

Research Article

Disparity in Thickness of Palatal Mucosa at Different Sites in Terms of Age and Gender in a South Indian Population

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Abstract

Background and aims. Palatal masticatory mucosa serves as donor material in periodontal plastic surgery. This study determined the palatal mucosal thickness in Indian subjects aged 14–59 years by direct bone sounding and its association with gender and age.

Materials and methods. This observational study was conducted on 40 dentate systemically and periodontally healthy Indians (age range of 14–59) including 20 males and 20 females, who were divided into two age groups: young (14–21) and older (30–59). A bone sounding method with a periodontal probe and a prepared clear acrylic stent were used to define 12 fixed measurement points for estimation of mucosal thickness. Multiple linear regression analysis was performed to examine the association of age and gender with mean mucosal thickness at subject level. Student's t-test was used to determine the difference in mucosal thickness between two age groups, and between genders at each measurement point.

Results. Younger group had significantly thinner mucosa (2.73 ± 0.43) than the older group (2.79 ± 0.28). The exception was at first premolar and first molar areas along the gingival margin. Females had thinner mucosa than males in the same age group, with no significant differences. Overall, the thickness of palatal mucosa increased from canine to first molar and in sites farthest from the gingival margin towards the mid-palate.

Conclusion. The palatal mucosa in the area extending along the tip of canine to mesiopalatal cusp tip of first molar seemed an appropriate donor site for grafting procedures in both young and older individuals

Key words: Mucosa, Connective tissue, Alveolar Bone

Introduction

The masticatory mucosa of the palate serves as a donor material in plastic surgery. In periodontics, grafts from the palate are harvested for various plastic surgery procedures.^{1,2} Periodontal plastic surgery is used widely to fulfill esthetic and functional demands. It is used for root coverage, to augment minor ridge deformities, for vestibuloplasty, for papillae reconstruction and for socket preservation.^{2,3} Several materials have been used for soft tissue augmentation, including autogenous subepithelial connective tissue graft and materials like acellular dermal matrix. Despite the introduction and availability of various materials, subepithelial connective tissue graft remains the most effective and predictable graft material for various plastic surgical procedures.^{2,3}

The volume and thickness of the graft obtained from palatal donor site is important for selection of treatment modalities and is a determinant of treatment outcomes. There are various methods to measure the thickness of palatal mucosa.²⁻¹⁰

There are few reports in the literature investigating the masticatory mucosa thickness in regions commonly used as donor site for soft tissue grafts.^{2,3,11} The majority of studies have determined the thickness of masticatory mucosa in edentulous patients wearing complete dentures; in contrast, the mucosal thickness of hard palate in dentate subjects has been determined in few investigations.^{1,3,8,12,13} The knowledge about palatal mucosa thickness in Asian population is still more limited.³

Hence, due to limited knowledge about the masticatory mucosa thickness in human hard palate of dentate subjects, and because of its basic interest as a potential donor site for soft tissue augmentation procedure, the present investigation was undertaken to determine the palatal mucosal thickness in Indian subjects aged 14–59 years by direct bone sounding. The association of gender and age with the thickness of palatal mucosa was also investigated.

Materials and Methods

After obtaining informed consent, 40 dentate systemically healthy persons were included in the study (20 males and 20 females) and divided into two age groups. The younger age group (14–21 years of age) consisted of 20 subjects, ten males and ten females; the older age group (30–59 years of age) consisted of 20 subjects, 10 males and 10 females. The inclusion criteria were complete dentition in the upper arch with or without third molars and healthy

periodontal tissue with no loss of attachment and no probing depth greater than 4 mm in the upper arch. The following exclusion criteria were considered: 1) history of palatal or tuberosity surgery; 2) history or present diagnosis of stomatological disease in the palate or tuberosity; 3) pregnancy or lactation; 4) use of any medication possibly affecting periodontal tissue; 5) wearing of removable or fixed devices in the upper arch; 6) smokers; 7) any severe tooth malposition, rotation or spacing

In the first visit, an upper arch alginate impression was made. A study model and a clear acrylic stent were fabricated. Measurement points were defined and marked on the study model (Figures 1 A).¹¹ Line P indicated the midline of the palate and line A was located at gingival margin. Lines Ca, P1, P2, and M1 were positioned along the tip of the canine to line P, lingual cusp of the first premolar to line P, lingual cusp of the second premolar to line P and mesio-palatal cusp of the first molar to line P, respectively. Line B was located 3 mm from line A. Lines C and D were located at $\frac{1}{4}$ and $\frac{1}{2}$ distances between lines B and P. A small headed tapered fissure bur was used to create holes at marked measurement points on the clear acrylic stent at 90° to the surface of the stent. This stent was prepared to provide the constant location for the measurement of mucosal thickness (Figure 1B).

