RESEARCH ARTICLE

THE RELATIONSHIP BETWEEN INTERCANINE WIDTH AND INTER-ALAR DISTANCE, INTER-CANTHAL DISTANCE AMONG DAKSHINA

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ABSTRACT

The maxillary anterior teeth are the key elements contributing to the esthetic importance of what we call dentofacial beauty. However the selection and arrangement of maxillary anterior teeth for edentulous patients in a natural and esthetically pleasing form has remained an elusive and challenging endeavor. Over the years, norms, criteria and guidelines for esthetic tooth selection have been suggested by the artisans of the dental profession. However, no universally accepted parameter currently exists for selection of anterior teeth in local population, and no such studies have been carried out previously1 , this study was conducted to determine the significance of correlation between the maxillary inter canine linear width and inter alar distance, inner inter canthal distance in the local population to potentially provide a guide for selecting maxillary anterior teeth.

INTRODUCTION

The part of human body which decides an individual's social acknowledgment is face. It is crucial that an esthetical and practical substitution of the missing teeth has to be provided, as it influences the facial appperances as well as psychological trauma to the individual. The selection of maxillary anterior teeth for edentulous patients in a natural and esthetically pleasing form has remained an elusive and challenging endeavor (Patel, 2011). Pound (Pound, 1962) stated that in restoring facial appearance and function for edentulous patients, five qualities must work together in harmony: the size, form, color, arrangement, and framing of the teeth. Selection of ideal anterior teeth for edentulous patient becomes a difficult task in the absence of pre-extraction records. The size, form and color of teeth should be in harmony with surrounding oral and facial structures. The number, size and shape of teeth vary among different ethnic groups (Krajicek, 1969). The maxillary anterior teeth are the key elements contributing to the esthetic importance of what we call dentofacial beauty. However the selection and arrangement of maxillary anterior teeth for edentulous patients in a natural and esthetically pleasing form has remained an elusive and challenging endeavor. Over the years, norms, criteria and guidelines for esthetic tooth selection have been suggested by the artisans of the dental profession.

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However, no universally accepted parameter currently exists for selection of anterior teeth in local population, and no such studies have been carried out previously[1], this study was conducted to determine the significance of correlation between the maxillary inter canine linear width and inter alar distance, inner inter canthal distance in the local population to potentially provide a guide for selecting maxillary anterior teeth.

METHODOLOGY

A survey was carried out within 100 individuals who are native of Dakshina Kannada region with an age ranging from 17 - 23 years old, who all visited the KVG Dental College & Hospital. This study was conducted at the department of prosthodontics including crown and bridge, K.V.G Dental College, Sullia. The subjects were selected based on particular inclusion and exclusion criterias as:

Inclusion criteria

- Should have un attrited sharp canine tips
- All individuals should have no missing maxillary or mandibular anterior teeth.
- All anterior teeth in proper alignment and occlusion
- Should not have interdental spacing or crowding
- Should not bare a history of orthodontic treatment

- Should not have any anterior restorations and teeth should be in healthy periodontal condition.
- No evidence of apparent loss of tooth structure due to attrition, erosion, abrasion or trauma
- Should be native of Dakshina Kannada region.

Exclusion criteria

- Patient with any tooth size or shape deformity.
- Patient with marginal periodontitis or gingival recession.
- Patient with deformity in face.
- Patient belonging to region other than Dakshina Kannada.

Ethical clearance was obtained from the institutional ethical committee. Nature of the study was explained with subject information sheet and an informed consent of all the subjects was obtained. The three parameters, Inner-Canthal Distance (ICD), Inter-Alar Width (IAW) of each subject was measured with digital vernier caliper and canine tip marker was used for measurement of Inter-Canine Width (ICnW) in Dakshina Kannada population.

