during probing.[19] In the TRAN method, the gingival biotype is considered thin if the outline of the probe is visible through the gingiva, and this method is minimally invasive and has good accuracy.[23] This method was found to be highly reproducible with 85% intra examiner repeatability (kappa-0.7, p-0.002) in a clinical trial of 100 periodontal healthy subjects.[19,24]

The ultrasonic device is a non-invasive method of determining gingival thickness. However, it has the following limitations: difficulty in determining the correct position for attaining reproducible measurements, unavailability and high cost.[21] The CBCT was used recently to visualize and measure the thickness of both hard and soft tissue. It was reported to be accurate and more objective method of measurement of both soft and hard tissues than direct method.[22]

Since gingival biotypes present with different gingival and osseous architectures and exhibit different pathological responses to inflammatory, traumatic or surgical insults, which require different treatment modalities, consideration of the gingival tissue biotypes during treatment planning for more appropriate strategies for periodontal management may be developed, resulting in more predictable treatment outcomes, hence, the justification of this study. Furthermore, there is paucity in the literature on the association between gingival biotype and gingival recession among Nigerians. The aim of this study, therefore, is to investigate the type of gingival biotype present among participants who attended the Periodontology clinic of the University of Port Harcourt Teaching Hospital (UPTH), Rivers State and to assess the association between the type of gingival biotype and the prevalence of gingival recession among the participants.

MATERIALS AND METHODS

This was a cross-sectional study conducted among participants who attended the Periodontology clinic at the University of Port Harcourt Teaching Hospital (UPTH), Port Harcourt, Rivers State, between May and June 2022. Ethical approval was obtained from the Health Research and Ethics Committee of the Institution. Participants' consents were obtained before the study was commenced. The inclusion criteria were as follows: participants presenting all maxillary incisors and subjects having good oral hygiene without any clinical signs of gingival inflammation or attachment loss (periodontal probing does not exceed 3mm). However, participants having pockets exceeding 3 mm or giving any past history of periodontitis, pregnant or lactating women, and participants taking medication with any known effect on periodontal soft tissues were excluded from the study. Ninety-eight (98) out of one hundred questionnaires were returned and correctly filled, giving a percentage response of ninety-eight percent. A non-probability sampling method (convenience sampling) was used to select the participants and data was collected using semi-structured, self-administered questionnaire. The questionnaire had three sections: section A included information on socio-demographic characteristics (age, gender, marital status, occupation), section B included information about oral hygiene practices of the participants, while section C included intraoral examination to determine the type of gingival biotype of the participants (thick or thin) using the Williams periodontal probe on the gingival sulcus of the six maxillary anterior teeth at the mid-buccal area of the tooth (right and left canines, right and left lateral incisors and central incisors). These teeth were selected in this study to assess gingival biotype because the shape, gingival tissue and contact points between the upper anterior teeth are important factors in determining the outcome of aesthetic restorations. The teeth were also examined for presence of gingival recession. A single trained and calibrated examiner conducted the entire procedure.

The gingival biotype was determined using the probe transparency method, based on the visibility of the underlying probe through the gingival tissue. Thin gingiva biotype was determined by the visibility of the Williams probe through the gingiva, when inserted into the gingival sulcus. The thick gingiva was determined if the Williams probe was not visible through the gingiva, when inserted into the gingival sulcus. Gingival recession was recorded to be present if there was an apical migration of the gingival margin, which is measured from the cementoenamel junction to the migrated gingival margin position.

Data analysis:

Statistical analysis was done using the Statistical Product and Service Solution, SPSS version 25.0 (IBM SPSS Inc. Chicago, Illinois). Categorical variables expressed as frequencies with accompanying percentages. Gingival biotype was cross tabulated against participant's age group and gender. Presence of Gingival recession was cross tabulated against participant's age group, gender, type of toothbrush, brushing method and gingival biotype. Chi square was used to determine difference between these variables; statistical significance was considered at $p \leq 0.05$.

RESULTS

Sociodemographic characteristics of participants

Ninety-eight participants were enrolled into the study, 55 of the participants (56.1%) were female while the remaining 43 (43.9%) were male. The age range of the participants was 18-70 years, with a mean age of 38.79±13.39 years. About 52 (53.1%) of the participants were married, while 44 (44.9%) were single and majority 63 (64.3%) had tertiary education. This is as shown in Table 1.