In the second visit, with the stent placed properly on the upper arch, 12 measurement points were marked with a gentian violet pencil corresponding to the holes prepared on the stent (Figure 1 C). The thickness of the hard palate was assessed by first anesthetizing the palate with a spray and then 2% lignocaine, 1:80,000 epinephrine injection. The greater palatine and incisive nerves were blocked with 0.1 mL and 0.05 mL of anesthetic agent, respectively. The anesthetic agent was injected slowly and the thickness measurements were performed 30 minutes after the injection. This step was designed to avoid any soft tissue increase associated with injecting the anesthetic solution. Without the stent the thickness of palatal masticatory mucosa was recorded by “bone sounding” with a UNC-15 probe and a rubber stopper (Figure 1 D).

If any rugae were present in the probing area, the “valley” point instead of hill point was defined as measurement site. The values were rounded up to nearest millimeter reading.

All the measurements were done twice by two different investigators with an interval of 10 minutes and the average of two measurements was recorded as the final thickness at each location.

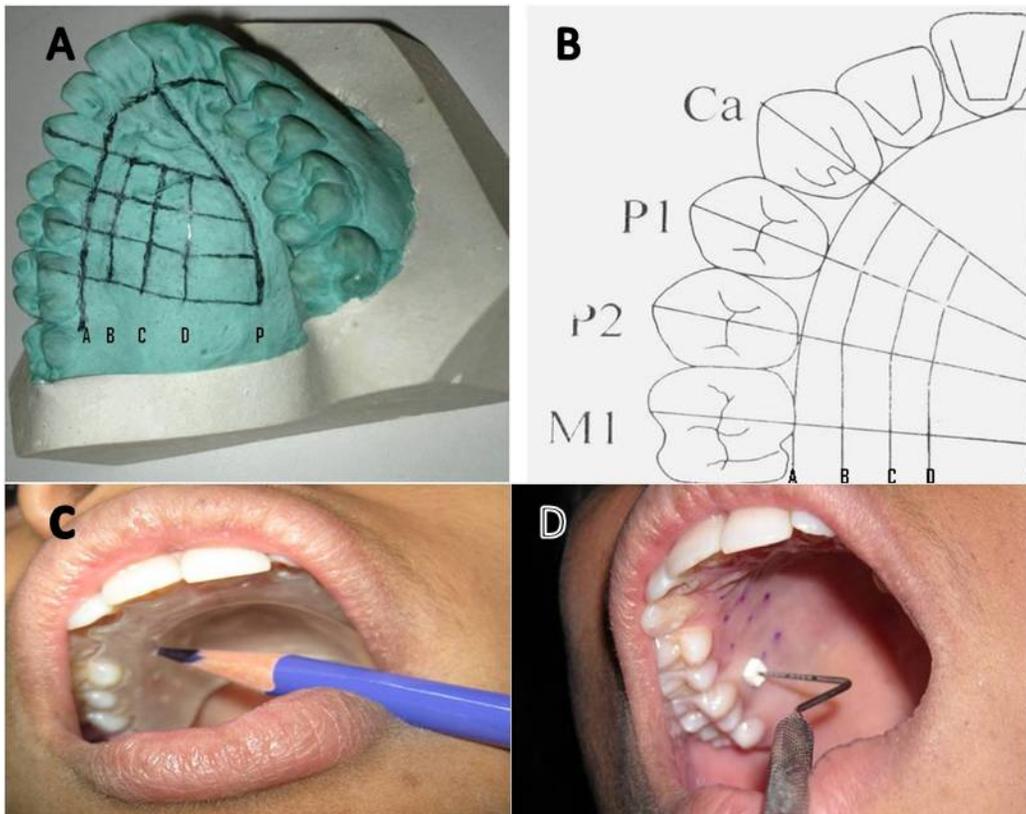


Figure 1. A: Twelve cross points among lines Ca, P1, P2, M1, M2, B, C, and D were defined as measurement points. B: Measurement points marked on the study model. C: Measurement points on palate marked with gantial violet pencil according to holes prepared on stent. D: Thickness of palatal masticatory mucosa measured by bone sounding with a periodontal probe and rubber stopper.

