

Correlation of Inter Alar Distance to Inter Canine Distance in Various Arch Forms in Gujarati Population

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ABSTRACT

Background: The solution and arrangement of maxillary anterior teeth for edentulous patients in a natural and aesthetically pleasing form has remained an elusive and challenging endeavour when pre-extraction records are not available. The aim of this study was to determine whether a relationship exists between the inter canine distance (ICD) and inter alar width (IAW) with the combined width of maxillary anterior teeth in various arch forms.

Material and Method: A total of 100 (N) subjects were chosen for the study from the city of Gandhinagar, Gujarat. ICD was measured between the cusp tip of right and left maxillary canine on the stone cast with the help of graph paper. IAW was estimated between the right and left ala of the nose at their widest point. Pearson's correlation coefficients were calculated to determine the relationship between ICD and IAW. The combined width of the maxillary anterior teeth was obtained from this data.

Result: The Pearson correlation coefficients, showed relative significance between inter canine distance and inter alar width with square and ovoid arch form ($P < 0001$). However, inter canine distance and inter alar width is not significant with taper arch form.

Conclusion: From this present study, it can be concluded that the combined width of maxillary anterior teeth is related to the inter alar width for square and ovoid arch form.

Keywords: Inter alar distance, inter canine distance and arch forms.

INTRODUCTION

Everyone is concerned about their facial appearance as it is a very significant part of the self image especially smile¹. As a Prosthodontist, it is our duty to preserve the natural dignity of advancing age while fabricating prosthesis with appropriate and careful selection and arrangement of teeth. In entirely edentulous patients, it is challenging to select anterior teeth the same as natural teeth when pre-extraction records are not available. Selection and positioning of anterior teeth

is challenging for dentists especially arranging them according to aesthetic and phonetics. Position of canine is critically essential in complete denture teeth arrangement because it provides tissue support at the corner of the mouth and its position is in the turning point of denture arch. Different guidelines have been given to determine the width of maxillary anterior teeth when pre-extraction records are not available. This guideline includes bi-

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zygomatic width, the circumference of the head, facial height, inter alar width and facial form.

Hoffman² conducted a study to determine the relationship between inter alar width and inter canine width. Wilson³, Boucher⁴, Lee⁵ have suggested that the width of the nose serve as a guide for the selection of mesiodistal dimension of anterior teeth and positioning the canine. Wehner⁶ indicated that the 'parallel lines' extended from the lateral surface of the alae of the nose onto the labial surface of the occlusal rim could be used to estimate the position of upper canine teeth.

The arch form refers to the overall configuration of the dental arch, and this takes into account the symmetry, roundness, elongation and convexity. This arch form is in large part determined by the shape of the underlying basal bone. When multiple teeth are misplaced, then irregularities or asymmetries may develop in arch form. A tapered arch form generally occurs in the maxillary arch and often as the result of a pathological narrowing of the anterior maxilla. The arch form also correlates with the palatal form so, when the arch form is narrow, the palate becomes deep and viscera -versa. This will indirectly affect the patient's prosthesis and teeth selection.

There are studies which prove co-relation between inter alar distance and inter canine width, but correlations with various arch form have not been established in Gujarati population. Hence, this study was conducted to correlate the inter alar distance to inter canine distance in various arch forms.

MATERIALS AND METHODS

A total of 100 (N) subjects were chosen from the patients visited Karnavati School of Dentistry. The procedure was explained to the subjects, and their written consent was obtained. Approval for the study was obtained from the ethical institution review board. The subjects were age ranges (18 to 30 years) and both sex. Subjects included patients of Karnavati School of Dentistry, Uvarsad, Gandhinagar in Gujarat.

Subjects presented with a full complement of natural teeth and having intact contact, no proximal restoration on the distal surface of maxillary canine, without having any Orthodontic or Prosthodontic treatment and no abnormal or altered nose.

Determination of Inter-Alar Width (IAW)

IAW was measured between the ala of the nose at their widest point. The distance between these two points was measured using a Digital vernier calliper without application of pressure by bringing the recording parts of the calliper just in contact with the outer surface of the nose. While measuring, the patient was asked to stop breathing momentarily to avoid any change in the shape of the nose. Mean value was determined. (Figure 2A)

Determination of Inter-canine Distance (ICD)

The dental arches have been classified as ellipsoidal, parabolic, cantenary curve, 'U' or square-shaped. However, an exact method to classify main forms as square ovoid and tapering has not been prescribed. Inter canine distance was taken in the square, ovoid and tapering arch forms according to Mc Laughlin, Bennett, Trevisi.²⁰

Preparation of Cast

A well-fitting dentulous stock metal tray was used to record a good alginate impression of the maxillary arch. All impressions were poured in dental stone. The cast was placed on graph paper and the midpoint between the central incisor was designated as 'V' and the marking of the tip of canines was designated as C₁ and C₂ (straight line). These points were joined to get arch form (C₁-V-C₂). A perpendicular line was dropped from point 'V' to meet C₁ - C₂ (straight line) arch at 'F' (Figure 1A). 'VF' and C₁ - C₂ (straight line) were measured.

