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Canine Tip Marker: A Simplified Tool for Measuring Intercanine Distance

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Keywords
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Abstract

Purpose: Appropriate selection of anterior teeth is considered to be of paramount importance in the success of denture prostheses. This study was undertaken to evaluate the correlation between the intercanthal width and interalar width with intercanine distance, in North Indian male and female patients for predicting the mesiodistal width of the maxillary anterior teeth during tooth selection.
Materials and Methods: The study was conducted with 100 North Indian patients (50 men, 50 women) ranging in age from 17 to 21 years. A digital caliper with an accuracy of 0.01 mm was used to measure the intercanthal and interalar width. A T-shaped flat metal plate (canine tip marker) was used to mark the intercanine distance, which was then measured with the digital caliper. These measurements were interpreted and subjected to statistical analysis. Student's *t*-test was applied to test the correlation between intercanthal width and interalar width with intercanine distance.
Results: Calculated *t*-values between intercanine distances with interalar width in both male and female groups were 3.14 and 3.56, respectively, greater than the standard value taken at a 5% level of significance with 48 degree of freedom, showing a higher correlation of interalar width with the intercanine distance. Values obtained between intercanthal width and intercanine distance were lower than the standard value in both groups.
Conclusions: A significant correlation was found between interalar width and intercanine distance in both men and women, suggesting that interalar width can be used as a reliable guide for maxillary anterior teeth selection.

The appearance of anterior teeth is critical for an attractive face and pleasing smile. Many tooth-related factors influence the perception of beauty. Sex-related differences in the form and arrangement of anterior teeth are assumed, and optimal esthetics can be achieved only if the face, arch, and tooth forms are in harmony.[1] Basic principles guide the dentist in providing the patient with a natural-looking appearance. The dentist must consider both the anatomy and physiology of the face, as well as artistic principles, to achieve a natural-looking denture.

To appear attractive, the anterior teeth must be in proportion to facial morphology. The most influential factors contributing to a harmonious anterior dentition are the size, shape, and arrangement of the maxillary anterior teeth. By using anatomic references, it is possible to place artificial teeth within the bounds, or "average of nature," permitting individual esthetics and physiologic variations.[2] Martone[3] pointed out that for pleasing esthetics, a proportionate relationship between the teeth and other facial features must exist. The maxillary anterior teeth are considered the most important in denture esthetics. The dominance of the maxillary cuspids in relation to both position and size is a determining factor in selecting and arranging teeth.

Dental appearance is influenced by a variety of factors. These factors determine a harmoniously balanced smile, which arises

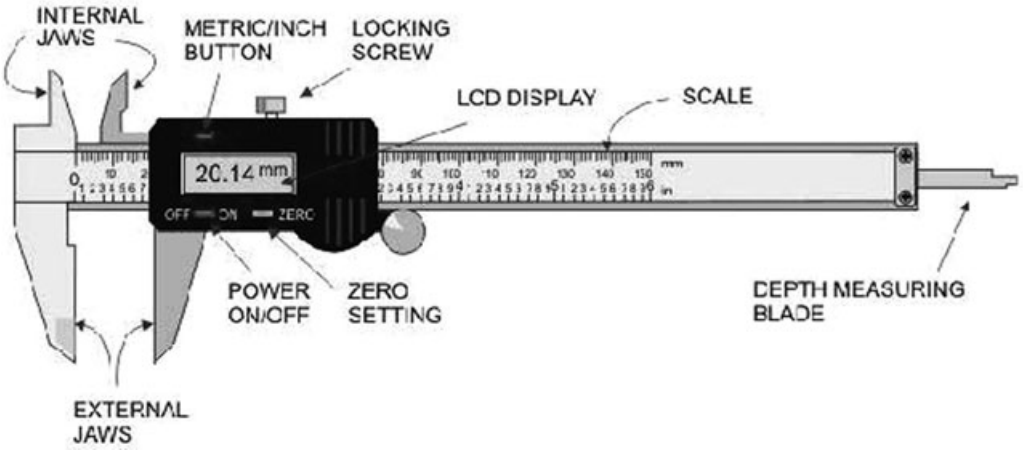

Figure 1 Digital vernier caliper.

as a result of the ideal interaction of dental and facial beauty criteria. Interalar width as a guide for determining the mesiodistal width of upper anterior teeth has been employed; however, conflicting reports have appeared in the literature regarding the correlation between interalar and intercanine distance. Some authors have also used intercanthal width for selection of upper anterior teeth, but variations are bound to occur to a greater extent between various ethnic groups and with sex differences. This study was undertaken in North Indian patients for predicting the mesiodistal width of the maxillary anterior teeth during tooth selection.