Data were analyzed both at site level (individual measurement points) and subject level (mean score of all measurement points). Multiple linear regression analysis was performed to examine the association of age and gender with mean mucosal thickness at subject level. Student's t-test was used to determine the difference in mucosal thickness between two age groups, and between genders at each measurement point.

Results

The mean palatal mucosal thickness was found to be 2.73 mm in the younger age group and 2.79 mm in the older age group. Table 1 presents the mean scores of palatal thickness at subject level. Table 2 compares the mean palatal thickness of 14–21 and 30–59 age groups by Student's t-test. As indicated by the data, the older-age participants had thicker mucosa at almost all the points, particularly at points C and D along the canine where the values were statistically significant. On the other hand, younger age group participants had significantly thicker mucosa at point B along the first premolar and first molar. Table 3 compares the mean palatal thickness

of males and females by Student's t-test. Data indicated no significant difference in palatal mucosal thickness between males and females at all the measurement points. The analysis of palatal mucosa at each measurement point indicated that the palatal mucosa was thinnest in the canine region, increasing in thickness posteriorly; in addition, the thickness increased with increasing distance from the tooth.

Discussion

The aim of the present study was to determine the thickness of palatal masticatory mucosa as a potential donor site in Indian subjects ranging in age between 14 and 59 years by direct bone sounding. The gingival margin and mid-palatal line were used as fixed reference points to define 12 measurement points on the hard palate. The association of age and gender with thickness of palatal mucosa was also considered. The second molar area was not included in the study as this area has low predictability, low accessibility and proximity to neurovascular bundles.³

The results of the present study indicated that palatal mucosa is thinnest in the canine region and

Table 1. The mean scores of palatal thickness at subject level

Age group (in years)	14-21			30-59			14-59		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Means	2.6917	2.7750	2.7333	2.8083	2.7750	2.7917	2.7500	2.7750	2.7625
Std.Dev.	0.5168	0.3334	0.4254	0.2861	0.2967	0.2842	0.4109	0.3072	0.3583
SE	0.1634	0.1054	0.0951	0.0905	0.0938	0.0636	0.0919	0.0687	0.0567

Table 2. Comparison of the mean palatal thickness of 14-21 year and 30-59 year age groups by student's t-test

Variable	Age groups	n	Mean	SD	t-value	p-value	Significance	
Canine	B	14-21yrs	20	1.6500	0.4894	-0.6766	0.5027	NS
		30-59yrs	20	1.7500	0.4443			
	C	14-21yrs	20	2.3500	0.5871	-3.1833	0.0029	S
		30-59yrs	20	2.9500	0.6048			
	D	14-21yrs	20	2.6000	0.6806	-2.7365	0.0094	S
		30-59yrs	20	3.1500	0.5871			
1st Pre-molar	B	14-21yrs	20	2.1500	0.4894	1.9386	0.0600	S
		30-59yrs	20	1.8500	0.4894			
	C	14-21yrs	20	2.8000	0.8944	-0.2090	0.8356	NS
		30-59yrs	20	2.8500	0.5871			
	D	14-21yrs	20	3.3500	0.9333	0.0000	1.0000	NS
		30-59yrs	20	3.3500	0.4894			
2nd Pre-molar	B	14-21 yrs	20	2.3000	0.7327	0.9189	0.3639	NS
		30-59 yrs	20	2.1000	0.6407			
	C	14-21 yrs	20	3.0000	0.7947	-1.1888	0.2419	NS
		30-59 yrs	20	3.3000	0.8013			
	D	14-21 yrs	20	3.3000	0.8013	-1.0597	0.2960	NS
		30-59 yrs	20	3.5500	0.6863			
1st Molar	B	14-21 yrs	20	2.2500	0.6387	1.8535	0.0716	S
		30-59 yrs	20	1.9000	0.5525			
	C	14-21 yrs	20	3.0000	0.8584	0.0000	1.0000	NS
		30-59 yrs	20	3.0000	0.7255			
	D	14-21 yrs	20	4.0500	0.9445	1.1767	0.2466	NS
		30-59 yrs	20	3.7500	0.6387			

