

Assessment of the Maximum Graft Dimensions at the different Anatomic Form of the Hard Palate as a Donor Site

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ABSTRACT

Objectives: The aim of the study was to evaluate the maximum dimensions (height and length) of the soft tissue graft that can be safely harvested from the palatal vault in shallow, medium and high arched palate individuals.

Materials and Method: A total of 151 systemically and periodontally healthy individuals (75 males and 76 females) participated in the study. Plaster impressions were taken, and casts were prepared for maxillary arch. The maximum height and length of different palatal vault shape were measured with the help of 23 gauge wire and aluminum foil which was adapted onto the cast.

Results: The mean length of the area for harvesting the graft was 27.95 ± 1.75 mm for low arched palate/ flat palate, 28.74 ± 2.14 mm for the medium arched palate and 29.37 ± 1.97 mm for high arched palate ranging from 24 to 34 mm. The mean value of graft height was evaluated as 6.89 ± 1.20 mm for the low arched palate, 7.43 ± 1.08 mm for the medium arched palate and 8.17 ± 0.94 mm for high arched palate ranging from 4 to 10 mm.

Conclusion: Both graft height and length, as well as the area of graft, was minimum in low/flat type and maximum in High/steep type.

Keywords: Connective tissue graft, masticatory mucosa, palatal vault, greater palatine artery, periodontitis.



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INTRODUCTION

The masticatory mucosa from the palate or tuberosity serves as donor material in plastic surgery.¹ Use of free soft tissue autograft procedures has expanded the available armamentarium in periodontics, which is an attempt which has been made, which fulfills the goal of reconstruction of normal functional architecture.² The palatal masticatory mucosa is widely used as a connective tissue donor site in periodontal plastic surgery and particularly in gingival recession treatment, with reported high success rates.³⁻⁷ The palate is the most commonly used donor site when considering autogenous soft tissue grafting. The hard palate is composed of the palatal process of the maxillary bone and the horizontal process of the palatine bone. It is covered with masticatory mucosa. The height, length, and thickness of donor tissue that can be obtained vary with the different anatomic dimensions of the palatal vault. The greatest height (inferior-superior dimension) can be found in the high (U-shaped) palatal vault. The greatest length (anterior-posterior dimension) can be found in a large palate. The thickest tissue can be found in that area from the mesial line angle of the palatal root of the first molar to the distal line angle of the canine.⁸ When the palatal vault is shallow (flat), neurovascular structures will be located more proximally to the CEJ. When the palatal vault is high (U-shaped), the structures will be located at a greater distance from the CEJ. The retrieval of donor tissue from the premolar region in the high and average palate offers a greater margin of safety than retrieval from the shallow (flat) palatal vault concerning the neurovascular structures. Caution must always be exercised not to violate the neurovascular bundle when obtaining the donor tissue, but extreme caution must be exercised when the palate is shallow.⁹ Reiser *et al.*⁹ suggested that variation regarding size and shape of the palatal vault may affect the dimensions of the donor tissue harvested. Therefore, we aimed to study the maximum dimension of the graft that can be procured from the palatal vault regarding height and

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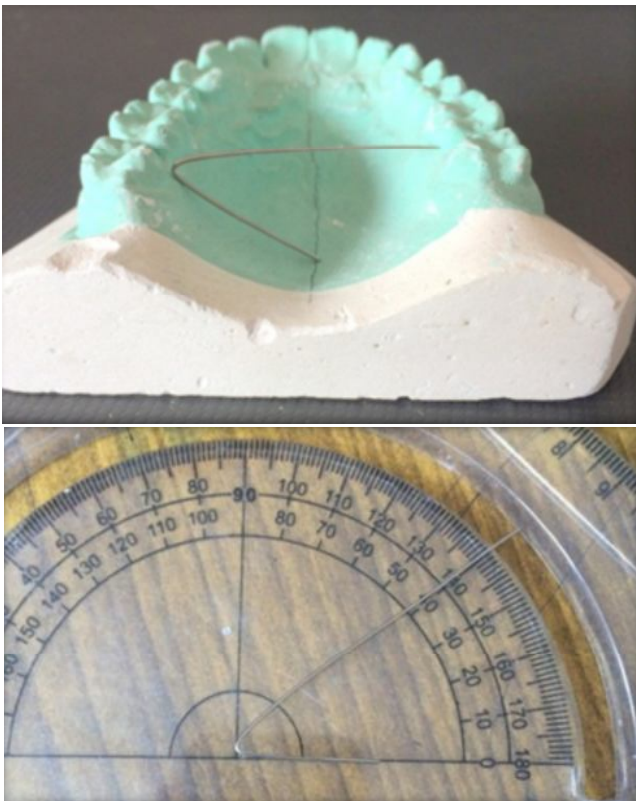


Figure 1a: 23 gauge wire adapted onto the cast; b: Angle measured on the protractor

length with the usual course of the greater palatine artery in a population free of periodontal disease.