Materials and methods

This study was conducted in 100 North Indian patients (50 men, 50 women) ranging in age from 17 to 21 years. The inclusion criteria for selection of subjects were no missing maxillary or mandibular anterior teeth, unattritioned sharp canine tips, all anterior teeth in proper alignment and occlusion, no interdental spacing or crowding, no history of orthodontic treatment, teeth in healthy periodontal condition, no anterior restorations, no evidence of apparent loss of tooth structure due to attrition, erosion, abrasion, or trauma, and no apparent defect, deformity, or asymmetry of the face.

A digital caliper (Fig 1) and canine tip marker (Fig 2) were used for measurement of intercanthal width, interalar width, and intercanine distance in male and female patients. For measurement of the intercanthal width, patients were seated in a dental chair with their heads supported in an upright position so they looked forward at the horizon. The external jaws of the digital caliper were placed against the forehead and lowered toward the eyes. The external jaws of the caliper were adjusted so they were in correct alignment with the medial angles of the palpebral fissures of the eyes. The distance between these two

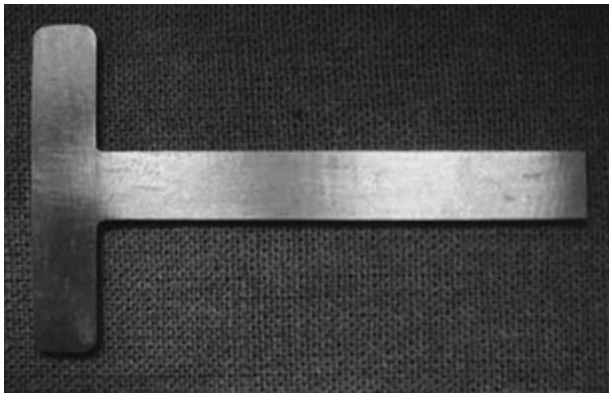

Figure 2 Canine tip marker.

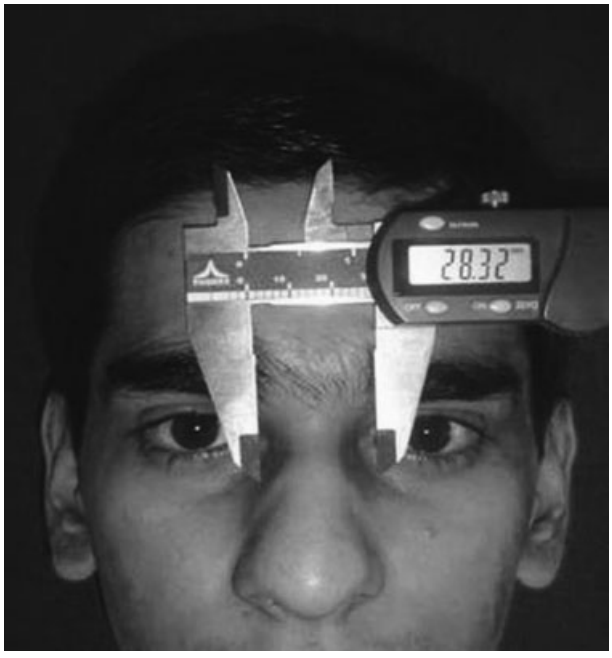

Figure 3 Measurement of intercanthal width using vernier caliper.