Table 1- Sociodemographic characteristics of participants

Variable		n (%)
Age group (years)	<20	4 (4.1)
	20-29	26 (26.5)
	30-39	24 (24.5)
	40-49	19 (19.4)
	50-59	19 (19.4)
	60-69	5 (5.1)
	70-79	1 (1.0)
Gender	Female	55 (56.1)
	Male	43 (43.9)
Marital status	Single	44 (44.9)
	Married	52 (53.1)
	Separated	1 (1.0)
	Widow (er)	1 (1.0)
Education	Primary	2 (2.0)
	Secondary	19 (19.4)
	Tertiary	63 (64.3)
	Postgraduate	14 (14.3)
Ethnicity	Igbo	28 (28.6)
	Hausa	1 (1.0)
	Yoruba	9 (9.2)
	Others (Ikweere, Ogoni, Efik etc)	60 (61.2)
	Total	98 (100.0)

Oral hygiene practices of participants

Majority 67 (68.4%) of the participants cleaned their teeth once a day: in the morning before breakfast. Eighty-five (86.7%) used toothbrush and fluoride toothpaste. Fifty (51.0%) of the participants used medium textured toothbrushes, while 26 (26.5%) used hard textured toothbrushes. Most of the participants [45 (45.9%)] used the horizontal method of brushing, while 44 (44.9%) used horizontal /vertical methods of brushing and 62 (63.3%) of the participants clean in-between

their teeth; 31 (31.6%) do so occasionally, 53 (54.1%) of the participants use toothpick as interdental cleaning aid. This is shown in table 2.

Table 2: Oral hygiene practices of participants

Variable		n (%)
Cleaning of teeth	Once	71 (72.4)
	Twice	27 (27.6)
Time of Day	Morning before breakfast	66 (67.3)
	Morning after breakfast	5 (5.1)
	Morning before breakfast & night before bedtime	22 (22.4)
	Morning after breakfast & night before bedtime	5 (5.1)
Cleaning Aids	Toothbrush &fluoride toothpaste	85 (86.7)
	Toothbrush & any toothpaste	11 (11.2)
	Toothbrush, fluoride toothpaste and chewing stick	1 (1.0)
	Toothbrush, any toothpaste and chewing stick	1 (1.0)
Type of toothbrush	Soft-textured	21 (21.4)
	Medium-textured	50 (51.0)
	Hard-textured	26 (26.5)
	Don't know	1 (1.0)
Brushing method	Horizontal	45 (45.9)
	Horizontal & roll	1 (1.0)
	Horizontal, roll & vertical	1 (1.0)
	Horizontal & vertical	44 (44.9)
	Roll	1 (1.0)
	Vertical	5 (5.1)
	Don't know	1 (1.0)
Do you clean in-between your teeth	No	36 (36.7)
	Yes	62 (63.3)
How often	After every meal	10 (10.2)
	Every day	18 (18.4)
	3-4 times a week	2 (2.0)
	Occasionally	31 (31.6)
	When needed	1 (1.0)
Interdental cleaning aids used	Dental floss	7 (7.1)
	Toothpick	53 (54.1)
	Dental floss & Toothpick	2 (2.0)
	None	36 (36.7)

Prevalence of gingival biotype among participants

Majority of the participants (82.7%) had thick gingival biotype, while 17.3% had thin gingival biotype. (Figure 1)

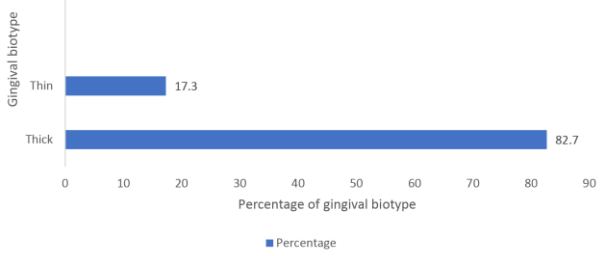

Figure 1- Prevalence of thick and thin gingival biotype among participants

Gingival biotype of participants based on age group and gender

Majority of the participants in the younger age group (<20 [100%], 20-29 [92.3%] and 30-39 [87.5%]) had thick gingival biotype, while majority of the elderly participants (60% of the participants in the 60-69 age group and 100% of the participants in 70-79 age group) had thin gingival biotype. This finding is statistically significant (p=<0.026). Based on gender, 47 (85.5%) and 34 (79.1%) of the female and male participants respectively, had thick gingival biotype, this is, however, not statistically significant (p=0.407). This is shown on Table 3

Table 3: Relationship between Age group, gender, and gingival biotype of participants

Variable		Gingival biotype		
		Thiok (%)	Thin (%)	p value
Age group (years)	<20	4 (100.0)	0 (0.0)	**0.026***
	20-29	24 (92.3)	2 (7.7)	
	30-39	21 (87.5)	3 (12.5)	
	40-49	15 (78.9)	4 (21.1)	
	50-59	15 (78.9)	4 (21.1)	
	60-69	2 (40.0)	3 (60.0)	
	70-79	0 (0.0)	1 (100.0)	
Gender	Female	47 (85.5)	8 (14.5)	0.407
	Male	34 (79.1)	9 (20.9)	

* - Statistically significant

Prevalence of gingival recession and its relationship with gingival biotype

Few of the participants,23 (23.47%) presented with gingival recession, while 75 (76.53%) did not have gingival recession (Figure 2). About 18.5% of participants with thick gingival biotype presented with gingival recession while 47.1% of participants with thin gingival biotype had gingival recession. (Figure 3).