increases in thickness posteriorly. This finding is inconsistent with previous studies which indicated a decrease in mucosal thickness from the second premolar to the first molar.^{2,3,11} In the present study, the younger group had significantly thinner mucosa (2.73±0.43) than the older group (2.79±0.28). The exception was at first premolar and first molar area along line B. This may be due to a high prevalence of exostoses in this area in adults.^{12,13} There have been few studies of palatal masticatory mucosa thickness in terms of age. Wara-aswapati et al¹¹ examined 62 Asians and reported that younger age group had a thicker mucosa than the older age group. It may be possible that thickness of orthokeratinized epithelium of the hard palate mucosa increases with age, resulting in thicker palatal mucosa in older subjects. In addition, it is not unreasonable to hypothesize that body weight has an effect on the

amount of adipose tissue and small mucosal glands in submucosal layer that results in increased thickness of palatal mucosa.² The majority of older subjects appear to have a higher body mass index as compared to younger subjects, and this can influence palatal thickness. The gingival recession associated with age might also have influenced the results. As a result, there might have been a shift in lines A, B, C and D to a position closer to the mid-palatine suture region, which could lead to thicker mucosa.³

Data indicates no significant difference in palatal mucosal thickness between males and females at all the measurement points. The result was consistent with studies conducted by Studer et al¹ and Wara-aswapati et al,¹¹ using a bone sounding technique. It was in contrast to a study by Song et al,³ using computerized tomography and Muller et al,¹⁴ using an ultrasonic device, who showed that the thickness

Table 3. Comparison of the mean palatal thickness of males and females by Student's t-test

Variable	Group	n	Mean	SD	t-value	p-value	Significance.	
Canine	B	Male	20	1.7500	0.4443	0.6766	0.5027	NS
		Female	20	1.6500	0.4894			
	C	Male	20	2.7000	0.5712	0.4728	0.6391	NS
		Female	20	2.6000	0.7539			
	D	Male	20	3.0000	0.7255	1.1567	0.2546	NS
		Female	20	2.7500	0.6387			
1st Pre-molar	B	Male	20	2.0000	0.4588	0.0000	1.0000	NS
		Female	20	2.0000	0.5620			
	C	Male	20	2.7000	0.8013	-1.0597	0.2960	NS
		Female	20	2.9500	0.6863			
	D	Male	20	3.3500	0.9333	0.0000	1.0000	NS
		Female	20	3.3500	0.4894			

of palatal masticatory mucosa was significantly greater in males.

The bone sounding technique, a direct clinical measurement using a periodontal probe and minimal local anaesthesia along with a prepared clear acrylic stent to ensure consistent locations for repeated measurements, was employed in this study to assess thickness of palatal mucosa. It has been previously suggested that this technique is relatively reliable for determining bone levels.^{1,9,11,15,16} In the hard palate area, a measurement error of 0.2 mm was reported when the mucosal thickness was assessed by bone sounding.¹ Recently computerized tomography has been introduced as an alternative method of measuring palatal masticatory mucosa to provide accurate, continuous and storable data.³ However, this method is not cost-effective and further studies on its validity and reliability are needed.

There may be other confounding factors that influence the thickness of palatal mucosa, such as genetic factors and body mass index that need to be further investigated.

Conclusion

In general free gingival graft procedure can be performed to correct mucogingival problems in young adults but can result in problems like keloid formation and color mismatch. Therefore, subepithelial connective tissue graft as an alternative can result in better esthetic outcomes. As suggested by Langer and Langer, ideal thickness of subepithelial connective tissue graft is 1.5 mm.¹⁷ Although the palatal mucosa was thinner in young adults than in older age group, the thickness in younger population ranged from 1.65 to 4.05 mm, suggesting that subepithelial connective tissue graft can be obtained from the palate. Therefore, it should be considered as a treatment modality in young patients. The palatal mucosa in the area extending

along the tip of canine to mesiopalatal cusp tip of first molar appear to be an appropriate donor site for grafting procedures in both young and adult individuals.

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