ORIGINAL ARTICLE

Relationship of Gingival Biotype with Schneiderian Membrane Thickness Using Cone Beam Computed Tomography (CBCT)

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ABSTRACT

Aim: To find out the relationship of gingival biotype with schneiderian membrane thickness using cone beam computed tomography (CBCT) in patients at tertiary care dental hospital presenting for routine periodontal care.
Methods: In this cross-sectional study, a total of 150 patients were observed in department of Periodontology, Fatima Memorial Hospital College of Medicine and Dentistry Lahore. Patients were clinically evaluated and gingival biotype wasrecorded. Afterthat cone beam computed tomography was performed to assess the patient's schneiderian membrane thickness from mesial of maxillary 2nd premolar todistal of maxillary 2nd molar due to many anatomical variations of maxillarysinus.
Results: In this study the mean age of the patients was 38.75±8.17 years, 70 (46.67%)patients were male. Thin biotype was found in 66(44%) patients and thickbiotype was found in 84 (56%) patients. In thin biotype the mean thickness of schneiderian membrane was 0.58±0.085mm while in thick biotype the mean of schneiderian membrane was1.25±0.07mm (p-value<0.05).
Conclusion: The study concluded that there is significant relationship exist between the schneiderian membrane and thickness of biotype.
positive correlation of gingival biotype with width of keratinizedgingivainmaxillaryanteriorteeth.
Keywords: gingival biotype, schneiderian membrane, Cone Beam Computed Tomography (CBCT), missing teeth

INTRODUCTION

Replacement of the missing teeth to restore mastication, esthetics and phonetics are very important. Replacements can be done by removable or fixed prosthetic appliances. One of them is dental implants which are part offixed prosthetic appliances, in which implants are placed in the jaw bones andthe required stability will be achieved through osseointegration between bone and implants[1,2].

Maxillary sinus is one of the four paranasal sinuses located near the nose. Thepyramidal-shaped maxillary sinus is the largest paranasal sinus as well whichdrains in the middle meatus. The sinus is lined by mucoperiosteum, with cilia that beat towards the ostia. This membrane is known as "Schneiderian Membrane", which is histologically bilaminar membrane with pseudostratified columnar epithelial cells. The size of sinuses not only varies in different individuals but also on two sides of the same individual. Normal thickness of schneiderian membrane is approximately 1mm[2].

Gingival biotype is known as the quality of soft tissue profile surrounding theteeth. It has significant impact on the outcome of the restorative, regenerativeor implant therapy. Its correlation also exists with gingival recession followed by any surgical procedure. "Gingival biotype" was first proposed by Ochsenbein and Ross[3], then Sibert and Lind he introduced the term "periodontal biotype". They classified the gingival contour into two types "thick" and "thin" based upon the visual appearance of the gingiva. Claffey and Shanley defined the thin tissue biotype having gingival thickness <1.5mmandthicktissuebiotypewithgingivalthickness≥2mm[4].
Manyinvasive&non-invasive methods are introduced to assess the gingival biotype. However, based upon the transparency of the periodontal probe through the gingival margin is an excellent method to determine the thickness of gingiva.

In the current era one of the challenges for the replacement of posterior maxillary teeth by implants is inadequate height of alveolar bone. To overcome this problem sinus lifting procedures are used in which the floor of the sinus is elevated which is lined by schneiderian membrane, to place the bone graft material into the cavity. But the major complication of this procedure is the

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perforation of schneiderian membrane during sinus floor elevation. Therefore, it is important to predict the possible sinus membrane perforation before the elevation of the sinus floor for implant placement. Many authors reported different anatomical factors to predict the sinus membrane perforation.[5] Whereas many other reported that male patients have thick schneiderian membrane than female patients[2].

