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Assessing position of canine by the use of facial landmarks in completely edentulous patients for optimal esthetics in Indian population

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Abstract

Statement of problem: The process of selecting anterior teeth is crucial in complete denture treatment, impacting not just aesthetics but also functions like chewing and speech clarity. However, traditional methods for selecting these teeth lack a strong foundation and are based on facial measurements and proportions, which can differ significantly among various ethnic groups.

Purpose: The purpose of the study wasto determine the correlation between various clinical landmarks and canine position and evaluating their efficacy in determining the position of the canine tooth.

Material and Methods: Twenty subjects (10 males and 10 females) between the ages of 18 and 25, all with a complete set of six maxillary anterior teeth, participated in this study. Three reference lines—ala line (A line), inner canthus to ala line (IA line), and pupil line (P line)—were established. Horizontal distances from every reference line to both the canine cusp tip and distal contact point were measured and assessed using paired sample t-tests and one-sample t-tests.

Results: In males, both the A line and IA line were observed to be closer to the canine tip compared to the P line. Conversely, among females, although not statistically significant ($P > 0.05$), the IA line exhibited closer proximity to the canine tip compared to both the A line and the P line. Significant differences were noted between all three reference lines and the canine distal contact point on both sides for both genders ($p< 0.05$).

Conclusion: The IA line can effectively determine the location of canines in complete denture patients of both genders, whereas the A line is specifically reliable for determining the location of canines in males only.

Clinical implication: The significance of facial landmarks in achieving a harmonious facial appearance cannot be overstated in the construction of complete dentures. When employing the A line method and IA line method in males, it's recommended that the line should align with the canine cusp tip. Conversely, in females, the IA line should align with the canine cusp tip. This gender-specific adjustment ensures accurate positioning of the lines relative to the canine teeth, optimizing the precision and aesthetic of dental procedures.

Keywords: Anterior teeth selection, complete denture treatment, facial landmarks

1. Introduction

A fixed or removable dental prosthesis is designed to replace the entire set of teeth and their associated structures in either the maxilla or mandible.[1]Patients who have experienced tooth loss not only face challenges with chewing and speech but also grapple with the emotional toll of altered physical appearance. Therefore, the primary objective of providing complete dentures is to restore both functionality and confidence in one's appearance. To accomplish this objective, it is essential to comprehend the various physical and biological factors involved.[2]

Artificial teeth selection typically relies on pre-extraction records such as diagnostic casts, radiographs, and recent photographs that capture the patient's natural smile. However, patients lacking such records present a more intricate challenge in tooth selection, potentially leading to misaligned teeth. This misalignment can have adverse effects on the patient's appearance, facial expressions, gingival health, and speech clarity.[3]

In the absence of pre-extraction records, clinicians have explored alternative methods, such as measuring the distance between the maxillary canines by referencing the width of the nose. This method stems from the embryological connection between the premaxilla and the nose.[4-5] Nevertheless, research has revealed inconsistencies in the correlation between interalar width and intercanine distance among different populations, underscoring the importance of exercising caution when relying exclusively on this method.[6]

Traditionally, clinicians have relied on two methods to evaluate the position of the canine cusp tips: the alar line and the inner canthus to alar line. These methods aim to estimate the location of the canine cusp tips but can lead to confusion due to their different reference points.[7] However, the distance between the distal contact points of the canines is critical for selecting the size of artificial teeth, attention should ideally focus on these contact points rather than the cusp tips.[8]

Due to the uncertainty regarding these concepts and the differences seen across ethnicities, this study seeks to quantitatively examine the disparities among three facial reference lines—the alar line, the inner canthus to alar line, and the center of the pupil line—in their relation to canine position. Additionally, it seeks to evaluate the effectiveness of using these reference lines in predicting the position of the canine distal contact points. By gaining a clearer understanding of these methods, clinicians can enhance the precision of denture fabrication for edentulous patients.[9-10]

Thus, this *in vivo* research work was designed to investigate and compare different reference lines, i.e., the alar line(A line), inner canthus to alar line(IA line), and pupil line(P line) for determining the position of the canine tooth. The null hypothesis of the present study was that the A line, the IA line, or the pupil line cannot be used to evaluate the position of the canines in the Indian population.

2. Materials And Methods

Patient selection

The study obtained approval from the institutional ethics committee. It included 20 participants (10 males and 10 females) aged 18 to 25 years, all having fully erupted maxillary anterior teeth. Horizontal distances from designated reference lines to both the tip and distal contact point of the canine were meticulously measured and analyzed.

All participants had fully erupted natural maxillary anterior teeth, with a vertical overlap ranging from 1 to 3 mm and a horizontal overlap of approximately 20% to 30% of the height of the mandibular incisors. They were categorized as having Angle Class I occlusion, with teeth that were free from cracks, artificial crowns, proximal restorations, crowding, rotation, or misalignment. Individuals who had undergone prior orthodontic treatment or had any facial abnormalities (congenital, traumatic, or surgical) were excluded from the study.

