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ORIGINAL ARTICLE

Correlation of Nasal Width to Inter-Canine Distance in Various Arch Forms

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Abstract Selection of teeth for dentures to provide a aesthetically pleasing appearance is a challenge often encountered. Various anthropometric measurements have been utilised traditionally, which is subjective to each practitioner. Interalar width is one of the routinely used method in the selection of upper anterior teeth. It is based on the premise that the parallel line drawn from the alae of the nose touches the tip of the canine. However this may not hold good for all type of arch forms. This paper finds a correlation between the alar of the nose and the tip of the canine for the various arch forms.

Keywords Nasal width · Intercanine distance · Arch forms

Introduction

Face is the most expressive part of human body as it determines an individual social acceptance. The loss of teeth which affects facial appearance, leads to psychological trauma. It is therefore essential that aesthetically pleasing and functionally comfortable dentures are provided. The selection and arrangement of anterior teeth for edentulous patients in natural and aesthetically pleasing form has remained a challenging experience.

Pre-extraction record is a reliable guide for selection of teeth in the absence of which arch form, face form and nasal width serve as useful guides. This is based on the premise that the size and arrangement of anterior teeth harmonises with anatomical landmarks.

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Determination of the width of the maxillary anterior teeth for an edentulous patient becomes difficult in the absence of pre-extraction records. Various techniques have been employed for selection of anterior teeth. These methods reveal a dependence on the physical characteristics of the dento-facial form. Facial landmarks such as bizygomatic width, circumference of head, facial height and interalar width have been taken into consideration while arriving at the mesiodistal dimensions of upper anterior teeth.

Hoffman [1] conducted a study to determine the relationship between interalar width and intercanine width. Wilson [2], Boucher [3], Lee [4] have suggested that the width of the nose serve as a guide for selection of mesiodistal dimension of anterior teeth and positioning the canine. Wehner [5] suggested that the 'parallel lines' extended from the lateral surface of the alae of nose onto the labial surface of occlusal rim could be used to estimate the position of upper canine teeth.

If the intercanine distance in natural teeth could be compared to a facial landmark such as interalar width in various arch forms, then it will be known whether it is a useful guide to select the width of upper anterior teeth. If a correlation exists between these two then the selection of anterior teeth is simplified. A study to ascertain the interrelationship between the interalar width and the intercanine distance was conducted in 300 young adults and the results of the study is published in this paper.

Literature Review

Intercanine Distance

The interalar distance has served as a reference for selection of the width of anterior teeth in some literature. Nelson

[6] analysed the relationship between the arch form and the alignment and concluded a definite relationship exists between maxillary tooth and the alignment form of upper anterior teeth.

Lammie [7] suggested that the position and form of arch of anterior teeth as the most important factor in good appearance. Stein [8] concurred with this suggestion. Roy MacGregor [9] said that for narrow arches, overlapping of central and lateral incisors enables the canine to be placed in its correct position while for broad arches, narrower teeth can be used.

Nasal Width

Wilson [10] introduced '*Nasal Index*', a relation between interalar width to the space available as an index for width of anterior teeth.

Lee [4] estimated that the distance between the outer surfaces of the alae of the nose was same as that between the tips of canines. Wehner [5] suggested the existence of parallel lines extending from the lateral surfaces of the alae of the nose onto the labial surface of the upper occlusal rim. Kehn [11] found that measurements of nasal width were within 0.5 mm of measurement of four maxillary incisors.

Smith [12] study showed that nose would not be a reliable guide for selecting or arranging anterior teeth. Hoffman [1] suggested that the interalar width multiplied by a factor of 1.31 would give the width of upper anterior teeth. Swissdent [13] investigators found that 34% of the subjects had the intercanine distance within 1.0mm of the interalar width and 48% within 2 mm.

Puri et al. [14] concluded that difference of interalar and intercanine distance in males was 1.08 and 0.62 mm in females. Shillingburg [15] indicated that as a percentage of circumferential arc distance between the distal surface of canines, the combined width of central incisors would occupy 37%, combined width of lateral incisors would occupy 31% and the distance and combined width of canines the rest. Keng [16] concluded that Chinese men have wider noses and greater intercanine distance combined to women.

Arch Forms

The dental arches have been classified as ellipsoidal, parabolic, cantenary curve, 'U' or square shaped. However a definite method to classify arc forms as square ovoid and tapering has not been prescribed.

Williams [17] observed that the position of six maxillary teeth as lying on the arch of circle with centre midway between the buccal grooves of the first molars. Izard [18] based his method of arch determination on facial dimensions with a specific premise of a constant ratio of arch width and facial depth. Lashar [19] constructed a series of geometric chart for comparison with dental arches. Wheeler [20] described the dental arches from the occlusal view as conforming to parabolic curves.

Materials and Methods

The study was conducted to determine the nasal width and the intercanine distance in square, ovoid and tapering arch forms. Sample size was 300 having both males and females in the age group of 18–25 years. The criteria for selection of subject was:

- Full complement of natural teeth without Orthodontic or Prosthodontic treatment.
- No proximal restorations on the distal surface of the maxillary canine that affected the width of the anterior teeth.
- Teeth with intact contact points.
- Subjects having no abnormal or altered nose.

