

# Correlation between Mesiodistal width of Maxillary Anterior Teeth and Interhamular Notch Distance amongst Dakshin Kannada Population

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## ABSTRACT

**Introduction:** Selection of maxillary anterior teeth for edentulous patients is primarily a subjective approach as there is no universally accepted method which can be used reliably in the absence of pre-extraction records. The aim of this in-vivo study was to find relationship between mesio-distal width of six maxillary anterior teeth and inter-hamular notch distance.

**Material and methods:** One hundred maxillary dentulous impressions were made (19 to 23 years old) using stock tray and irreversible hydrocolloid impression material. Mesio-distal width of the six maxillary anterior teeth and inter-hamular notch distance were measured using digital caliper on stone casts by two independent observers. Data so obtained was analyzed using SPSS-16 data analysis software and was analyzed using sing Karl Pearson correlation test, Kolmogorov-Smirnov test and p-value of less than or equal to 0.05 was considered as statistically significant.

**Results:** Pearson correlation coefficient was  $r = -0.037$ , and hence, showed poor correlation ( $p = 0.713$ ) between the mesiodistal width of six maxillary anterior teeth and the inter-hamular notch distance.

**Conclusion:** No correlation was found between the total mesio-distal width of maxillary six anterior teeth and the inter-hamular notch distance among the Dakshina Kannada population.

**Keywords:** Maxillary Anterior Teeth, Hamular Notch, Edentulous, Teeth Selection, Prosthodontics

## INTRODUCTION

Teeth selection is a crucial step in complete denture fabrication, which can be disappointing if it does not meet up to the patient's expectations. Pound stated five qualities which must work together in harmony in order to restore facial appearance and function for edentulous patients, namely; size, form, color, arrangement, and framing of the teeth.<sup>1</sup>

Selection of ideal anterior teeth for edentulous patient becomes a difficult task in the absence of pre-extraction records which may deprive us from getting the desired results. For anterior teeth selection a number of facial landmarks have been proposed, however; none of them are reliable enough to be regarded as a universally accepted single method for artificial tooth selection.<sup>2-5</sup> Young reviewed 21 techniques spanning between 1700 and 1951 relating to the issue and concluded none of them as satisfactory. He recommended the development of an operator esthetic sense as most effective.<sup>6</sup>

The main problem of biometric measurements that use soft tissue structures for artificial tooth selection is the absence of a static relationship of soft structures, as the width of soft tissues may change due to several factors like aging, weight and built of a person. Therefore, a relationship between dimensions of

the anterior teeth with anatomical landmarks can be drawn reliably only when the landmarks are independent of such factors.

Pterygomaxillary notch is a palpable notch formed by the junction of maxilla and the pterygoid hamulus of the sphenoid bone, and does not undergo any change by factors such as weight change, ageing, and extractions.<sup>7,8</sup> Pterygomaxillary notches can be easily identified on dental casts and may be used as an alternative anatomical landmark for anterior teeth selection. Johnson and Stralton also suggests inter-ptyergomaxillary notch distance as a guide for selection of artificial anterior teeth.<sup>9</sup>

Currently, no universally accepted anatomical landmarks exist for selecting maxillary anterior teeth for edentulous patients. The purpose of our study was to determine correlation between mesio-distal width of six maxillary anterior teeth and inter-hamular notch distance among Dakshina Kannada population.

## MATERIAL AND METHODS

The study was conducted in Department of Prosthodontics, Crown and Bridge and Implantology of a dental college in the Dakshina Kannada Region of South India. A total of 100 individuals native the region, within an age group ranging from 19 to 23 years were selected for the study. Parameters for inclusion and exclusion of subjects for the study were as follows:

**Inclusion criteria:** Individuals having intact teeth, Angle class I skeletal and occlusal relationship and a minimal of tooth rotation or compression were allowed as subjects of study.

**Exclusion criteria:** Individuals with more than one missing tooth (except 3<sup>rd</sup> molars), presence of any restoration, any visible tooth attrition on anterior tooth, having tooth size or shape deformity, marginal periodontitis or gingival recession or those who have undergone orthodontic treatment were excluded from the study.

**Methodology:** Subjects of the study were selected from the regional population according to the defined inclusion and exclusion criteria. Their participation was confirmed after

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obtaining an informed consent from them for the same. Subject was comfortably seated on the dental chair in an upright position for tray (perforated rim lock stock tray, S S WHITE) selection. Modifications, where required, were done with utility/beading wax. T-burnisher was used to locate hamular notch distal to tuberosity behind the ridge crest on either sides and the hamular notches were marked with an indelible pencil prior to impression procedure.