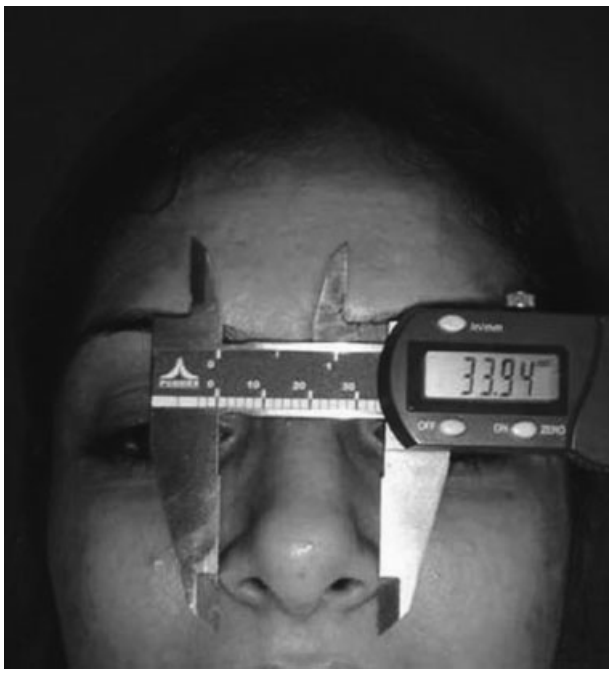

Figure 4 Measurement of interalar width using vernier caliper.

anatomical landmarks was recorded as the intercanthal width to an accuracy of 0.01 mm (Fig 3). With the subject in the same position as described above, the external jaws of the digital caliper were placed against the forehead and lowered toward the nose. The external jaws of the caliper were adjusted so they were in gentle contact with the maximum contour of the alae of the nose. The distance between these two anatomical landmarks was recorded as the interalar width to an accuracy of 0.01 mm (Fig 4). The intercanthal width and interalar width were measured three times for each patient by the same person, and the values were averaged.

A T-shaped flat metal plate, known as a canine tip marker, was specifically made to accurately record the distance between the tips of the maxillary canines. The horizontal arm of the metal plate was 5-cm long and 1-cm wide with rounded ends and was used for marking the canine tips. The vertical arm was 7.5-cm long and 1-cm wide and was used for holding the canine tip marker. One side of the horizontal arm of the canine tip marker was blackened with carbon soot. The markings of the cusp tips of the right and left maxillary canines were obtained on it, by contacting the horizontal arm against those teeth, without touching the upper incisors, while holding it steady by the vertical arm (Fig 5). The distance between the marks of the tips of maxillary canines obtained on the canine tip marker was measured with the caliper (Fig 6). The procedure was repeated twice, to obtain three readings for each patient, and the mean was calculated and recorded in each case. The entire procedure was performed by the same person, and the measurements obtained were interpreted and subjected to statistical analysis.

Figure 5 Canine tip marks obtained on canine tip marker.

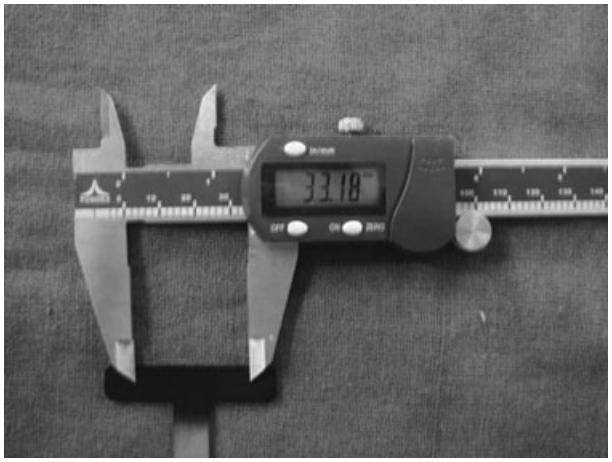

Figure 6 Measurement of intercanine distance with digital vernier caliper.

Table 1 Measurements in male patients

Location	Range (mm)	Mean (mm)	Standard deviation	Standard error
Intercanthal distance	25.12 to 32.07	28.89	1.72	0.243
Interalar distance	31.89 to 41.21	36.31	2.53	0.3579
Intercanine distance	32.51 to 37.88	35.14	1.26	0.1775

Table 2 Measurements in female patients

Location	Range (mm)	Mean (mm)	Standard deviation	Standard error
Intercanthal distance	20.95 to 34.01	27.57	2.93	0.4181
Interalar distance	28.99 to 36.47	32.77	1.70	0.2401
Intercanine distance	31.3 to 38.16	33.84	1.37	0.1937

Table 3 Correlation coefficient, regression coefficient, *t*-value, *p*-value, and regression equation for intercanthal width and intercanine distance

Subject groups	Difference in mean values (mm)	Correlation coefficient	Regression coefficient	*t*-value	*p*-value	Regression equation
Men	6.25	0.177	0.129	1.24	<0.05	$X_2 = 0.1290\ X_1 + 31.4134$
Women	6.27	0.145	0.068	1.02	<0.05	$X_2 = 0.06782\ X_1 + 31.9709$

X_1 = intercanthal width; X_2 = intercanine distance, taken as dependent variable.