Determination of Nasal Width

The subject was seated in the upright position with the head position firmly. Two points were marked on either side of the nose with fine tip marking pen indicating the widest point in the outer surface of the alae of the nose. The distance was measured using a vernier calliper. While measuring the patient held the breath. Each measurement was mean of three readings.

Determination of Intercanine Distance

Intercanine distance was taken in square, ovoid and tapering arch forms. The classification of the subjects into the three category was made on the following definition:

- In square form the anterior teeth are set straight up and incisal edges are even and approach is straight line.
- The ovoid arch is wider between the canines, the central incisor slant slightly inwards. The lateral incisor overlay the central and are depressed at the neck.
- In tapering arch the arch is narrow between the canine to canine the teeth slant out and the incisal edges are forward from the cervical.

Production of Cast

A well fitting dentulous stock tray was used to record a good alginate impression of the maxillary arch. Impression was poured in dental stone. Standard w/p ratio was used as laid down by the manufacturer. The cast was placed on

graph paper and the midpoint between the central incisor was designated as 'V' and the marking of tip of canines was designated as C_1 and C_2. These points were joined to get arch form. A perpendicular was dropped from point 'V' to meet $C_1 - C_2$ arch at 'F'. 'VF' and $C_1 - C_2$ were measured (Fig. 1).

It was found that the readings were fitting the equation of an parabola:

$$\frac{C_1 - C_2}{VF} = R \quad (1)$$

where $C_1 - C_2$ is distance between two canines and VF is perpendicular distance from the central incisor to the line joining C_1 and C_2 (refer Fig. 2a). R is a constant. Values of R for different arch form (refer Fig. 2b) are:

1. Tapering arch, R will be below 3.5
2. Square arch, R will be between 3.5 and 4
3. Ovoid arch, R will be above 4

Study Findings

The study was conducted on 150 males and 150 females. The breakup of arch forms is given at Table 1 and the statistical analysis result is given in Table 2

Discussion

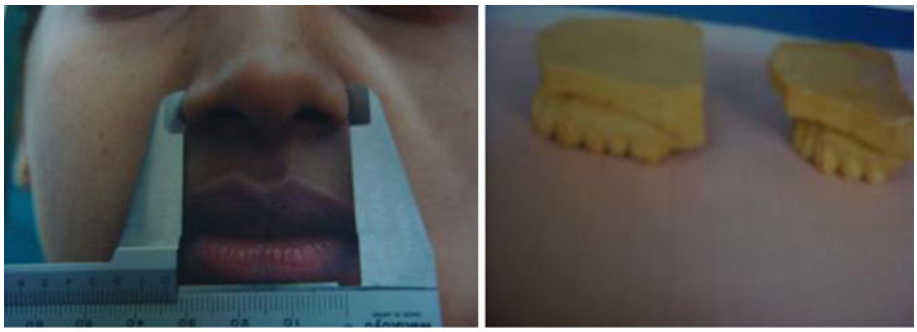
An anterior denture teeth should occupy the same position as that of the natural predecessor. Keeping this in mind this study was conducted with an objective to ascertain the validity of the interalar width as a guide to obtain the mesiodistal width of upper anterior teeth. Any significant relationship would be beneficial to the edentulous situation. Further the prosthodontic technique that use nasal width for the selection of upper anterior teeth also predict the position of the maxillary canine.

The study measured and compared the width of the nose with the distance between the tips of the natural maxillary canine in square, ovoid and tapering arch forms. The interalar width of the nose was measured at the widest points between the outer surface of the alae of the nose which is a reliable landmark. The intercanine distance was obtained from the stone cast. The method was reliable and repeatable. The arch form was deduced from the value of *'R'*, in Eq. 1.

Statistical analysis was done on the data. Pearson's product-moment coefficient was calculated by Eq. 2. This is obtained by dividing the covariance of the two variables by the product of their standard deviations. The correlation refers to the degree of correspondence of relation between the two variables. When the value of a variable increase

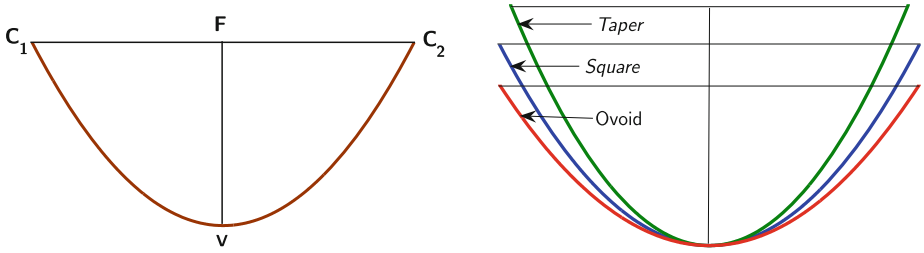
Table 1 Distribution of various arch forms in studied subjects

Subject	Arch forms in number (%)			Total
	Square	Ovoid	Taper	
Males	53 (35.33%)	52 (34.67%)	45 (30%)	150 (100%)
Females	55 (36.67%)	50 (33.33%)	45 (30%)	150 (100%)
Total	108 (36%)	102 (34%)	90 (30%)	300 (100%)