Alginate powder (Plastalgin) was mixed with water according to the manufacturer's instructions (1: 2.6; water: powder ratio, proportion by weight) in a flexible rubber bowl using a curved stainless steel spatula in a figure of eight motion. Impression tray was then loaded and maxillary impression was made. Cast was poured using hard setting dental stone (GYPROCK) by mixing dental stone and water in appropriate ratio (according to manufacturer) in a rubber bowl using a wide blade straight stainless steel spatula. Cast was retrieved after an hour and base was formed using a base former. The procedure was followed for all 100 subjects.

Measurements were made very precisely on the casts using Dial vernier calliper (with 0.0 5mm accuracy, Mitutoyo Ltd. 505-633-50) and recorded on an excel sheet for all 100 casts by 2 independent observers, i.e., observer 1 and observer 2. The measurements of concern were:

**Inter-hamular notch distance:** The bucco-palatal center point of the pterygomaxillary notches were identified on each stone cast and marked with graphite pencil. The distance between two pterygomaxillary notches was measured on straight line using a vernier calliper. The arms of calliper were adjusted so that they remain in contact with the graphite marks (Figure-1).

**Mesio-distal width of each maxillary anterior tooth:** It was measured with caliper by drawing a line perpendicular to long axis of the tooth at the maximum coronal width of the tooth. Each individual maxillary anterior tooth width measurements were added to give a total width for the six maxillary anterior teeth (Figure-2).

## STATISTICAL ANALYSIS

Data so obtained was analyzed using SPSS-16 data analysis software and was analyzed using sing Karl Pearson correlation test, Kolmogorov-Smirnov test and p-value of less than or equal to 0.05 was considered as statistically significant. To check the correlation between total mesio-distal width of six maxillary anterior teeth and inter-hamular notch distance, Karl Pearson correlation test was applied. Normality of the distribution was tested by the Kolmogorov-Smirnov test.

## RESULT

Table 1 shows mean and standard deviation of total mesio distal width of six maxillary anterior teeth (TOTAL<sub>1</sub> and TOTAL<sub>2</sub>) as recorded by observer 1 and 2 for 100 samples and inter-class correlation coefficient test for this value. Table 2 shows mean and standard deviation of inter-hamular notch distance (HN<sub>1</sub> and HN<sub>2</sub>) as recorded by observer 1 and 2 for 100 samples and inter-class correlation coefficient test for this value.

Interclass correlation test was carried out at 95% confidence interval to check for any significant interobserver variability. Interclass correlation obtained for total mesio-distal width of six maxillary anterior teeth was 0.97 and for hamular notch distance was 0.896 (Table 1 and 2). Data recorded by observer 1

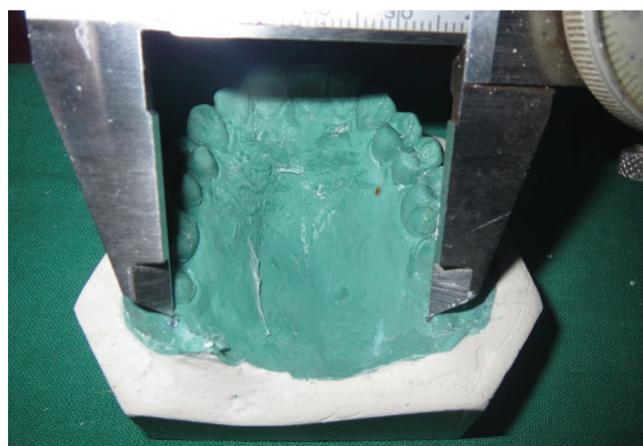


Figure-1: Inter-hamular notch distance measurement

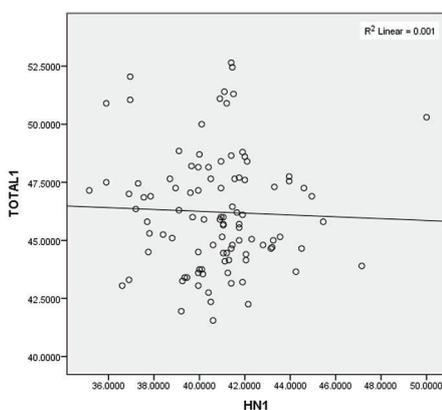


Figure-2: Mesio-distal width of each maxillary anterior tooth measurement

Item Statistics							
	Mean	Std. Deviation		N			
Total <sub>1</sub>	46.221500	2.5083422		100			
Total <sub>2</sub>	46.140200	2.4801592		100			
Total <sub>1</sub> : Total mesio-distal width of maxillary six anterior teeth by observer 1; Total <sub>2</sub> : Total mesio-distal width of maxillary six anterior teeth by observer 2; N: Total number of sample.							
Table-1: For total mesio distal width of teeth by observer 1 and 2							
Inter class Correlation Coefficient test							
	Inter class Correlation	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	p value
Single Measures	.979	.969	.986	96.196	99	99	.000
Any value above .8 is excellent agreement							

