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Assessment of Gingival Biotypes in Patients Visiting a Tertiary Care Centre in Eastern Nepal

Sajeev Shrestha,[1] Khushboo Goel,[1] Surya Raj Niraula[2]

[1]Department of Periodontology and Oral Implantology, BP Koirala Institute of Health Sciences, Dharan, Nepal, [2]School of Public Health and Community Medicine, BP Koirala Institute of Health Sciences, Dharan, Nepal

ABSTRACT

Background: Evaluation of gingival biotype has become a routine procedure in periodontal examination because the type of gingival biotype can positively or negatively affect the outcome of periodontal, restorative, orthodontic and implant therapy. The aim of the study was to assess the proportion of types of gingival biotypes in patients visiting a tertiary care center in eastern Nepal.

Methods: Two hundred and fifty patients between 25 to 45 years attending the Periodontology and Oral Implantology were assessed. Gingival biotype of the patents was determined with Probe Transparency technique

Results: Out 250 patients assessed, 73 patients (approximately 29.2 %) had thin gingival biotype and remaining 177 patients (approximately 70.8 %) had thick gingival biotype. The number of the male with thin biotype was 31 whereas the number of the male with thick biotype was 82. Similarly, out of 137 female, 42 had thin biotype and remaining 95 female had thick biotype. The types of biotypes were not associated with gender (p=0.67).

Conclusions: Thicker gingival biotype was the more common type of gingival biotype in patients attending the tertiary care center of Eastern Nepal. The occurrence of thick gingival biotype was more common in Adivasi Janajati ethnic community compared to Brahmin / Chhetri ethnic community.

Keywords: Adivasi janajati; gingival biotype, probe transparency technique

INTRODUCTION

The term "gingival biotype" was introduced to describe the thickness of gingiva in a buccolingual dimension (thin or thick).[1] Various studies have shown a wide range of clinical difference in form and thickness of tissue biotypes in individuals.[2-5] Different factors contribute to these differences including genetics, tooth morphology, tooth position, age, gender, and growth.[6] Studies have revealed that thin gingival biotype is linked to more problems. In response to inflammation, thin gingival biotype was associated with rapid loss of bone and gingival recession.[2,7] No study is conducted yet in Nepalese population which assesses the prevalence of gingival biotype so far as our knowledge. Thus this study was conducted with the objectives to determine the prevalence of different biotype in upper central incisor in patients visiting a tertiary care hospital in eastern Nepal and to evaluate the relationship between the width of keratinized gingiva and gingival biotype.

METHODS

A cross-sectional study was conducted at College of Dental Surgery, BP Koirala Institute of Health Sciences, Dharan, Nepal. Two hundred and fifty subjects were selected from patients attending OPD of Department of Periodontology and Oral Implantology between June 2017 and November 2017 who fulfilled the inclusion criteria. Every third patient fulfilling the inclusion criteria was enrolled into the study sample till the sample size was reached. The inclusion criteria for the study included subjects having all maxillary incisors, subjects having good oral hygiene without any clinical signs of gingival inflammation (no bleeding on probing) or loss of attachment in maxillary incisors, patients of either sex between 25 to 45 years and patient with at least 20 natural teeth within both jaws. The exclusion criteria for the study were: patients under medicaments known to increase gingival overgrowth, systemic diseases having gingival manifestations and/or influence the bone metabolism, pregnant, presence of periodontal

Correspondence: Dr Sajeev Shrestha, Department of Periodontology and Oral Implantology, BP Koirala Institute of Health Sciences, Dharan, Nepal, Email: sajeevshrestha@gmail.com, Phone: +9779862746197.

probing depths ≥4 mm, periodontal recessions, crown restorations or fillings in the upper central incisor area, sensitivity to Lugol's iodine solution, incisal attrition and anterior crowding. The sociodemographic characteristics of the recruited patients were also recorded.

The gingival biotype for each of the subjects was determined by single examiner based on the transparency of periodontal probe through gingival sulcus (TRAN) technique.[4] Gingival biotype evaluation was made with a calibrated and standardized periodontal probe {University of North Carolina- 15 (UNC-15), Hufriedy}. For determination of the gingival biotype, the probe was inserted at the mid-facial aspect of maxillary right and left central incisors with a gentle force. If the outline of the underlying periodontal probe could be seen through the gingiva, it was categorized as thin; if not, it was categorized as thick (figure 1). If both right and left central incisors were of the same biotype, it was recruited for the study otherwise excluded from the study.