To measure the inner inter-canthal distance: For measurement of the inner inter-canthal distance, patients were seated in a dental chair with their heads supported in an upright position in such a way that they looked forward at the horizon. The external jaws of the digital caliper was placed against the forehead and lowered toward the eyes. The external jaws of the caliper were adjusted so that they were in correct alignment with the medial angles of the palpebral fissures of the eyes. The distance between these two anatomical landmarks was recorded as the inner intercanthal distance to an accuracy of 0.01mm. The inner inter-canthal distance was measured twice for each patient by different observer, and the values were averaged.

To measure the inter-alar distance: With the subject in the same position as described above, the external jaws of the digital caliper was placed against the forehead and lowered toward the nose. The external jaws of the caliper were adjusted so that they are in gentle contact with the maximum contour of the alae of the nose. The distance between these two anatomical landmarks was recorded as the inter alar distance to an accuracy of 0.01 mm. The inter-alar distance was measured twice for each patient by different observer, and the values were averaged.

Canine tip marker: A T-shaped flat metal plate, known as a canine tip marker, is specifically made to accurately record the distance between the tips of the maxillary canines. The horizontal arm of the metal plate is 5-cm long and 1-cm wide with rounded ends and is used for marking the canine tips. The vertical arm is 7.5-cm long and 1-cm wide and is used for holding the canine tip marker.

To measure the inter-canine width: One side of the horizontal arm of the canine tip marker was coated with Okklean spray. The markings of the cusp tips of the right and left maxillary canines will be obtained on it, by contacting the horizontal arm against those teeth, with-out touching the upper incisors, while holding it steady by the vertical arm. The distance between the marks of the tips of maxillary canines obtained on the canine tip marker was measured with

the caliper. The procedure was repeated twice for each patient, and was performed by different observers and the measurements obtained were interpreted and subjected to statistical analysis (Tripathi, 2011).

Collection of Data: All measurements were obtained from the patient's mouth using canine tip marker, by two independent observers and average value was taken and statistically analyzed. The inter class correlation was calculated for two observers and showed excellent agreement between both the observers.

OBSERVATIONS AND RESULTS

Two investigators measured the three parameters independently for each subject two times. Table-1, Table-2 and Table 3 show mean ICnW, IAD and ICaD values recorded.

Table 1. Mean and Standard Deviation for inter canine width by observer 1 and 2

	Mean	Std. Deviation	N
$ICnW_1$	35.020	2.3740	100
$ICnW_2$	35.21	2.42068	100

$ICnW_1$: linear inter canine width recorded by observer1;
$ICnW_2$: linear inter canine width recorded by observer 2;
N: total number of sample.

Table 2. Mean and Standard Deviation for inter alar distance recorded by observer 1 and 2

	Mean	Std. Deviation	N
IAD_1	39.640	5.4021	100
IAD_2	41.22	5.91929	100

IAD_1: inter alar distance recorded by observer1;
IAD_2: inter alar distancereorded by observer 2;
N: total number of sample.

Table 3: Mean and Standard Deviation for inner inter canthal distance recorded by observer 1 and 2

	Mean	Std. Deviation	N
$ICaD_1$	31.910	2.8144	100
$ICaD_2$	33.64	3.54629	100

$ICaD_1$: inner inter canthal distance recorded by observer1;
$ICaD_2$: inner inter canthal distance recorded by observer 2;
N: total number of sample.

Table 4. Pearson correlation coefficient test :

Correlations			
		IAD_1	$ICaD_1$
$ICnW_1$	Pearson correlation	0.590	0.185
	p value	.000	.066
	N	100	100
		Highly significant	Non significant

$ICnW_1$: linear inter canine width;
IAD_1: inter alar distance
$ICaD_1$: inner inter canthal distance;
N: total number of sample

The mean of the inter canine width was 35.02mm, the mean of the inter alar distance was 39.64mm and the mean of inter canthal distance was 31.91mm among Dakshina Kannada

population. A highly significant correlation was found between inter canine distance and inter alar width (P< 0.001; r = + 0 .59) . The result suggestive of no significant correlation (P=0.067; r= + 0 .18) between the inter canine width and the inter canthal distance .