MATERIALS AND METHODS

Total of 151 systemically and periodontally healthy individuals participated in the study (75 males and 76 females). The individuals were categorized according to gender and different palatal arch forms. Impressions of the upper jaw were taken using irreversible hydrocolloid impression material poured by a type IV dental stone. The study was conducted in accordance with the Helsinki Declaration of 1975, as revised in 2008. Informed consent to obtain impressions of the upper jaw was obtained from

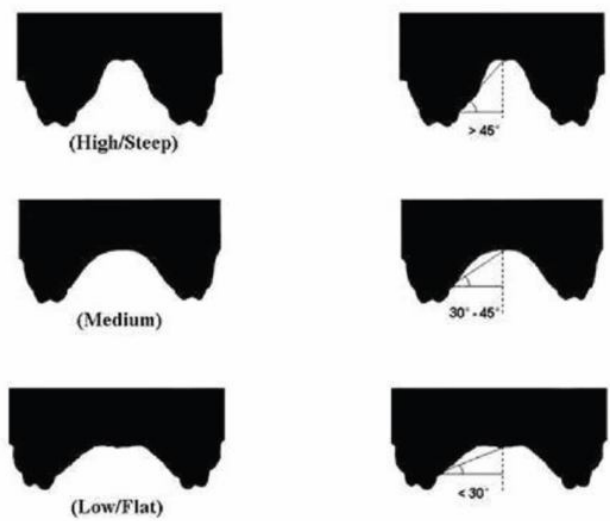


Figure 2: Classification of palatal vault form¹⁰ (Kim SJ, Donovan DM, Blanchard SV, Kowolik JE. The relationship between acute otitis media and the anatomic form of the hard palate. *Pediatr Dent* 2008; 30: 9-14.)

all patients. Angle for the palatal arch form is measured with the help of 23 gauge wire, adapted onto the palate (Fig. 1). The angle of different palatal vault was classified as Class I- High arch or steep, Class II- Medium, or Class III- Low-arch or flat (Fig. 2).¹⁰

The emergence of the greater palatine artery (GPA) has been located midway between the gingival margin of the second molar and the midline raphe.¹¹ To verify the position of the GPA, half of the measurements made with the help of aluminum foil adapted to the palate to measure the accurate length from GM to midpalatine raphe to the nearest millimeter were recorded (Fig. 3). The length of the palatal vault donor site was measured from the mid-palatal aspect of the maxillary canine to the mid-palatal aspect of the maxillary second molar at the GPA level. A safety margin of 3 mm from the GPA and 2 mm from the gingival margin were subtracted from previous measurements.

Statistical analysis: Data was analyzed using SPSS version 15. Data has been represented as number and percentages



Figure 3a: Aluminium foil adapted; b: Foil is folded to half at approximate location of greater palatine artery; c: Appr oximate measurement of greater palatine artery from gingival margin

and mean and standard deviation. ANOVA and chi-square tests have been used for the purpose of comparison. A p value less than 0.05 indicate a significant association.

RESULTS

A total of 151 maxillary casts were obtained from completely dentulous patients contains 75 males and 76 females. In both males and females, medium arched palate type was most common (Table 1). Although in males high arched palate type was more common than low arched palate type whereas in females low arched palate type was more common as compared to high arched palate type (Fig. 4), yet the difference between two genders was not significant statistically ($p>0.05$), thus indicating that palate type was independent of gender.

Table 1: Gender-wise comparison of palate type

Type	Male (n=74)		Female (n=77)	
	No.	%	No.	%
Low	21	28.4	21	27.3
Medium	29	39.2	39	50.6
High	24	32.4	17	22.1

As per the measurement technique discussed in material and method the mean length of the area for harvesting the graft was 27.95 ± 1.75 mm for low arched palate or flat palate, 28.74 ± 2.14 for the medium arched palate and 29.37 ± 1.97 mm for high arched or steep palate ranging from 24 to 34 mm. The mean graft height is shown in Table 2. The mean value evaluated as 6.89 ± 1.20 mm for the low arched palate, 7.43 ± 1.08 mm for the medium arched palate and 8.17 ± 0.94 mm for high arched palate, ranging from 4 to 10 mm. All these measurements were made after subtracting the safety margin from the graft height. The graft height and length, as well as area of graft, were minimum in low arch or flat type and maximum in high arch or steep type (Fig. 5). Statistically, this difference among different palate types

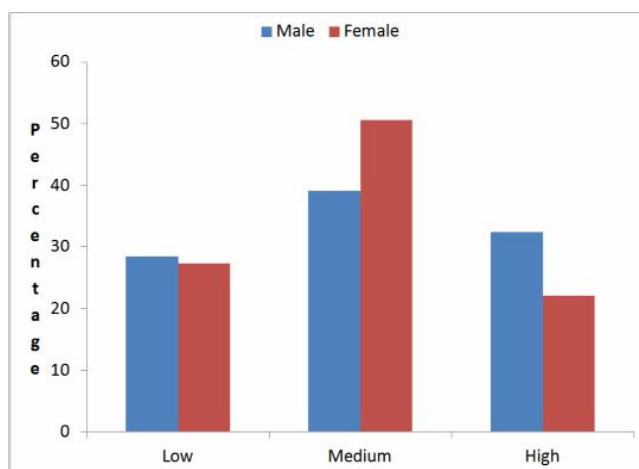


Figure 4: Graph showing gender-wise comparison of palate type

was found to be significant ($p<0.001$), thus confirming our hypothesis that with increment in palate angulation the graft area increases significantly ($p<0.001$).

