

A COMPARATIVE ANALYSIS OF INTER-ALAR WIDTH AND INTER-HAMULAR WIDTH AS PARAMETERS TO DETERMINE THE WIDTH OF ANTERIOR TEETH - A CROSS SECTIONAL STUDY

Dr. Hridya HP *, Dr Menon Prasad Rajagopal **, Dr. Pradeep Samuel **, Dr. Athira Jubin***, Dr. Chaithanya Chandrasekharan P*, Dr. Asha C S*

Abstract

Aim: To analyze the correlation between the measurements made from the landmarks on the cast along with inter-alar width and the width of the anterior teeth in dentulous study subjects.

Materials and methods: Measurements were made on the cast as well as extra-orally. The measurements made were, inter-hamular width, inter-canine and inter-alar distance. After measuring these distances, the predicted value was calculated by taking mean of these three distances. The actual value in both the groups was measured with a flexible ruler. The mean and standard deviation of both groups were calculated. Results were analyzed with correlation and regression analysis.

Results: The analysis showed that there was a positive correlation between actual and predicted values in dentulous group of study subjects (p -value < 0.01). As the actual value increased in the groups, the predicted value also increased. So the actual value can be derived with the help of predicted value which will be useful in selecting the proper tooth mould size of the maxillary teeth for edentulous patients.

Conclusion; A positive correlation exists between width of the maxillary teeth (actual value) and mean of the inter-hamular distance(predicted value) in dentate subjects .

Key words: Complete dentures, Maxillary anterior teeth width, Denture aesthetics, Inter-hamular width, Inter-alar width

The successful prosthetic rehabilitation of an edentulous patient is the culmination of achieving patient comfort, improving functional capabilities along with satisfying the patient's aesthetic expectations. The above factors cannot be achieved easily and is dependent on multiple factors.¹

Prosthetic rehabilitation improves the quality of a patient's life, not only by improving function, but also by building the patient's confidence by means of improving their aesthetics. Dental aesthetics, in fact is to be developed based on an individual's personality

and lifestyle.

One of the primary factors which affect the patient aesthetics is the anterior tooth selection. Size, contours, Incisal edges, occlusal plane, and midline must all be in harmony to provide a pleasant face, especially when the patient smiles. The purpose of prosthodontic treatment in the maxillary anterior segment of the mouth is to provide a beautifully balanced smile by ensuring that teeth, gingiva, lips, and face interact appropriately.

Literature suggests several methods for teeth selection. One such method is the usage of various facial measurements like bizygomatic, inter-commisural, inter-alar, inter-pupillary, and inter-canthal width, as well as the length of the nose. Apart from these extraoral landmarks, certain intraoral landmarks are also considered for teeth selection. The incisive papilla and hamular notch are two such landmarks as these remain considerably stable throughout an individual's lifetime.²

*Post Graduate Student, Dept. of Prosthodontics, Educare Institute of Dental Sciences

**Professor and HOD, Dept. of Prosthodontics, Educare Institute of Dental Sciences

****Senior lecturer, Dept. of Prosthodontics, Educare Institute of Dental Sciences

Correspondence address: hridyahp122@gmail.com

The present study was conducted to compare the accuracy of extraoral and intraoral parameters, with respect to the width of the anterior teeth. The parameters considered here are inter-alar width and inter-hamular width, respectively. To the author's knowledge, no such study has been conducted which considered a combination of these two parameters for anterior teeth selection.

METHODOLOGY

Inclusion criteria: Participants with class I molar and canine relationships

Exclusion criteria: History of orthodontic treatment and extractions, presence of facial deformity, anterior crowding, spacing, congenitally missing anterior teeth and restorations in the anterior teeth.

Based on the formula, $n = 2 \times (([Z\alpha/2 + Z\beta]]^2) / [(d1-d2)]^2 \times [SD]]^2$ where α is the type I error, β is the type II error, SD is standard deviation and d is the mean difference, a sample size of 30 was calculated. The subjects were randomly selected from the student population of Educare Institute of Dental Sciences belonging to the age group of 20 to 25. The basic demographics of the participants including name, sex and age were recorded. Informed consent was taken from the participants for using their data in the study.³

A standard upright position was maintained for making the measurements and the measurements were carried out by a single operator. Once the participants were seated, they were asked to relax and the inter-alar width was measured using a digital vernier callipers. To record the distance between the hamular notches, maxillary stone casts were obtained of each of the participants. Before making the impressions, appropriate trays were selected and hamular notches were located using T burnishers in the subject's oral cavity and these were marked with indelible pencils. These markings could then be transferred onto the impressions to accurately identify the location of the hamular notches. The impressions were made with stock tray and alginate. The casts were poured with type III dental stone and the distance between the marks were measured using digital callipers. The inter-canine measurements were also recorded from the same casts using dental floss. The distal ends of each canine were marked and the distance between the two markings were recorded with the floss over the

area of greatest curvature. The dental floss was then cut at the two markings, straightened out and was measured. To ensure accuracy, all the measurements were repeated thrice for each parameter and the average value was taken.

RESULTS

Data was analyzed using the statistical package SPSS 26.0 (SPSS Inc., Chicago, IL) and level of significance was set at $p < 0.05$. Data analysis was done using Pearson correlation test.