The aim of this study is to determine the correlation between gingival biotype and schneiderian membrane thickness. However, Aimetti et al already reported a correlation between schneiderian membrane thickness and gingival biotype in 2008, in which he took mucosal biopsies from maxillary sinus during otorhinolaringologic surgical intervention and correlate t with gingival thickness of maxillary central incisors. Results of this study reveal that the thickness of schneiderian membrane was 0.97±0.36mm. Patients having thick gingivalbio type had1.26±0.14mm thickness of sinus lining compared to 0.61±0.15mm thickness in patients with thin gingival biotype, but further investigations are still needed to support the preliminary data[6]. Results showed that gingival thickness is a reliable factor in predicting schneiderian membrane thickness. Frequency of thick gingival biotype was 55% and thin was 45%[6].

For the treatment plan of the posterior region of maxilla a detail radiographicinvestigation should be done. Many important anatomical areas in maxillacannot be assessed properly by two dimensional radiographs due overlapping of the structures. In order to avoid this problem a three-dimensional radiograph which is cone beam computed tomography should be done to getthe detail analysis of the maxilla. Cone beam computed tomography is a novel 3D imaging modality which has been used since 1998. The advantage of this technique is it requires less radiation exposure and produces high quality radiographic images.

METHODOLOGY

The present study was conducted at department of Periodontology, Fatima memorial Hospital College of medicine and dentistry Lahore, from 7th August 2020 to 8th February 2021. In this study a total of 150 patients aged 18-60 years of both genders having no attachment loss were included in the study. Subjects having periodontal pockets of more than 3mm, patients with gingival enlargement, crowded teeth, fixed prosthesis in maxillary

anterior teeth, missing teeth in anterior maxilla, smokers, pregnant patients, using medications having effect on periodontal tissues, and/or history of surgery in anterior maxilla were excluded from the study. A detailed history followed by clinical examination of the patient was performed to select patient according to inclusion and exclusion criteria. The Periodontal biotype (gingival thickness) were determined by using the transparency of the periodontal probe through gingival sulcus, by placing the periodontal probe into the midfacial site of gingival sulcus of maxillary central incisors. After that cone beam computed tomography was performed to assess the patient's schneiderian membrane thickness from mesial of maxillary 2nd premolar to distal of maxillary 2nd molar due to many anatomical variations of maxillary sinus.

The data was collected using a customized proforma which collected the patient's biographical data in addition to the study variables. Assessment of both gingival biotype and schneiderian membrane thickness was performed by the same examiner to address any bias.The collected data was analyzed using SPSS version 20. Frequency and percentages was calculated for categorical variables like gender and gingival biotype (thick and thin). Mean +SD was calculated for numerical variables like age and width of keratinized gingiva. Pearson correlation coefficient test were applied to see relationship between gingival biotype and width of keratinized gingiva. All the results were presented in the forms of table and charts. Data was stratified for age & gender; chi square test was used post stratification with a P value ≤0.05 considered as significant.

RESULTS

In this study total 150 patients were enrolled.Themean age of the patientswas 38.75±8.17 years with minimum and maximum ages of 23 & 56 years respectively (Table 1).

Table 1: Age in years (n=150)

Mean	38.75
Standard Deviation	8.17
Minimum	23.00
Maximum	56.00

Gender distribution was analyzed as 70(46.67%) patients were male while 80(53.33%) patients were female. Male to female ratio of the patients was1.14:1 (Fig.1).

Fig 1: Gender
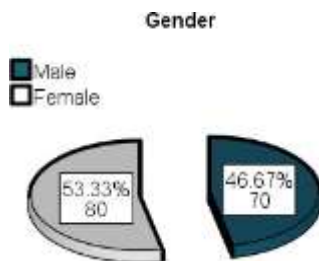
Mean thickness of gingival biotype of the patients was1.78±0.44mm with minimum and maximum thickness of 1&2.50mm respectively (Table 2).