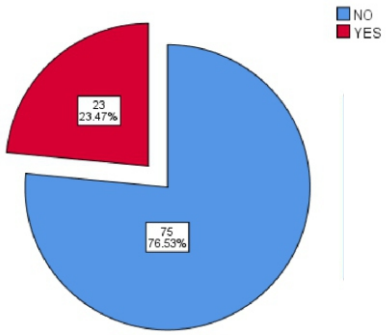

Figure 2: Prevalence of gingival recession

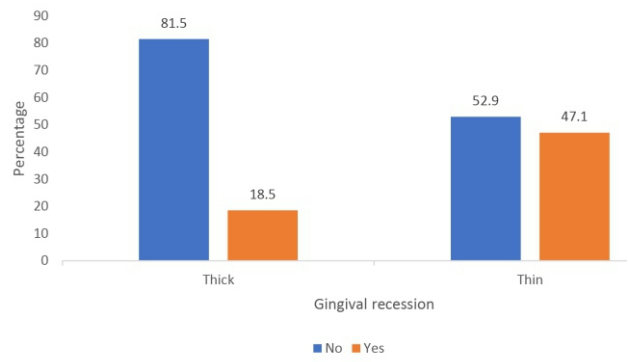

Figure 3: Types of gingival biotype and its relationship with prevalence of gingival recession

Presence of gingival recession based on age group, gender, type of toothbrush, brushing method, interdental aids and gingival biotype.

Ten participants (52.6%) between the 40-49 age group had gingival recession, 2 (40%) of the participants in the 60-69 age group had gingival recession, while none of the participants in <20 age group had gingival recession, and this finding was statistically significant (p = 0.003).

As regards gender, 10 (18.2%) of the females and 13 (30.2%) of the males had gingival recession, while 45 (81.8%) of the females and 30 (69.8%) of the males did not present with gingival recession. This finding, however, is not statistically significant (p = 0.162). Concerning the type of toothbrush being used, 10 (38.5%) and 7 (33.3%) of the participants, who use hard textured toothbrushes and soft textured toothbrushes respectively, presented with gingival recession, while 44 (88%) who use medium textured toothbrush did not have gingival recession. This finding was statistically significant (p = 0.039). Ten (22.2%) of the participants who use horizontal brushing technique presented with gingival recession, while 4 (80.0%) of the participants who brush with the vertical brushing technique had gingival recession. This finding is statistically significant (p = 0.032). Few of the participants, 1 (14.3%) and 17 (32.1%) who use dental floss and toothpick respectively presented with gingival recession, while half of the participants who use both dental floss and toothpick had gingival recession. This finding is not statistically significant (p = 0.095). Majority of

the participants [66 (81.5%)] with thick gingival biotype did not have gingival recession while almost half of the participants 8 (47.1%) with thin gingival biotype presented with gingival recession. This finding is statistically significant (<0.05). This is shown on Table 4

Table 4: Presence of gingival recession among participants based on age group, gender, type of toothbrush, brushing method, interdental aids and gingival biotype

		Presence of Gingival recession		
Variable		**No (%)**	**Yes (%)**	**p value**
Age group (years)	<20	4 (100.0)	0 (0.0)	**0.003***
	20-29	24 (92.3)	2 (7.7)	
	30-39	21 (87.5)	3 (12.5)	
	40-49	9 (47.4)	10 (52.6)	
	50-59	14 (73.7)	5 (26.3)	
	60-69	3 (60.0)	2 (40.0)	
	70-79	0 (0.0)	1 (100.0)	
Gender	Female	45 (81.8)	10 (18.2)	0.162
	Male	30 (69.8)	13 (30.2)	
Type of toothbrush	Hard	16 (61.5)	10 (38.5)	**0.039***
	Medium	44 (88.0)	6 (12.0)	
	Soft	14 (66.7)	7 (33.3)	
	Don't know	1 (100.0)	0 (0.0)	
Brushing method	Horizontal	35 (77.8)	10 (22.2)	**0.032***
	Horizontal & roll	1 (100.0)	0 (0.0)	
	Horizontal, roll & vertical	0 (0.0)	1 (100.0)	
	Roll	1 (100.0)	0 (0.0)	
	Vertical	1 (20.0)	4 (80.0)	
	Don't know	1 (100.0)	0 (0.0)	
Interdental cleaning aids	None	32 (88.9)	4 (11.1)	0.095
	Dental floss	6 (85.7)	1 (14.3)	
	Toothpick	36 (67.9)	17 (12.1)	
	Dental floss & Toothpick	1 (50.0)	1 (50.0)	
Gingival biotype	Thick	66 (81.5)	15 (18.5)	**0.012***
	Thin	9 (52.9)	8 (47.1)	

***-Statistically significant**

DISCUSSION

In this study, we investigated the types of gingival biotype and its association with prevalence of gingival recession among the participants who presented at the Periodontology clinic in Port Harcourt, Rivers State. Also, the effects of age, type of toothbrush, and brushing technique on the prevalence of gingival recession among participants were assessed.