TABLE 1- DESCRIPTIVE DATA

	INTER-ALAR	INTER - HAMULAR	INTER-CANINE
Mean	32.35	64.58	55.33
	3.45	3.78	2.59

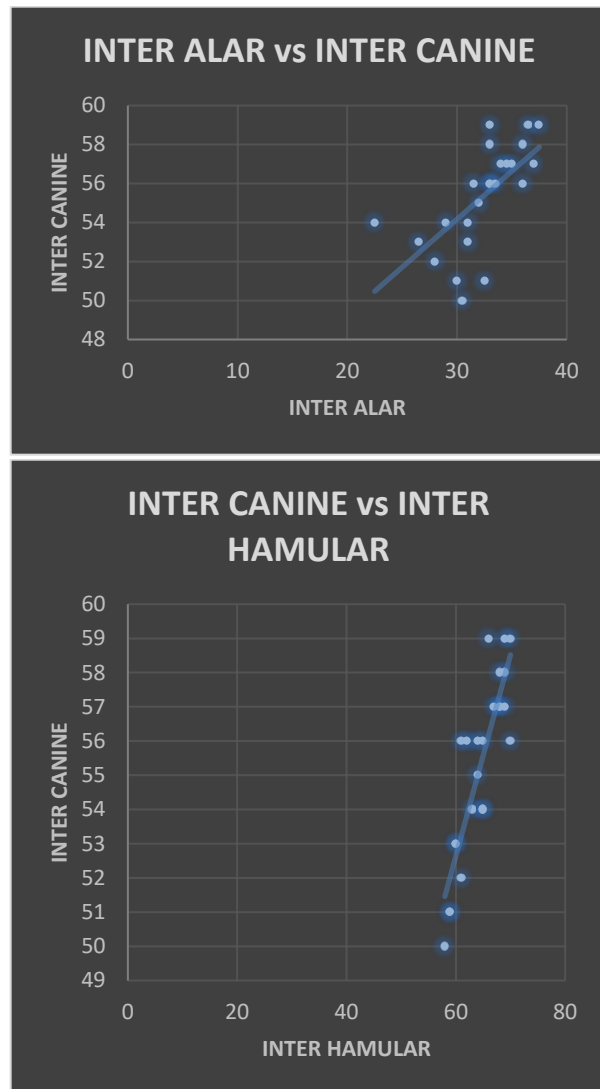
The mean inter-alar, inter-hamular notch and inter-canine width from the 30 samples obtained was 32.35 mm, 64.58mm and 55.33 mm, respectively.

TABLE 2- PEARSON CORRELATION

	INTER- CANINE
INTER- ALAR	0.65 (P=0.0001*)
INTER -HAMULAR	0.85 (P=0.0001*)

*P<0.05 is statistically significant

Size of Correlation	Interpretation
.90 to 1.00	Very high positive correlation
.70 to .90	High positive correlation
.50 to .70	Moderate positive correlation
.30 to .50	Low positive correlation
.00 to .30	Negligible correlation



Significant correlation was obtained between inter-canine and inter-alar distances (0.65) as well as inter-canine and inter-hamular notch distances (0.85).

DISCUSSION

Most often pre-extraction data are hard to come by and dentists often resort to various measurements for teeth selection. Several studies have compared different parameters in various demographics to assess the correlation between intraoral and extraoral parameters and anterior teeth selection.⁴

Many authors have reported inconsistent results on comparing many extraoral parameters to the width of the anterior teeth. Moreover, soft tissue measurements remain erratic as these may be affected by age changes. This has led to the usage of intraoral parameters which are independent of dynamic changes for anterior teeth selection.⁵

The current study focused on the comparison of an extraoral feature and an intraoral feature and aimed to find which parameter has more of an impact on anterior teeth selection.

The extraoral parameter that was selected is the inter-alar width. According to the embryogenic philosophy, the nose has been considered as an essential guide for the selection of the size of the upper incisors. The nose and the four upper maxillary incisors develop from the same embryonic origin called the fronto-nasal process.⁶ Furthermore, the inter-alar width is a facial landmark that is at the closest distance from the teeth.⁷ In a study conducted by Ellakwa A et al., inter-alar width was the anatomical landmark that provided the strongest predictive relationship with anterior maxillary teeth among other landmarks such as intercanthal distance, inter-pupillary distance and inter-commissure distance.^{1,8}

Hamular notch is considered as a reliable anatomical landmark, since, they are independent to resorptive changes overtime. The hamular notch is a palpable notch formed by the junction of maxilla and pterygoid hamulus of the sphenoid bone.⁹ The position of the hamular notch do not appear to change with factors such as weight, aging, and extraction of teeth. Therefore, inter-hamular notch distance was chosen as an intraoral reference to calculate the width of maxillary anterior teeth.^{2,10}

From the results of the study, a positive correlation was obtained for both inter-alar and inter-hamular notch distances to the width of the anterior teeth. However, a more significant correlation was obtained for the intraoral parameter and the extraoral parameter received only a moderately positive correlation. These results indicate the increased predictability of using static parameters for teeth selection. The results are in line with a study conducted by Shivaji JM et al., who had also found a positive correlation between the width of the maxillary teeth and the inter-hamular distance in dentate subjects.^{11,12}

These results can aid during teeth selection along with the conventional methods. However, the current study did not include individuals belonging to other ethnic groups and a comparison among the different sexes was also not considered. The current study can be

enhanced by including individuals from a wider diaspora, which would make the results more relevant.

CONCLUSION

This study showed that inter-hamular distance and inter-alar width are the anatomical landmarks that provide the strongest predictive relationship with width of anterior maxillary teeth. Using these dimensions an average multiplying factor can be used to calculate

maxillary incisor width or canine tip to canine tip distance.¹³ Combining these measures can improve the strength of the correlation. Using these dimensions can assist clinicians to calculate maxillary incisor width. Although statistical correlation is weak to moderate, evidence supports its use as an initial guide to tooth selection in the absence of pre-extraction records.¹⁴

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Conflict of Interest: None Declared