Methodology

Each participant was positioned facing forward in a relaxed posture. The first reference line, termed the alar line (A line), was identified as the widest point of the nose. To ascertain the positional relationship of the A lines relative to the maxillary canine, a stainless steel ruler was placed perpendicular to the floor and gently positioned against the widest part of the ala of the nose, corresponding to the A line (see Fig. 1). Using a digital vernier caliper (see Fig. 2), measurements were taken of the distances between the ruler and two specific points—the canine CT (canine tip) and CD (canine distal contact point)—on both the left and right sides.

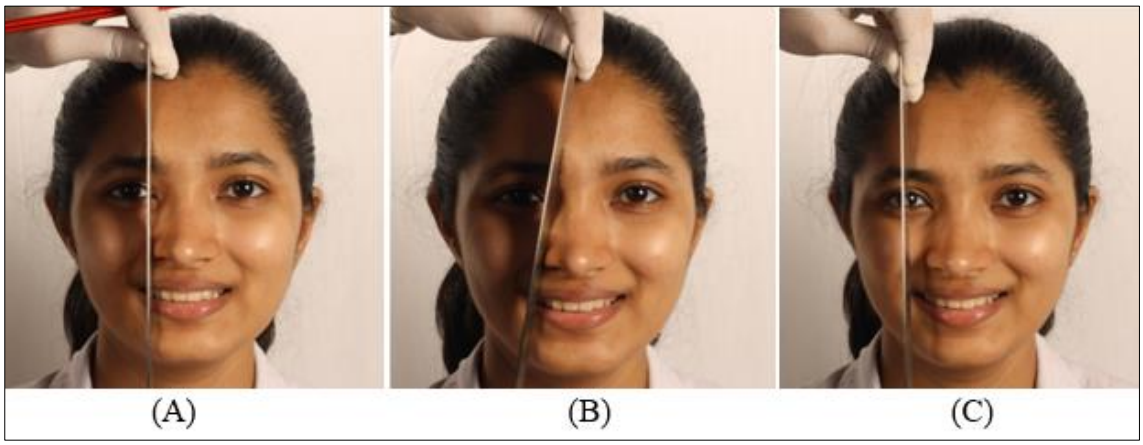


FIGURE 1: FACIAL REFERENCE LINES, A-ALAR LINE, B-INNER CANTHUS TO ALA LINE, C- PUPIL LINE

When the ruler was positioned precisely at the landmark of interest, the measurement was recorded as 0. A positive value indicated that the alignment was distal to the landmark, while a negative value indicated alignment mesial to the landmark. To evaluate the inner canthus to ala line (IA line) relative to the maxillary canine, the stainless steel ruler's position was adjusted to define a reference IA line connecting the inner canthus of the eye to the widest part of the ala of the nose (see Fig. 1). Horizontal distances between the ruler and two landmarks—the CT (canine tip) and DC (canine distal contact point)—were measured using the same method employed for assessing the A line (Fig. 2). To analyze the pupil line (P line) and its relationship with the maxillary canine, the ruler was adjusted to pass through the center of the pupil while maintaining perpendicularity to the floor (Fig. 1). Horizontal distances between the ruler and the CT and DC landmarks were examined using the identical approach used for measuring the A line (Fig. 2).

FIGURE 2:HORIZONTAL DISTANCE BETWEEN THE REFERENCE LINE AND CANINE LANDMARKS WERE MEASURED

All measurements were conducted by a single investigator, and mean values were calculated. Statistical analysis was performed to analyze the data. The differences between males and females for each measurement were evaluated using the unpaired t-test. Additionally, for the measurements of the A line, IA line, and P line to CT (canine tip) or A line, IA line, and P line to DC(canine distal contact point) positions, the 1-sample t-test was employed with a test value of 0 to determine the alignment of facial landmarks with the canine position.