Table 4 Correlation coefficient, regression coefficient, 't'-value, 'p'-value, and regression equation for interalar width and intercanine distance

Subject groups	Difference in mean values (mm)	Correlation coefficient	Regression coefficient	*t*-value	*p*-value	Regression equation
Male	1.17	0.413	0.205	3.14	>0.05	$X_2 = 0.2047\ X_1 + 27.7077$
Female	1.07	0.457	0.367	3.56	>0.05	$X_2 = 0.3686\ X_1 + 21.7598$

X_1 = interalar width; X_2 = intercanine distance, taken as dependent variable.

Results

Range, mean, standard deviation, and standard error of intercanthal width, interalar width, and intercanine distance in male and female patients are shown in Tables 1 and 2. Correlation coefficient, regression coefficient, *t*-value, *p*-value, and the regression equation for intercanthal width and intercanine distance and similarly for interalar width and intercanine distance in male and female patients are given in Tables 3 and 4. The scatter of the actual readings of intercanine distance with intercanthal and interalar width are depicted in Figures 7–10. These were plotted for both groups to show a possible correlation between the two readings. The corresponding regression lines were also obtained in the scatter diagram on the basis of prediction formulas (Tables 3 and 4).

Discussion

If old photographs or preextraction records are available, it should be remembered that these records not only provide a wealth of information regarding the patient's preedentulous state, but also provide a focal point for discussion. Most

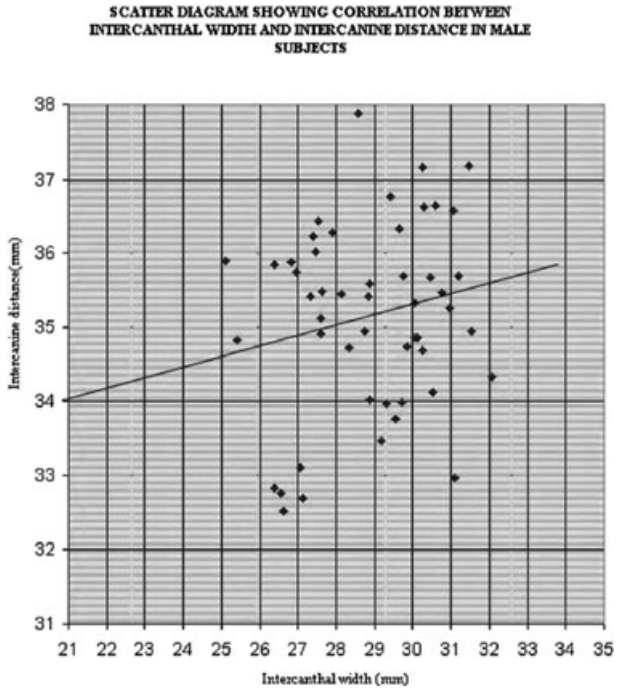

Figure 7 Correlation between intercanthal width and intercanine distance in men.