DISCUSSION

Appropriate selection of maxillary anterior teeth is considered to be of paramount importance in the success of complete denture prostheses.Maxillary anterior teeth play an important role in the esthetics of a complete denture. The size, form, and color of the teeth must be in harmony with the supporting facial structures. Comparing the results of previously reported studies, it is well understood that the differences rooted primarily in ethnic and morphological characteristics of different population. In any smile, the central incisors dominate and may be compared to the fundamental note of a music chord. Using the same analogy, the next dominant harmonic must be in the region of the canines. Canines should be dominant to mark the corner of the mouth clearly and to stress the visual strength contained in the arch. Without dominance at the corner, the arch looks neutral and lacks vigor and individuality. The most difficult aspect of prosthodontics is to establish the exact shape of the corner of the arch so as to be in complete harmony with the visual personality projected by the patient. Every same individual likes to be presentable irrespective of sex and age. When an individual becomes edentulous, he/she seeks dental treatment to restore esthetics. It is the primary concern for the individual. Even when the complete denture prosthesis is functionally suitable, the individual will not accept it if esthetic requirement are not fulfilled. Tooth size is one of the important factors that must be considered to add life like appearance to complete denture prosthesis. Since the time of Leonardo da Vinci, dentists are in search for the objective method that can be used for determination of teeth size. So this study was to determine the correlation between the maxillary inter canine width and inter alar distance, inner inter canthal distance to potentially provide a guide for selecting maxillary anterior teeth.

Anatomical landmarks which are reliable for selecting maxillary inter canine distance varies between different ethnic groups, as shown by different studies done on tooth and arch dimensions for different ethnic groups in worldwide, but still new studies for certain ethnic groups have to be implemented before considering any anatomical landmark is a reliable guide for selecting maxillary anterior for that particular population. Development of more scientific or objective method of teeth selection would greatly assist dentist in delivering their service for patient care and satisfaction confidently and will also enable lab technician to accurately pick the teeth without seeing the patient on dental chair, computer would also be used to scan and measure casts to give image of patient teeth in the proper size relationship. A study conducted by Strajnic et al, to determine the correlation between the inner inter canthal distance and inter alar width and the width between the canine cusp tips, which may be useful in clinical practice. It was concluded that the examined inter alar width and inner inter canthal distance cannot be considered reliable guidelines in the selection of artificial maxillary anterior teeth. However, they may be used as a useful additional factor combined with other methods for objective teeth selection.

Sears stated that the total width of the maxillary anterior teeth can be determined by dividing the bizygomatic width by 3.3mm. In another study, Hasanreisoglu et all also showed that bizygomatic width and interalar width may serve as references for establishing the width of maxillary anterior teeth. Schiffman P used a method to determine the size of the artificial maxillary teeth by using the incisive papilla and the cuspid eminence. Ricketts (Ricketts, 1968) advocated drawing a perpendicular through the pupil of the eye. The corners of the mouth fell halfway between this line and the outer limits of the alae portion of the nose. Silverman[8] pointed out that the inter canine distance of maxillary anterior teeth can be related to the distance between the corners of the mouth. Looking back at literature if the canine eminences are discernible a line can be placed on the cast at the distal termination of the eminence. If eminences are not discernible attachments of buccal frenum are used as guide. A line placed slightly anterior to the buccal frenum will be distal to the eminence. A flexible ruler is used and the distance between the two canine eminences at their distal side through the anterior of the incisive papilla is measured in millimetres and this measurement gives the combined width of the six anterior teeth.