It was found that the readings were fitting the equation of a parabola¹⁸:

$$C_1 - C_2 = R$$

VF

where C₁ - C₂ (straight line) is the distance between two canines and VF is the perpendicular distance from the central incisor to the line joining C₁ and C₂ (straight line). (refer Fig. 1 A). R is constant. Values of R for different arch form (refer Fig. 2B) are¹⁸:

1. Tapering arch, R will be below 3.5
2. Square arch, R will be between 3.5 to 4

Ovoid arch, R will be above 4

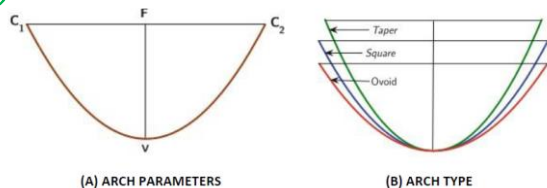


Fig 1: Classification of the arch.

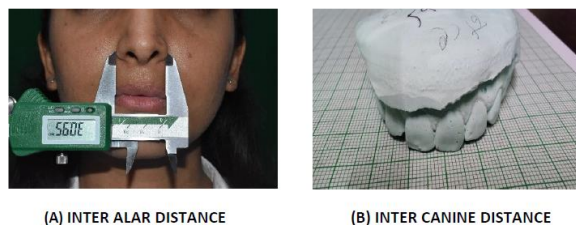


Fig 2: Measurement of inter alar and inter canine distance.

Table 1: Different shape of the arch form (R-value).

Sr No	R Value	Sr No	R Value	Sr No	R Value	Sr No	R Value
1	3.45	26	3.2	51	3.27	76	4.11
2	3.7	27	3.7	52	5.28	77	4.87
3	3.5	28	4.33	53	3.6	78	3.6
4	3.4	29	4.6	54	3.27	79	4
5	3.7	30	4.22	55	4	80	4.57
6	3.8	31	3.8	56	3.7	81	5
7	3.7	32	3.7	57	3.88	82	3.88
8	5.28	33	5.42	58	3.4	83	4.87
9	3.25	34	3.36	59	3.16	84	3.54
10	5	35	3.8	60	4.37	85	3.6
11	3.88	36	3.7	61	3.5	86	5.42
12	3.88	37	3	62	3.6	87	3.77
13	3.5	38	3.3	63	5.28	88	3.8
14	4.1	39	3.18	64	2.69	89	4.33
15	5.42	40	4.12	65	5.57	90	3.6
16	3.18	41	5.28	66	3.7	91	4.22
17	4	42	3.25	67	3.8	92	3.7
18	4.12	43	3.5	68	3	93	5.42
19	3.27	44	4.33	69	3.9	94	3.8
20	4.2	45	3.45	70	4	95	3.66
21	3.6	46	3.8	71	3.6	96	5.14
22	3.18	47	4.37	72	4.75	97	4.5
23	4.11	48	2.92	73	5.28	98	4.71
24	4.22	49	3.6	74	3.5	99	3.8
25	2.38	50	5.42	75	3.88	100	3.6

OBSERVATION AND ANALYSIS

The different shape of the arch form (R-value) of 100 subjects are listed in Table 1. The investigators measured the two parameters for each item two times.

The mean of ICD in males was 37.11 mm, with a range of 33 –39 mm (Table 2). The mean ICD of female was 35.72 mm with a range of 31 - 39 mm (Table 2). There was a higher mean inter-canine distance in male subjects in comparison to female subjects (Table 2). The difference between the inter-canine distance mean of the two sex groups was statistically significant. $t = 4.193$ ($p < 0.0001$).

Table 2: Shows mean IAW (Inter alar width) and ICD (Inter canine distance) values recorded for male and female patients in various arch forms(R).

	Male	Female	Male	Female	Male	Female	Male	Female
	IAW (mm)	IAW (mm)	ICD (mm)	ICD (mm)	VF (mm)	VF (mm)	R	R
Mean	32.42	29.66	37.11	35.72	9.53	9.29	3.99	3.93
SD	1.919	2.269	1.605	1.71	0.154	0.152	0.691	0.713
No	52	48	52	48	52	48	52	48

*note: SD = Standard deviation

The mean of IAW of the male was 32.42 mm with a range of 26.81– 36.91 mm. The mean IAW of female was 29.66 mm with a range of 25.37 – 34.63 mm. Higher mean inter-alar width in male subjects than

female subjects (Table 2). The difference between the inter-alar width mean of the two sex groups was statistically significant. $t = 6.584$ ($p < 0.0001$).