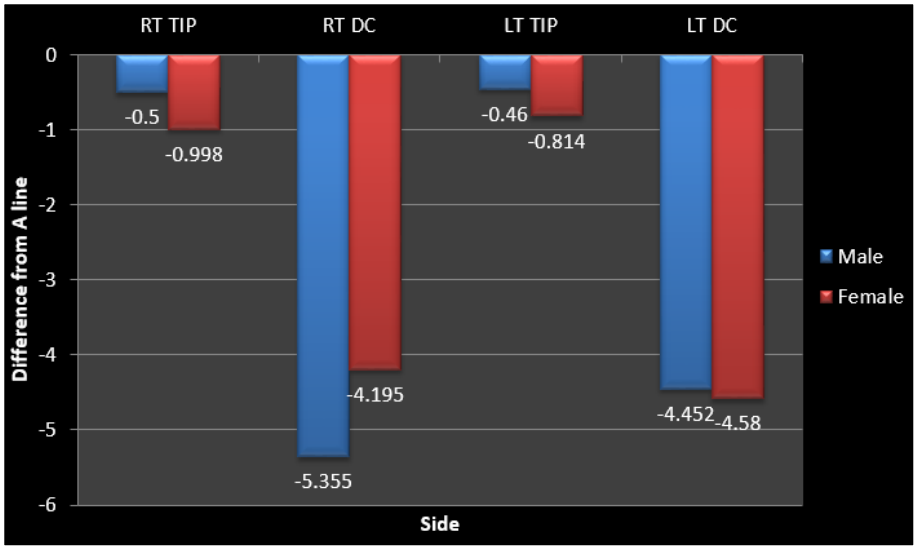
3. Results

Table 1 illustrates that regarding the ala line (A line), there was no statistically significant difference observed in males regarding RT TIP (right canine tip) and LT TIP (left canine tip) ($P>0.05$), whereas a significant difference was noted in females for both RT TIP and LT TIP($P<0.05$). Regarding the A line's relation to the canine distal contact point (DC), a significant difference was found in both males and females. In terms of gender comparison, no statistically significant difference was present between males and females in relation to the target landmark on both RT DC and LT DC sides while the statistically significant difference was found between males and females in relation to target landmark on both RT TIP and LT TIP (Graph 1).

TABLE 1:ALA WISE DISTRIBUTION IN MALE AND FEMALE SUBJECTS

Reference line	Canine landmarks	Gender	Number	Value		P Value	P Value
				Mean	SD		
ALA	RT TIP	Male	10	-0.500	1.663	0.219**	0.042*
		Female	10	-0.998	0.770	0.010*	
	RT DC	Male	10	-5.355	2.073	≤ 0.001*	0.170**
		Female	10	-4.195	1.512	≤ 0.001*	
	LT TIP	Male	10	-0.460	0.650	0.052**	0.034*
		Female	10	-0.814	0.920	0.021*	
	LT DC	Male	10	-4.452	1.459	≤ 0.001*	0.847**
		Female	10	-4.580	1.474	≤ 0.001*	

Level of Significance P ≤ 0.05, * Significant, ** Non Significant

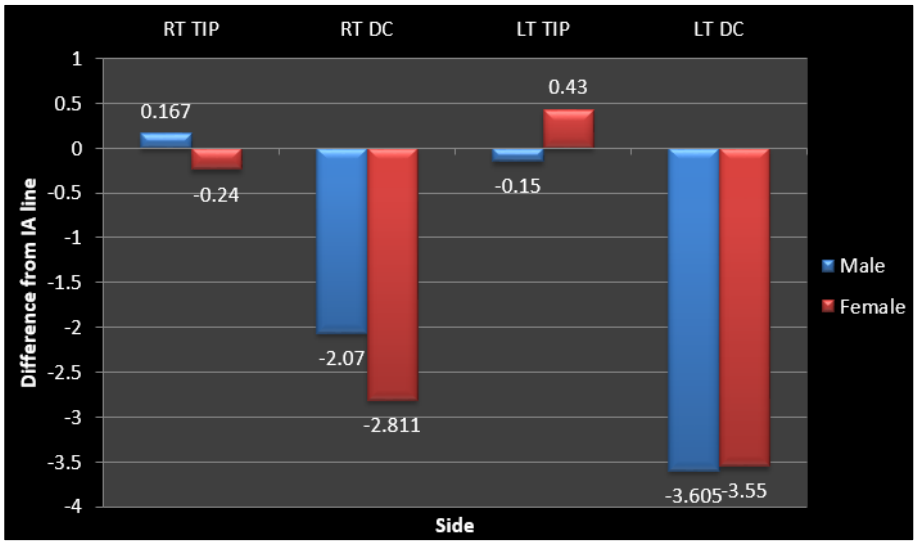


GRAPH 1: ALA WISE DISTRIBUTION IN MALE AND FEMALE SUBJECTS

TABLE 2: IA LINE WISE DISTRIBUTION IN MALE AND FEMALE SUBJECTS

Reference line	Canine landmarks	Gender	Number	Value		P Value	P Value
				Mean	SD		
IA LINE	RT TIP	Male	10	0.167	2.304	0.144**	0.090**
		Female	10	-0.240	0.935	0.438**	
	RT DC	Male	10	-2.070	3.229	0.043*	0.526**
		Female	10	-2.811	1.536	≤ 0.001*	
	LT TIP	Male	10	-0.150	1.609	0.775**	0.472**
		Female	10	0.430	1.907	0.494**	
	LT DC	Male	10	-3.605	2.332	0.001*	0.954**
		Female	10	-3.550	1.886	≤ 0.001*	