Another method of marking the canine eminence is to place the fabricated occlusal rim in the patient's mouth and ask the patient to relax with the lips closed. With a sharp marker, mark at the corner of the lips. The vertical line drawn from this mark coincides with the pupil of the eye. The distance between the marks following the contour of the arch marked in millimetres is the combined width of six maxillary anterior teeth. A study was conducted in a Central Indian population to determine the correlation between facial measurements and the combined width of maxillary anterior teeth. The observations found out the existence of any correlation between facial measurements and the combined width of maxillary anterior teeth. Hence, it can be recommended that this method should be used as a guideline in selecting the width of anterior artificial teeth, only when combined with other methods. Additional studies are required to replicate the present findings in Indian subpopulation groups, so as to confirm the relationship among the anthropometric parameters investigated (Deogade, 2015). Wehner et al. suggested that the ''parallel lines''extended from the lateral surface of the ala of the nose onto the labial surface of the upper occlusal rim could be used to give an estimation of the midline vertical axis of the upper canine teeth.

There is a lack of agreement in the literature regarding the selection of upper anterior teeth based on the correlation of interalar width and intercaninedistance, and Smith, Latta et al, and Varjao and Nogueira supported this finding, but Mavroskoufis and Ritchie,13 Hoffman et al, and Ahn et al Hasanreisoglu et al found interalar width to be a fairly accurate guide. Abdullah suggested that intercanthal distance can be used to estimate the mesiodistal width of a maxillary central incisor for edentulous patients. TripathiS,et al reported that the tips of the cusps of the canines were recorded clinically by use of the canine tip marker, which were then measured with the use of a digital vernier caliper. This was considered to be more accurate and reliable as compared to measurements taken from a dental stone model

as done by Smith, Mavroskoufis and Ritchie, Varjao and Nogueira, and Zlataric and Kristek. The canine tip marker was used directly for measuring intercanine width in subjects, while measurement of intercanine width on stone models is an indirect approach of measurement, where the first impression of the arch is made and then the cast is poured. During this process, chances of errors are high, due to certain inherited properties of materials and also variations occurring during manipulation. Using a canine tip marker was a simpler procedure because steps for measuring the intercanine width were also reduced. Also, this method is more cost effective, as only the single marker can be used for all subjects, which is not possible in the case of stone models, where an individual stone model is required for each subject. In present study canine tip marker is used as the instrument for recording the canine cusp tip clinically, the width between two canine tips were then measured with the use of a digital vernier caliper. Another study undertaken by Tripathi. S et al, to evaluate the correlation between the intercanthal distance and interalar distance with intercanine width, in NorthIndian male and female patients for predicting the mesiodistal width of the maxillary anterior teeth during tooth selection. A significant correlation was found between interalarwidth and inter- canine distance in both men and women, suggesting that interalar width can be used as a reliable guide for maxillary anterior teeth selection.

In , present study, the mean of the inter canine width was 35.02mm, the mean of the inter alar distance was 39.64mm and the mean of inter canthal distance was 31.91mm among Dakshina Kannada population. A highly significant correlation was found between inter canine distance and inter alar width (P< 0.001; r = + 0 .59). This finding is supportive with the result obtained by Tripathi et al .There is no significant correlation (P=0.067; r= + 0 .18) between the inter canine width and the inter canthal distance. With the review of literature it is clear that, 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 teeth selection. The anatomical -landmark as a guide for selecting anterior teeth will vary from population to population. Modern anthropological studies of genetic admixtures and biological relationship among the various groups of human races, has found that teeth and dental arches have a high genetic component. Furthermore, studies of the etiological factors of malocclusion have shown that growth of the jaws is strongly influenced by genetic, as well as by environmental factors such as nutrition health, physical status.

Very few studies were done in Asian and Indian population, even though they form largest population as compared to other ethnic groups.

Conclusion

Within the limitations of this study, it can be concluded that there is correlation between maxillary inter canine width and inter alar distance which can be used as a guide for selecting maxillary anterior teeth but there is no correlation between maxillary inter canine width and inner inter canthal distance, which cannot be used as a guide for selecting maxillary anterior teeth among Dakshina Kannada population.

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