(a) Interalar distance **(b)** Intercanine distance

Fig. 1 Measuremnt of Interalar and Intercanine distances



(a) Arch parameters **(b)** Arch types

Fig. 2 Classification of arch type

Table 2 Regression analysis results of the measurements on the subjects

Subjects	Arch form	Nasal width	Intercanine distance	'ρ'	'a'	'b'	'P'
Males	Square	3.51 ± 0.22	3.65 ± 0.19	0.3059	2.25	0.345	$\leq$ 0.01
	Ovoid	3.68 ± 0.26	3.75 ± 0.21	0.275	4.4925	0.27	$\leq$ 0.05
	Taper	3.55 ± 0.3	3.19 ± 0.25	0.1962	2.419	0.3554	$\geq$ 0.05
Females	Square	3.329 ± 0.2	3.576 ± 0.202	0.52	1.416	0.535	$\leq$ 0.01
	Ovoid	3.365 ± 0.228	3.655 ± 0.24	0.364	2.101	0.344	$\leq$ 0.05
	Taper	3.221 ± 0.307	3.131 ± 0.421	0.124	2.4815	0.236	$\geq$ 0.05

'ρ' refers to the Pearson's product-moment coefficient *'a', 'b'* are regression constant for plot of nasal width against intercanine distance 'P' is the *Test of Significance* constant for correlation between nasal width against intercanine distance

there is a corresponding increase/decrease of other variable. The coefficient gives a meaningful direction (positive/negative) and the degree of coupling (high, moderate, low) between the two variables.

$$\rho_{x,y} = \frac{\sum xy - \frac{\sum x \sum y}{N}}{\sqrt{\left(\sum x^2 - \frac{\left(\sum x\right)^2}{N}\right) \times \left(\sum y^2 - \frac{\left(\sum y\right)^2}{N}\right)}} \quad (2)$$

Where *'x'* and *'y'* are the two variable of interest.

'ρ' was calculated for variables interalar width and intercanine distance. A standard value for the *Test of Significance, 'P'* $\leq$ 0.05, was accepted to be statistically significant. From the results at Table 2, it can be seen that relation between interalar distance and intercanine distance for both male and female subject of square and ovoid arch form is significant, while for taper arch form it is not.

Higher mean interalar width in males subject in comparison to females subject (refer Table 3) reveal the influence of male dominance factor. This is also seen in size of the jaws and teeth between the two sexes.

There is a general opinion that the interalar width is more or less similar to intercanine distance and this observation is the criteria for the selection and placement of upper six anterior teeth. However this study shows that this standard approach is not to be followed as a general rule. The study reveals that in both sexes, with square and ovoid arches, the interalar distance corresponds to the distance between the tips of canines. However it is not so in tapering arch. Here the canines were placed more mesial and the intercanine distance was lesser than the interalar distance.

The clinical application of this finding is beneficial during the selection and arrangement of teeth. The interalar distance in square and ovoid form, are reliable references to place the tip of canine teeth in edentulous arch, besides its influence in obtaining the appropriate intercanine distance in artificial anterior teeth. This study is in concurrence with study done by Lee [4]. The study also conform Keng's [16] study which finds men having wider nose and greater intercanine distance.

This study brings to light that the interalar width and the intercanine tooth width are not always related. However there is a sufficient correlation to use the interalar width to obtain the approximate intercanine, if we consider another variable the *'arch form'*. In square and ovoid arch forms the interalar distance gives a sense of approximate intercanine width while arranging anterior teeth in complete denture. In this context, it should be stated that the guidance of interalar distance is certainly beneficial. Also it's a valid counter check to verify other recommended methods.

It may also be argued that the arch form in edentulous subjects may not always represent the arch form in dentulous state and that these findings are pertinent to the dentulous arch forms. It should be pointed out that the chances of square and ovoid arch forms become tapering or

Table 3 Mean values of interalar and intercanine distance

Subjects	Mean Interalar Distance	Arch form	Mean Intercanine Distance	Ratio of Interalar Distance to Intercanine Distance
Males	3.58	Square	3.75	1:0.96
		Ovoid	3.75	1:0.98
		Taper	3.19	1:0.89
Females	3.27	Square	3.57	1:0.94
		Ovoid	3.65	1:0.93
		Taper	3.13	1:0.87

vice-versa are remote. It has been shown that the form of the edentulous arch remains fairly constant in absence of surgical intervention. Boucher [21] is of the opinion that the original form of dental arch is maintained after the removal of natural teeth. Therefore with a rare exception, the findings of this investigation justify the recommendations highlighted in the study.

Conclusion

Literatures have shown that there exists a conclusive correlation between interalar distance and intercanine distance. This study adds a caveat to it that this relationship is related to another variable, the arch form. The correlation between interalar distance and intercanine distance is statistically significant in case of square and ovoid arch form but not significant in case of taper form. The sample size is moderately high to satisfy the statistic criteria.

The study confirms that the arch form is an important factor in selection of upper anterior teeth and has to be necessarily considered in selection of upper anterior teeth.

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