Item Statistics							
	Mean	Std. Deviation	N				
HN <sub>1</sub>	40.740200	2.3714629	100				
HN <sub>2</sub>	40.846000	2.6438769	100				
HN <sub>1</sub> : Hamular notch distance recorded by observer 1; HN <sub>2</sub> : Hamular notch distance recorded by observer 2; N: Total number of sample.							
<b>Table-2: For hamular notch distance by observer 1 and 2</b>							
Inter class Correlation Coefficient test							
	Inter class Correlation	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	p value
Single Measures	.896	.849	.929	18.174	99	99	.000
Two-way mixed effects model where people effects are random and measures effects are fixed.							

		HN <sub>1</sub>
*Total <sub>1</sub>	Pearson Correlation	-.037
	p value	.713
	N	100
		Non significant
Total <sub>1</sub> : Mesio distal width of six maxillary anterior teeth; HN <sub>1</sub> : Hamular notch distance;		
<b>Table-3: Pearson correlation coefficient test</b>		



TOTAL<sub>1</sub>: Total mesio-distal width of maxillary six anterior teeth by observer 1  
HN<sub>1</sub>: Hamular notch distance recorded by observer 1

**Graph-1:** Normality distribution of data between Total<sub>1</sub> and HN<sub>1</sub>

(Prime observer) was used for further analysis due to excellent interclass correlation values obtained for each variable under consideration.

To check the correlation between total mesio-distal width of six maxillary anterior teeth and inter-hamular notch distance, Karl Pearson correlation test was applied. Pearson correlation coefficient test showed poor correlation ( $p = 0.713$  and  $r = -0.037$ ) between the two parameters. (Table 3)

Normality of the distribution was tested by the Kolmogorov-Smirnov test. Graph 1 suggested that the distribution data was not different from normal distribution, as revealed by Kolmogorov-Smirnov test ( $p > 0.05$ ).

**DISCUSSION**

Every individual likes to be presentable irrespective of sex and age. When an individual becomes edentulous, his/her main concern is to seek dental treatment to restore their esthetics. Now days, even with a suitably functional complete denture, it isn't acceptable to the individual till he or she is esthetically satisfied with the prosthesis. Tooth size is one of the important factors that must be considered to add life like appearance to the patient denture. Dentists are constantly in search of an efficient

and an objective method that can be used for determination of tooth size.<sup>10</sup>

Scandrett Forrest et al designed a study to find the relationship between width of the maxillary anterior teeth and the central incisor to that of inter commissural width, bizygomatic width, sagittal cranial diameter, inter buccal frenum distance and philtrum width. The investigators hypothesized that two or more of these predictor variables would provide a better prediction of maxillary tooth width than any of them individually.<sup>11</sup>

In the absence of pre-extraction records, there is however, no accurate objective method in order to select the anterior teeth for edentulous patients. Although, many methods have been utilized, none of these methods are absolutely reliable for tooth selection.<sup>4,12-15</sup> Petricevic N et al. stated that sum of width of maxillary anterior teeth is equal to hamular notch distance as well as distomaxillary arch width.<sup>16,17</sup> Baker PS et al. concluded that adding 10 mm to the hamular notch distance showed strong correlation with the maxillary anterior teeth.<sup>18</sup> Johnson and Stratton in their study stated that pterygomaxillary notch plus 5 mm equals the width of maxillary six anterior teeth.<sup>19</sup> Guldag in his study concluded that inter-pterygomaxillary notch cannot be used as a predictive factor for anterior teeth selection.<sup>20</sup>

In the present study, no significant correlation was found between the sum of mesiodistal width of maxillary anterior teeth and Inter-hamular notch distance. Anatomical landmarks which are reliable for selecting maxillary anterior teeth in edentulous individuals vary between different ethnic groups worldwide. Still, newer studies for certain ethnic groups have to be implemented before considering any anatomical landmark is a reliable guide for selecting maxillary anterior teeth for that particular population.<sup>21</sup>

Parameters like proximal wearing of teeth with advancing age<sup>11</sup>, gender variations in tooth size, ethnic variations, differences in size of dentition on the left and right side and a specific sample size<sup>22,23</sup> limit the arenas of our study.

**CONCLUSION**

Keeping in view the limitations of the study, it can be concluded that there is no correlation between the total mesio-distal width of maxillary six anterior teeth and Inter-hamular notch distance, and hence, it cannot be used as a guide for selecting maxillary anterior teeth among the Dakshina Kannada population. Development of a more scientific, reliable and objective method for teeth selection would highly assist the dentists in delivering their services for patient care and satisfaction confidently and would also enable lab technicians to efficiently select the teeth even without seeing the patient on a dental chair.

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