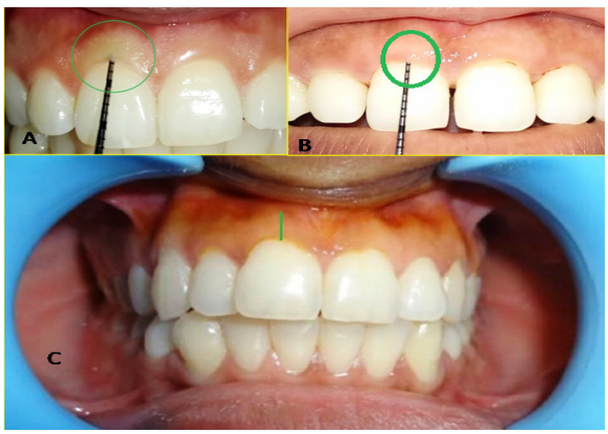

Figure 1. Gingival biotypes and keratinized gingiva evaluation, A= Thin gingival biotype, B= Thick gingival biotype, C= width of Keratinized gingiva.

In order to detect the mucogingival junction, 2% of Lugol's iodine solution was applied to patient's upper labial alveolar mucosa, more specifically in the mucogingival junction area. Alveolar mucosa gives an iodo-positive reaction while keratinized tissue, because of low glycogen content, gives an iodo-negative reaction. After demarcation of the mucogingival junction, the width of keratinized gingiva was measured by using "UNC-15 probe", from the margin of gingiva to the line of demarcation of the mucogingival junction on a maxillary right central incisor. The width of attached gingiva was determined later by subtracting sulcus depth from the measurement of the width of keratinized gingiva. The width of keratinized gingiva and attached gingival were measured in both right and left maxillary central incisors. The measurements were recorded to the nearest millimeter marking. The intra-examiner repeatability of the clinician who performed all the clinical examination was analyzed in first 12 patients. Patients were re-examined after a week of the first examination. For categorical variable (gingival biotype), Cohen's K statistics was used. For continuous variables (width of keratinized gingiva and width of attached gingiva), intra-examiner repeatability was evaluated using Pearson's correlation coefficient. Written informed consent was obtained from the entire participants who were enrolled in the study. The study was carried out after approval by the Institutional Review Committee of BPKIHS.

For sample size calculation, a study done by Shah R[8] was considered. According to them, the proportion of thin gingival biotype was found to be 43.25 % in Department of Periodontics, Bapuji Dental College and Hospital, Davangere, Karnataka, India. Taking proportion, p=43.25 %, q= 56.75% and Permissible error (l) = 15 % of p = 6.48. Using Sample size calculation formula, $n= Z^2 *p*q / l^2$ = 224.5≈ 225 was obtained. Finally adding 10% of the sample for non-response, the final sample size, n = 247.

Data was entered into MS-Excel and analysis was done using SPSS software (version 11.0). Chi-square and independent t-test were applied to find out the significant association between dependent and independent variables at 95% CI where p=0.05.

RESULTS

A total of 250 patients attending to the Department of Periodontology and Oral Implantology were recruited in the study. The socio-demographic characteristics that comprise age group, gender, smoking status, brushing frequency and ethnic community of the study population were tabulated in table 1. The ethnic/caste groups division was as per Central Bureau of Statistics census 2001.[9] More than 50 % of study population comprised of Adivasi Janajati ethnic community.

Table 1. Socio-demographic characteristics of patient attending Periodontology OPD.

Characteristics	Categories	Number of Patients	Percent
Age group in years	25-29	105	42.0
	30-34	41	16.4
	35-39	33	13.2
	>=40	71	28.4
Mean age in years ± SD (Min to Max)		33.41 ± 7.5 (25 - 45)	

Gender	Male	113	45.2
	Female	137	54.8
Smoking	No	227	90.8
	Yes	23	9.2
Brushing frequency	Once	150	60.0
	Twice	100	40.0
Ethnicity	Adivasi Janajati	132	52.8
	Brahmin/ Chhetri	76	30.4
	Madhesi	29	11.6
	Others	13	5.2
Total		250	100

The K value of 0.75 (p=0.005) for gingival biotype determination, Pearson's correlation coefficient (r) of 0.93 for measurement of the width of keratinized gingiva (p<0.001) and Pearson's correlation coefficient (r) of 0.95 for measurement of the width of attached gingiva (p<0.001) revealed good intra-examiner repeatability.

Out of 250 patients, 73 patients had thin gingival biotype while remaining 177 had thick gingival biotype. The average width of keratinized gingiva and attached gingiva of maxillary right and left central incisors were shown in table 2.