Table 2: Thickness of Ginival Biotype(mm) (n=150

Mean	1.78
Standard Deviation	0.44
Minimum	1.00
Maximum	2.50

Of 150 patients, thin biotype was found in 66(44%) patients and thick biotype was found in 84(56%) patients (Fig. 2).

According to this study the mean thickness of schneiderian membrane of the patients was 0.96±0.32mm with minimum and maximum thickness of 0.32 &1.39mmrespectively (Table3).

In thin biotype the mean thickness of schneiderian membrane was 0.58±0.085mm while in thick biotype the mean of schneiderian membrane was1.25±0.07mm. This difference was statistically significant i.e. p-value=<0.001 (Table 4).
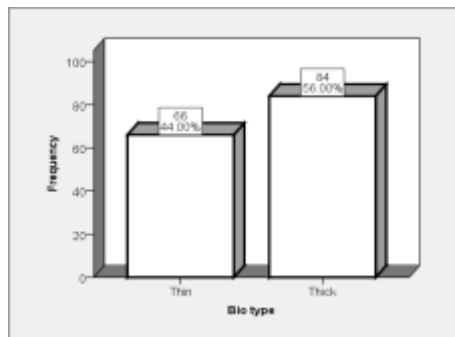
Fig. 2:

Table 3: Thickness of schneiderian membrane(mm) (n=150).

Mean	0.96
Standard Deviation	0.34
Minimum	0.32
Maximum	1.39

Table 4: Thickness of schneiderian membrane(mm)

	Biotype	
	Thin	Thick
n	66	84
Mean	0.58	1.25
Standard deviation	0.085	0.07

P value <0.001

In patients having age ≤ 40 years the thin biotype was found in 39(59.1%) patients whereas thick biotype was found in 53(63.1%) patients. Similarly, in patients having age>40yearsthe thin biotype was found in 27(40.9%) patients whereas thick biotype was found in 31(36.9%) patients. This difference was statistically in significant i.e. p-value=0.617 (Table 5).

Table 5: Age in years

Age in years	Biotype		Total
	Thin	Thick	
≤ 40	39(59.1%)	53(63.1%)	92(61.3%)
>40	27(40.9%)	31(36.9%)	58(38.7%)
Total	66(100%)	84(100%)	150(100%)

P value 0.617

In male patients the thin biotype was found in 29 (43.9%) patients whereas thick biotype was found in 41(48.8%) patients. Similarly in female patients the thin biotype was found in 37 (56.1%) patients whereas thick biotype was found in 43(51.2%) patients. This difference was statistically insignificant i.e., p-value=0.553 (Table 6).

Table 6: Gender

Gender	Biotype		Total
	Thin	Thick	
Male	29(43.9%)	41(48.8%)	70(46.7%)
Female	37(56.1%)	43(51.2%)	90(53.3%)
Total	66(100%)	84(100%)	150(100%)

P value 0.553

In patients having age ≤40 years: the mean thickness of schneiderian membrane in thin biotype was 0.58±0.09mm while the mean thickness of schneiderian membrane in thick biotype was 1.25±0.07mm (p-value=<0.001). In patients having age>40 years: the mean thickness of schneiderian membrane in thin biotype was 0.58±0.08 mm while the mean thickness of of schneiderian membrane in thick biotype was 1.25±0.06mm (p-value=<0.001) (Table 7).

Table 7: Thickness of schneiderian membrane (mm)

Age groups	Biotype		P value
	Thin	Thick	
≤ 40	0.58±0.09	1.25±0.07	<0.001
>40	0.58±0.08	1.25±0.06	<0.001

In male patients: the mean thickness of schneiderian membrane in thin biotype was 0.58±0.093mm while the mean thickness of schneiderian membrane in thick biotype was 1.26±0.069mm (p-value=<0.001). In female patients: the mean thickness of schneiderian membrane in thin biotype was 0.58±0.08mm while the mean thickness of schneiderian membrane in thick biotype was1.24±0.069mm(p-value=<0.001) (Table 8).