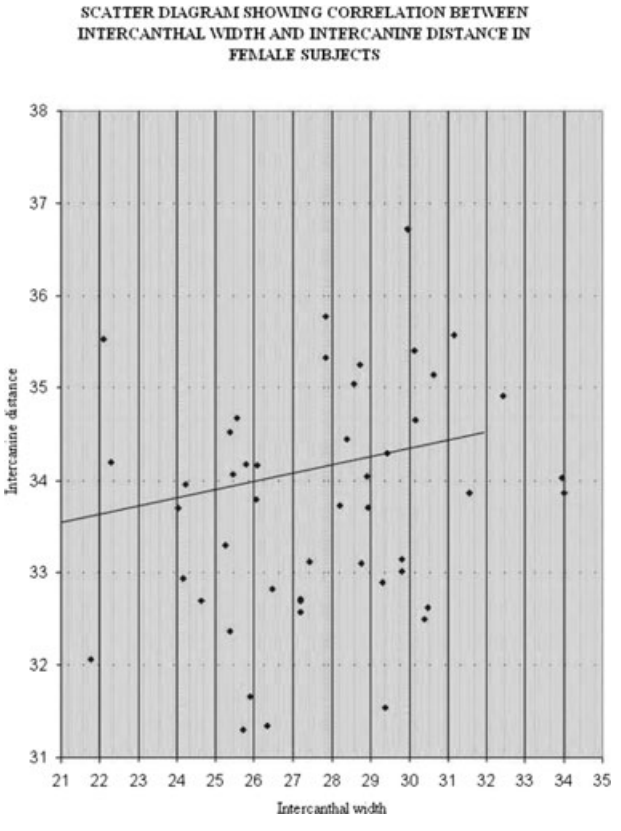

Figure 8 Correlation between intercanthal width and intercanine distance in women.

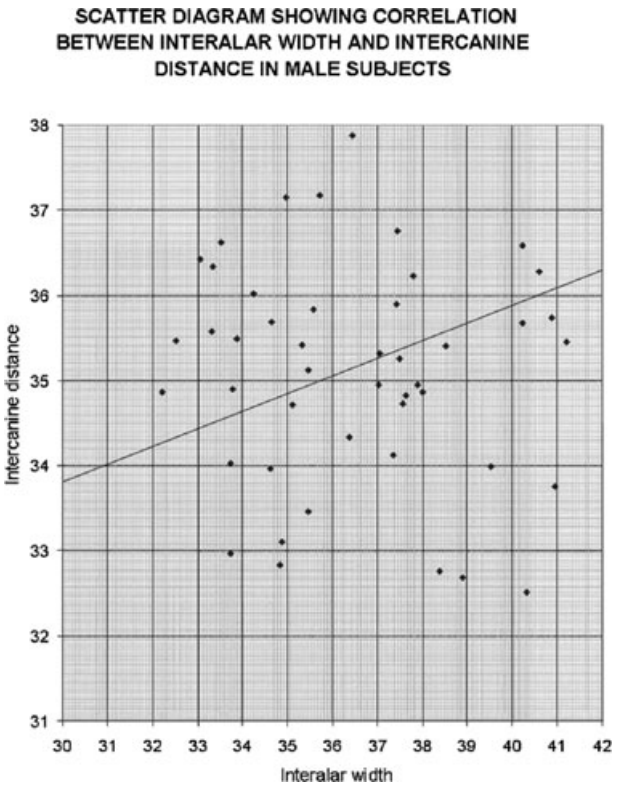

Figure 9 Correlation between interalar width and intercanine distance in men.

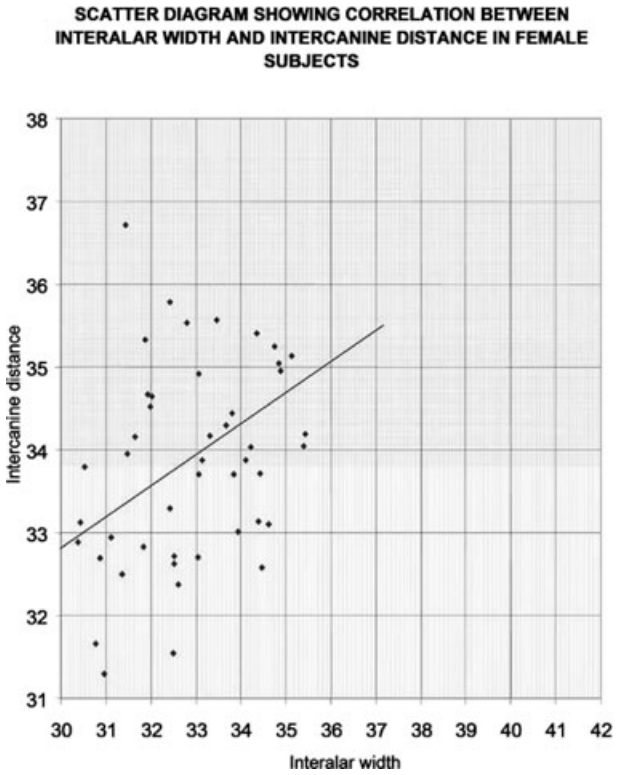

Figure 10 Correlation between interalar width and intercanine distance in women.