Table 2. Width of keratinized and attached gingiva of Maxillary Central Incisors.

Characteristics	Maxillary right central Incisor Mean ± SD	Maxillary left central Incisor Mean ± SD	p-value
Average width of Keratinized gingiva	4.86 ± 1.15 mm	4.72 ± 1.11 mm	0.18†
Average width of attached gingiva	3.78 ± 1.09 mm	3.66 ± 1.10 mm	0.19†

† independent t-test

The socio-demographic characteristics of study the population with different gingival biotype were depicted in table 3.

Table 3. Socio demographic characteristics of patient with different gingival biotype.

Characteristics	Gingival biotype Thin (n-73)	Thick (n=177)	p value	Remark
Age group in years	25-29	39 (37.1%)	66 (62.9%)	0.005	S*
	30-34	11 (26.8%)	30 (73.2%)		
	35-39	12 (36.4%)	21 (63.6%)		
	>=40	11 (15.5%)	60 (84.5%)		
Gender	Male	31 (27.4%)	82 (72.6%)	0.675	NS*
	Female	42 (30.7%)	95 (69.3%)		
Smoking	No	68 (30.0%)	159 (70.0%)	0.479	NS*
	Yes	5 (21.7%)	18 (78.3%)		
Frequency of tooth Brushing	Once	40 (26.7%)	110 (73.3%)	0.321	NS*
	Twice	33 (33.0%)	67 (67.0%)		
Ethnicity	Adivasi Janajati	27 (20.5%)	105 (79.5%)	0.009	S*
	Brahmin /Chhetri	30 (39.5%)	46 (60.5%)		
	Madhesi	11 (37.9%)	18 (61.5%)		
	Others	5 (38.5%)	8 (61.5%)		
Total		73	177		

**Chi square test The highest number of patient*

with thin biotype was observed in 25 - 29 years whereas the highest number of patient with thick gingival biotype in ≥40 years patient and the difference was statistically significant (p=0.005). Although thin gingival biotype was more common in female compared to male, it was not statistically significant (p=0.675) in our study. The population belonging to Janajati ethnic community had thicker gingival biotype compared to other ethnic community, which was also statistically significant (p<0.009). Both, the mean width of keratinized and attached gingiva were significantly different between thin and thick gingival biotype as shown in table 4.

Table 4. Width of keratinized and attached gingiva in the patient with different gingival biotype.

Character-istics	Gingival biotype Thin (n-73)	Thick (n=177)	t value	p value	Remark
Width of Keratinized gingiva	4.144 ±.9555 mm	5.059 ± 1.0663 mm	6.654	<0.001	S†

Width of attached gingiva	3.116± 0.9447 mm	3.969 ±1.0241 mm	6.328	<0.001	S†

† denotes independent t-test

DISCUSSION

Studies have shown a significant variation in both width and thickness of facial gingiva within and among individuals. Different type of gingival biotype exhibits different pathologic response when subjected to inflammatory, traumatic or surgical insults. It has been suggested that plaque-associated inflammation may result in a deep pocket with a thick-flat gingival biotype and recession with thin- scalloped biotype.[2] Patient with thin biotype are more likely to have gingival recession following surgical therapies.[10] The present study was carried out to determine the gingival biotypes in maxillary central incisors in patients attending a hospital in eastern Nepal. Central incisor was chosen because it is the one of the tooth which influences the aesthetics and the determination of biotype is easier and more accurate for that tooth.

Many methods (both invasive and noninvasive) have been utilized to evaluate the thickness of facial gingiva and other parts of the masticatory mucosa. These methods include conventional histology on cadaver jaws, [11] visual evaluation, probe transparency, modified calipers, [4] injection needles, transgingival probing, [12,5] histologic sections, [13] ultrasonic devices, [1] and cone beam computed tomography (CBCT).[5]

Of various methods of determining gingival biotype, TRAN technique was utilized in the present study owing to its advantages over others. Simple visual evaluation method cannot be used in clinical practice because even experienced clinicians fail to distinguish between thick and thin biotype most of the times.[14] Another commonly used technique, transgingival probing with a probe or endodontic file with silicon stopper, has also disadvantages such as the measurement can be affected by probe angulations and tissue distortion during probing.[12] Further, it is unethical to do transgingival probing in healthy gingiva just to determine thickness. Although CBCT scans are more objective than direct measurement, Fu et al.[5] in a study had shown no statistical difference between clinical measurement with caliper and CBCT measurement of both soft tissue and alveolar bone thickness. Other disadvantages may be its expensiveness to install, a necessity of technical skills, radiation exposure, and unavailability in each and every hospital. Ultrasonic devices appear to be least invasive, reliable and valid tools to measure gingival thickness but they are not popular and not available everywhere. The TRAN method of determining gingival biotype was highly reliable as De-Rouck observed an intraexaminer repeatability of 85% for gingival thickness assessment.[3] The TRAN technique was chosen in the present study because it the simple, easy, minimally invasive and routinely done procedure during the periodontal examination.