Table 8: Thickness of schneiderian membrane(mm)

Gender	Biotype		P value
	Thin	Thick	
Male	0.58±0.09	1.26±0.07	<0.001
Female	0.58±0.08	1.24±0.07	<0.001

DISCUSSION

Demands for an excellent esthetic outcome requires the establishment of periodontium and its compatibility with the surrounding hard and soft tissues.Various factors influence the position and form of gingival tissue around thenatural tooth or fixed prosthesis. The gingival biotype plays an important role in harmonizing the ideal esthetics for any restorative procedure. The dimensions of gingival and different parts of the masticatory mucosa demonstrate considerable site and subject variability. They have become the subject of considerable interest in restorative and periodontics from both anepidemiologic,as wellas atherapeuticpointofview[7,8].

In this study the mean thickness of gingival biotype of thepatientswas1.78±0.44mm. In this study thin biotype was found in 66 (44%) patients andthick biotype was found in 84(56%) patients. In our study male have higher number of thick biotype as compared to females.

Rucha Shah, N.K. Sowmya et al[9] demonstrated in their study that the prevalence of thin biotype was 43.25%, and that of thick gingival biotype was 56.75%. The mean gingival thickness of central incisor, lateral incisor, and canine in Group I was 1.11±0.17, 1.01±0.16 and 0.82±0.17mm, respectively. Similar prevalence rates have been reported in a previous study[10].

Vinaya Bhat and Sonali Shetty[8] results in their study that the thicker biotype was observed to be more prevalent in male population with short, wider forms of maxillary central incisors while the females had thinner biotypes and narrow, long form of maxillary central incisors. Among the different age groups, young group had a thicker biotype compared to older group. A study by Rosa Valletta et al[11] reported that regarding gingival biotype, most patients presented a thick gingival biotype (upper anterior teeth 86.78%; lower anterior teeth 52.07%).

Studies by De Rock et al[12] and Muller et al[13] stated 1/3rd of the sample to be females with a thinner biotype. De rock et al. in their study presented that male participants had thicker gingiva to conceal the periodontal probe when compared to female. Study by Eghbali et al[14] documented the presence in 1/3rd of female samples with thin scalloped gingival form while 2/3rd of the male samples with broad band of keratinized tissue and thick flat biotype.

In our study, in thin biotype the mean thickness of schneiderian membrane was 0.58±0.085mm while in thick biotype the mean of schneiderian membrane was 1.25±0.07mm (p-value=<0.05). So according to this study we can say that there is significant relationship exist between the schneiderian membrane and thickness of biotype.

S Chaturvedi et al[15] done a study on analysis of schneiderian membrane thickness and its relationship with gingival biotype and arch form. The author of this study showed that average thickness of the Schneiderian membrane was 1.18 ± 0.43mm on left side and 1.09 ± 0.41mm on right side with a range of 0.50 - 2.00mm. Mean schneiderian membrane thickness was more in case of thick gingival biotype and with square arc form both on right and left sides. The Schneiderian membrane thickness was positively and highly associated with gingival biotype.

Aimitti et al[6] in 2008 investigated the correlation between gingival phenotype and schneiderian membrane and found that mean schneiderian Membrane thickness was 1.26±0.14mm in individuals with thick gingival compared to 0.61±0.15mm in subjects with thin gingival tissues and recommended the use of gingival thickness as reliable parameter to predict sinus membrane thickness, Deepthi et al. in 2012 later reported a strong correlation between schneiderian membrane thickness and gingival biotype[16].

CONCLUSION

According to this study the most of 56% patients had thick biotype whereas 44% patients had thin biotype. From the findings of this study it is furtherconcluded that there is significant relationship exist between the schneiderian membrane and thickness of biotype. Future studies including larger groups of participants should be necessarily conducted in order to establish the relationship between the schneiderian membrane and biotype thickness of the patients.

Conflict of interest: Nil

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