commonly, the corners of the mouth and lip lines have been suggested as guides for the selection and placement of upper anterior teeth, but this procedure is not considered to be reliable, as this relation is different at rest, and continuously changes in function. Further, it is also dependent on the tonicity of the muscles comprising the lip mass. In the absence of teeth or alveolar structures or in the presence of an inadequately constructed prosthesis, the musculature does not have adequate support to maintain tonus of the facial muscles. The face then loses its variegated and differentiated contours, which identify the individual esthetics of each patient.[4]

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.[5]

The intention of the present study was to explore the possible relationship of the intercanine distance with the intercanthal and interalar distance in young male and female groups. Subject age groups were restricted to 17 to 21 years in North Indian dentulous subjects, as attrition and other damages are minimal at this age. The data provided through a statistical analysis serve as a guide for proper selection of the upper anterior teeth for edentulous patients. In the present study, the tips of the cusps of the canines were recorded clinically by use of the canine tip marker. Distinct markings of canine tips were obtained, 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,[6] Mavroskoufis and Ritchie,[7] Varjao and Nogueira,[8] and Zlataric and Kristek.[9] The canine tip marker was used directly for measuring intercanine distance in subjects, while measurement of intercanine distance 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 distance 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. Hoffman et al[10] used wax incisal edge registration for marking canine tips, which is not considered reliable, because wax may get distorted.

Student's *t*-test was applied to test the significance of an observed sample correlation coefficient at 0.05 level of significance with 48 degree of freedom. Values found when intercanthal width and intercanine distance were correlated in men and women were 1.24 and 1.02, respectively, less than the standard value (1.96), showing no significant correlation between

these landmarks. When interalar width and intercanine distance were correlated in men and women, the values were 3.14 and 3.56, respectively, greater than the standard value (1.96), showing significant correlation between these two anatomical landmarks. This analysis supports the fact that interalar width can be used as a guide for selecting anterior teeth. From a clinical point of view, a very small difference between the mean intercanine distance and mean interalar width of men and women again strengthens the same result.

There is a lack of agreement in the literature regarding the selection of upper anterior teeth based on the correlation of interalar width and intercanine distance, and Smith,[6] Latta et al,[11] and Varjao and Nogueira[8] supported this finding, but Mavroskoufis and Ritchie,[7] Hoffman et al,[10] Ahn et al,[12] and Hasanreisoglu et al[13] found interalar width to be a fairly accurate guide. Abdullah[14] suggested that intercanthal distance can be used to estimate the mesiodistal width of a maxillary central incisor for edentulous patients. Gomes et al[15] found in their study that intercanthal distance, interpupillary distance, and intercommissural width showed the highest probability of being correlated to the mesiodistal width of the teeth.

It was also seen that men had a wider nose and slightly greater intercanine distance than women did. This is in agreement with the findings of Smith,[6] and Varjao and Nogueira.[8] Unfortunately, preextraction records are not available in most cases, and in the absence of these records, interalar width for the selection of maxillary anterior teeth can only be taken as a guide and not as a rule. This study was done in a limited number of subjects, but further study should be carried out to evaluate any definite relationship of intercanine distance with various soft-tissue landmarks.

Conclusion

This study introduced a new tool—a T-shaped flat metal plate (canine tip marker), which was successfully used to mark the intercanine distance. Within the limitations of this study in a North Indian population, the following conclusions can be drawn:

(1) A significant correlation was found between interalar and intercanine distance in men as well as in women, as the *t*-values at a 5% level of significance and 48 degree of freedom calculated were 3.14 and 3.56, respectively, showing a greater value than standard value (1.96). These findings suggest that interalar width can be used as a reliable guide for maxillary anterior teeth selection.

(2) No significant correlation between intercanthal width and intercanine distance was found in men and women, as the *t*-value was less than standard value suggesting that intercanthal width cannot be used as guideline for anterior teeth selection.

(3) In men, intercanine distance and interalar width were found to be of greater value than those found in women.

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