Table 3: Sex wise distribution of various arch form in subjects.

Subject	Arch form in Number (%)			Total
	Square	Ovoid	Taper	
Male	20 (38.46%)	20 (38.46%)	12 (23.07%)	52 (100%)
Female	20 (41.66%)	19 (39.58%)	9 (18.75%)	48 (100%)
Total	40 (40%)	39 (39%)	21 (21%)	100 (100%)

Table 4: Co-relation between Inter alar width and Inter canine distance in various arch form.

		Taper		Square		Ovoid	
		IAW (mm)	(ICD) (mm)	IAW (mm)	(ICD) (mm)	IAW (mm)	(ICD) (mm)
Mean	Male	31.01	36.75	32.84	37.3	32.84	37.3
	Female	29.33	34.77	29.14	35.65	30.37	36.26
SD	Male	1.783	1.96	1.87	1.08	1.87	1.08
	Female	2.83	2.33	2.13	1.18	2.03	1.72
No	Male	12	12	20	20	20	20
	Female	9	9	20	20	19	19
r		0.305		0.700		0.699	
p		0.177(NS)		0.0001(ES)		0.0001(ES)	

Table 4 shows the Pearson's correlation coefficient (r) , and test of significance (P) between inter-alar width and inter-canine distance for all subjects of different arch form. Pearson's correlation coefficient (r) between ICD and IAW for all 100 subjects was found to be positive and strong ($r = 0.588$) with a statistical significance ($P < 0.0001$).

DISCUSSION

In the construction of complete dentures, the estimation of the combined width of six maxillary anterior teeth is an essential clinical procedure when pre-extraction records are not available. While numerous methods have been suggested for estimating the combined width of the maxillary anterior teeth and the central incisor, there seem to

be few reliable guidelines and many conflicting views.⁹⁻¹⁶

When anterior teeth are selected for edentulous subjects, the mesiodistal width of the maxillary central incisors is crucial because they are the most prominent teeth in the arch when viewed from the frontal aspect. Shillingburg et al.¹⁷ reported that the combined width of the maxillary central incisors occupied 37% of the circumferential arch distance between the distal surfaces of the maxillary canines. The combined width of the lateral incisors and canines accounted for 31% and 32% of the distance, respectively.

Many authors have suggested that the width of the nose serves as a guide for the selection of the width of maxillary anterior teeth. They stated that "parallel" lines extended from the lateral surface of the alae of the nose onto the labial surface of the occlusal rim can be used to estimate the position of the maxillary canine.¹⁸ 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 frontonasal process. Furthermore, the inter alar width is a facial landmark that is at the closest distance from the teeth.¹⁹

In prosthetics, arch form plays a significant role in teeth selection and arrangement. The new trend in prosthetics is to replace the teeth by placing implants. Implant position and number are based on biomechanics, which varies between arches.

In this present study, we try to correlate the inter alar width and inter canine distance. A standard value for the test of significance, 'P' < 0.05, was accepted to be statistically significant. From the results at (Table 4), it can be seen that relationship between inter alar distance and inter canine distance for both male and female subject of the square and ovoid arch form is significant, while in the tapered arch form it is not significant.

There is a general opinion that the inter-alar width is more or less similar to inter canine 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 inter-alar distance corresponds to the distance between the tips of canines. However, it is not so in a tapering arch. Here the canines were placed more mesial and the inter-canine distance was lesser than the inter alar distance.

The clinical application of this finding is beneficial during the selection and arrangement of teeth. The inter-alar distance in square and ovoid form, are reliable references to place the tip of canine teeth in an edentulous arch, besides its influence in obtaining the appropriate inter-canine distance in artificial anterior teeth. This study is in concurrence with study done by Lee.⁵ This study also conforms Keng's⁷ study which finds men having wider nose and greater inter canine distance.

This study brings to light that the inter-alar width and the inter-canine tooth width are not always related. However, there is a sufficient correlation to use the inter-alar width to obtain the approximate inter canine, if we consider another variable the 'arch form'. In the square and ovoid arch forms the inter-alar distance gives a sense of approximate inter canine width while arranging anterior teeth in the complete denture.

In this context, it should be stated that the guidance of inter alar 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 the square and ovoid arch forms becoming tapering or vice-versa are remote. It has been shown that the form of the edentulous arch remains relatively constant in the absence of surgical intervention. Boucher⁸ is of the opinion that the original form of the 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

This study not only shows the co-relation between inter alar distance and inter canine distance but also adds another variable, the arch form. The

correlation between inter alar width and inter canine distance is statistically significant in case of square and ovoid arch form but not significant in case of taper form. The study confirms that the arch form is an essential factor in the selection of upper anterior teeth.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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