A large percentage of the participants had thick gingival biotype, this follows the trend in a previous study, in which most of the participants had thick gingival biotype. [25] However, in some other studies conducted in Saudi Arabia[26] and India,[27] though more participants had thick gingival biotype, the difference between the thick gingival biotype and the thin gingival biotype was marginal.[26,27]

It has been reported in the literature that gingival thickness varies with age: thicker gingival biotype is found in the younger age group, while thin gingival biotype is found in the older age group.[28] The finding in this present study corroborated this report, as majority of the younger participants had thicker gingival profile, while the elderly participants presented with thin gingival biotype in tandem with that of previous studies.[29,30] This variation in the thickness of the gingival biotype with age, may be related to changes in oral epithelium caused by age-linked thinning of the epithelium and diminished keratinization, as well as, the interdental papilla which may recede with age leading to greater frequency of thin biotype in the elderly.[31] Reports from studies conducted in

Nepal,[28] Kashmiri,[32] and Yenepoya[33] showed that males had a thick gingival biotype and females possessed a thin gingival biotype. Interestingly, the females in this study presented with thick gingival biotype just like the males as there was no significant difference between them, with the finding comparable to that from one previous study,[29] but in contrast to some other previous studies,[34,35] in which more females presented with thin gingival biotype. This difference could be linked to racial variation, where blacks, both male and female, have more thick gingival biotype.

The prevalence of gingival recession among participants in this study was 23.47%, which is similar to 22.2% reported by Osadolor et al.[36] However, it is higher than 13.2% reported by Nwhator et al. [37] and lower than 32.1% reported by Soroye et al.[38] Periodontal health has been associated with a thick biotype as thick gingival tissue can withstand trauma, it also has less inflammation and, therefore, a better ability to resist gingival recession (GR).[39] On the other hand, the thin gingival biotype is delicate, less resistant to inflammatory insults, and more prone to gingival recession.[40] In this study, few of the participants with thick gingival biotype had gingival recession, while about half of those with thin gingival biotype presented with gingival recession. This finding is statistically significant, and is in tandem with a previous study [41] but in contrast to the finding from a study conducted among 400 participants aged 20-35 years,[27] in which there was no significant difference between the gingival biotype and prevalence of gingival recession. This may be due to age difference, as the study by Shah et al,[27] was conducted among young participants with age range of 20-35 years, while the participants in this study were both young and old individuals.

In this study, the prevalence of gingival recession increased with age among the participants, this follows the trend in previous studies.[36,38] The increase in prevalence of gingival recession with age may be because of the cumulative effect of periodontal disease and prolonged exposure to predisposing agent of gingival recession such as faulty toothbrushing.[42] Although the finding in this study was not statistically significant, the males presented with higher prevalence of gingival recession compared to females, which is similar to that from previous studies.[37,38]

The texture of toothbrush used during brushing and the wrong method of brushing are factors that can predispose to gingival recession.[43] Gingival recession caused by toothbrushing has been shown to be increased by toothbrushing frequency, a horizontal or scrub toothbrushing method, bristle hardness, tooth brushing duration, and the frequency of changing a toothbrush.[44] In this study, despite the fact that there was a significant difference between the type of toothbrush used and the presence of gingival recession, most of the participants who used the hard-textured toothbrushes did not present with gingival recession. Also, majority of the participants who used horizontal brushing technique did not have gingival recession, this is in contrast to the finding from previous study.[38] The reason for this finding in the present study, could be because the questionnaire is subjective and some of the participants may not know the exact method of toothbrushing. Furthermore, majority of the participants had thick gingival biotype. Other factors that can aggravate gingival recession, such as toothbrushing duration and tooth brushing frequency were not taken into cognisance in this study.

It can, therefore, be inferred from this study that the aetiology of gingival recession is multifactorial and gingival biotype may be an important factor in the aetiology of gingival recession. The limitation of this study includes the fact that the effect of the width of keratinized tissue was not assessed to determine if there is any correlation between gingival biotype, width of keratinized tissue and gingival recession. Hence, further study is recommended that will determine if there is an association between gingival biotype and these variables among Nigerians.

CONCLUSION

Majority of the participants presented with thick gingival biotype. Gingival recession was more common in participants with thin gingival biotype. The prevalence of gingival recession in this study was statistically associated with the age of the participants, type of gingival biotype,

type of toothbrush and tooth brushing method used.

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