DISCUSSION

Periodontal reconstruction of damaged tissues has taken an increasingly important role in periodontal plastic surgeries.¹² The palate is covered with oral masticatory mucosa which is widely used as a tissue donor site, especially in periodontal plastic surgery. FGG and CTG can be obtained from the palate to correct the deformities of the alveolar or gingival mucosa.¹³ Inadequate donor tissue area from the palate may be either due to varying anatomic form of palate or due to insufficient thickness of the soft tissue to be harvested.¹²

The primary objective of the present study was to determine the dimension of the donor tissue for procurement of the soft tissue graft (FGG and CTG) from different types of palatal vault concerning the usual course of the greater palatine artery in a selected population of patients free of periodontal disease. In the cohort of selected healthy patients older than 21 years, this study showed that the CTG and FGG harvested from the different palatal donor site are large enough to allow safe withdrawal in a high percentage of patients.

Our results are concordant with those reported by Momnet-Corti *et al.*,¹⁴ who found a mean height of graft as 5 to 8 mm as a safe withdrawal from the donor site. There is some concern regarding variations in the anatomy of the palatal vault that may interfere with the graft dimensions

Table 2: Association between Graft dimensions and Palate Size

	Palate type	N	Mean	Std. Deviation	Minimum	Maximum
Graft height (mm)	Low/ Flat	42	7.06	1.209	4	10
	Medium	68	7.43	1.087	6	10
	High/ Steep	41	8.17	.943	7	10
	Total	151	7.53	1.160	4	10
	$F=11.477; p<0.001$ (ANOVA)					
Graft length (mm)	Low/ Flat	42	27.95	1.752	25	32
	Medium	68	28.74	2.141	24	34
	High/ Steep	41	29.37	1.972	26	34
	Total	151	28.69	2.050	24	34
	$F=5.244; p=0.006$ (ANOVA)					
Area	Low / Flat	42	198.54	42.48	100.00	304.00
	Medium	68	214.55	42.07	137.50	340.00
	High / Steep	41	240.85	37.89	169.00	320.00
	Total	151	217.24	43.82	100.00	340.00
	$F=11.257; p<0.001$ (ANOVA)					

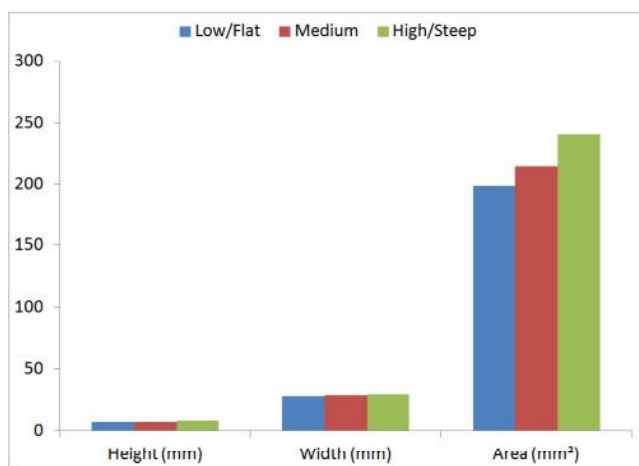


Figure 5: Graph showing association between Graft dimensions and Palate Size

that can be harvested. Reiser *et al.*⁹ proposed to subdivide the palatal vault into three groups, high, average, and shallow and suggested that caution should be observed not to endanger the GPA when dealing with a shallow palatal vault. They found that the average distance from the CEJ to the neurovascular bundle in high arched palate is 17 mm, medium arch palate is 12 mm and low arched palate is 7 mm.⁹ With the help of anatomical landmark and proper localization of greater palatine artery and nerve and taking the safety margin into consideration it can be concluded from the study that it is possible to harvest the minimum of 96 mm² of graft area with the length of minimum 24 mm and graft height of 4 mm in any palatal arch form. Based on measurements done on cast impressions of the upper jaw in patients free of periodontal disease, our study suggests that caution should be taken not to endanger the GPA when dealing with a shallow palatal vault.

The palatal masticatory mucosa is one of the most commonly used the free gingival graft (FGG) and connective tissue donor site for gingival augmentation. However, the potential risk of damaging the greater palatine artery (GPA) due to anatomical variations in the palatal vault is always there. The anatomy of the palatal vault regarding size and shape may affect the maximum dimensions available for the safe procurement of soft tissue from the palatal. From the present study, it may be concluded that both graft height and length, as well as the area of graft, was minimum in low-arch or flat type and maximum in high arch or steep type.

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