The highest number of the patient was in 20 – 25 year category followed by 40 – 45, 30-34 and 35 – 39 year category, respectively. The observation of present study revealed that with the increase in the age, there is more prevalence of thicker gingival biotype. This result was in disagreement with the study done by Vandana et al.[15] who showed the thinner thickness of facial gingiva in older individuals compared to younger. The reasons behind this difference might be that 1) in the current study, we used TRAN technique to determine gingival biotype which does not give an exact measurement of thickness of gingiva and 2) the gingival epithelium might not be atrophic or decreased keratinized at 40 - 45 year because atrophic epithelium is usually observed above the age of 65 years.[16]

The percentage of thick biotype in the sample was 70.8 % and most commonly present in male gender which was in accordance with studies [3, 17] that also showed the prevalence of thick biotype in two- third of sample population. The prevalence of thick gingival biotype differs in races, ethnicity, and geographic location. In Mangalore, the prevalence of thick and thin gingival biotype among male was 63% and 37 %, respectively whereas the prevalence of thick and thin biotype among female was 41 % and 59%, respectively.[18] The result of the present study was in accordance with previous studies done by Shah et al.[8] and Cook et al.[19] where they didn't observe any significant difference in biotypes between male and female patients.

In the present study, gingival biotypes were not found to be different in either smoker or non-smoker. This finding was inconsistent with a previous study[20] which showed a higher number of smokers with thicker gingival biotype. It was hypothesized that nicotine increases the rate of proliferation of gingival epithelium[21] and increase the production of collagen[22] thus increasing epithelial thickness among smokers. The reason behind insignificance might be because of very low number of smokers in our study.

In a study of the effect of toothbrush stimulation on the keratinisation **of the gingival epithelium,** Kuntsche et al.[23] showed a significant thickening in all epithelial

layers in an animal study. However, increase in keratinization of epithelium is a result of the removal of plaque rather than the direct effect of stimulation by a toothbrush.[24] The result of our study also revealed that there was no significant difference between one who brushes once or twice daily. Further, this insignificance might be because we had not considered the techniques of tooth brushing.

Ochsenbein and Ross[25] suggested that long-tapered teeth tend to have thin-scalloped periodontium, whereas wide-square teeth have thick-flat periodontium. On the other hand, various studies [19, 26] reported no relationship between the tooth shape and gingival thickness according to the crown width (CW) and Crown length (CL). Gingival thickness influences the biotype of the gingiva, whereas, crown width (CL): Crown length (CW), crown shape and papilla height are responsible for determining the gingival bioform/scallop.[27] Therefore, the crown shape was not considered in the present study.

A higher proportion of thicker biotype in the Adivasi janajati ethnic community (indigenous nationalities) compared to other ethnic groups has suggested a need for investigations in genetic factors that can affect gingival biotype.

In the present study, we use Lugol's solution for determination of mucogingival junction (MGJ) because the intra and interexaminer reproducibility were shown to be better with a visual with histochemical staining method (intra-class correlation coefficient 0.99) compared to the visual method and the functional method for MGJ determination in order to measure the apico-coronal dimension of the gingiva.[28] Data from current study validated an association between gingival biotype and width of keratinized and attached gingiva. The present findings were consistent with the study done by Olsson et al.[26] who demonstrated a significant relationship between the thickness of gingival margin and width of keratinized gingiva, and buccolingual width of central incisor after performing regression analysis. Further, they also found 1.2 to 1.35 mm wider keratinized gingiva with wide crown form compared to narrow crown form central incisor. After performing a multivariate models analysis, Stein et al.[29] identified CW/CL and GW as significant predictors for gingival thickness at CEJ, whereas CW/CL was a significant predictor for buccal cortical bone thickness at the crest.

CONCLUSIONS

The proportion of thick gingival biotype compared to thin biotype in maxillary central incisor was higher in patients attending the tertiary care hospital of eastern Nepal. The proportion of thick gingival biotype was higher in older age group compared to younger age group. Thicker biotype was more common in adivasi janajati ethnic community compared to other communities. However, the result obtained by the hospital-based study could not be extrapolated to the general population.

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