Level of Significance P ≤ 0.05, * Significant, ** Non Significant



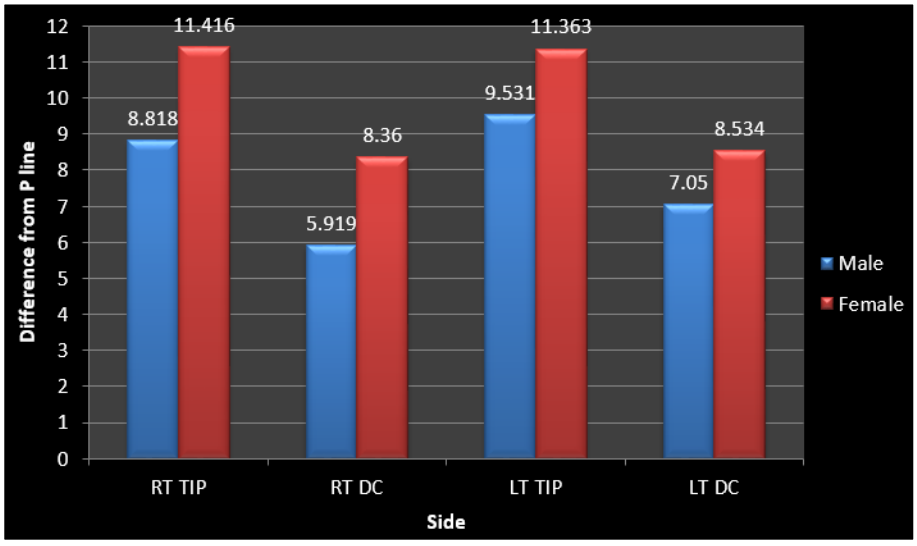
GRAPH 2: IA LINE WISE DISTRIBUTION IN MALE AND FEMALE SUBJECTS

Table 2 illustrates that concerning the inner canthus to ala line (IA line), there was no statistically significant difference observed in both males and females regarding RT TIP and LT TIP (P>0.05), whereas a significant difference was found in both gender for both RT DC and LT DC (P<0.05). In terms of gender comparison, no statistically significant difference was present between males and females in relation to RT DC, LT DC, RT TIP and LT TIP.

TABLE 3: PUPIL LINE WISE DISTRIBUTION IN MALE AND FEMALE SUBJECTS

Reference line	Canine landmarks	Gender	Number	Value		P Value	P Value
				Mean	SD		
PUPIL	RT TIP	Male	10	8.818	3.652	≤ 0.001*	0.124**
		Female	10	11.416	3.551	≤ 0.001*	
	RT DC	Male	10	5.919	3.763	0.001*	0.117**
		Female	10	8.360	2.794	≤ 0.001*	
	LT TIP	Male	10	9.531	3.479	≤ 0.001*	0.118**
		Female	10	11.363	2.583	≤ 0.001*	
	LT DC	Male	10	7.050	3.727	≤ 0.001*	0.277**
		Female	10	8.534	1.898	≤ 0.001*	

Level of Significance P ≤ 0.05, * Significant, ** Non Significant



GRAPH 3: PUPIL LINE WISE DISTRIBUTION IN MALE AND FEMALE SUBJECTS

Table 3 illustrates that concerning the Pupil line(IA line), there was a statistically significant difference observed in both males and females regarding RT TIP, LT TIP, RT DC and LT DC($P<0.05$). In terms of gender comparison, no statistically significant difference was found between males and females in relation to RT DC, LT DC, RT TIP and LT TIP (Graph 3).

4. Discussion

Based on the current findings, the initial research hypothesis was partially refuted as neither the A line, IA line, nor pupil line precisely predicts the location of the canine tip (CT) in either gender. However, in males, both A line and IA line successfully determined the location of the canine tip on both sides. In females, only IA line was effective in determining the canine tip bilaterally. These findings are crucial for guiding tooth selection in complete denture treatments, especially in cases where pre-extraction records are unavailable.

The accurate replication of natural tooth size and alignment is essential in artificial teeth selection. Various methods, such as estimating tooth size from the width between the broadest part of the nose (interalar width), have been explored. Previous studies have predominantly examined the correlation between interalar width and intercanine width. Gender differences observed are attributed to variations in facial proportions, necessitating separate analysis of data for males and females.

Therefore, generalizing data from one ethnicity to others should be avoided, emphasizing the need for ethnicity-specific studies to optimize satisfaction with complete denture therapy in diverse populations.[11]

This study addresses the limitations of prior research, which primarily centered on the correlation among interalar width and intercanine distance.[12] While McCord and Grant recommended adding 8 to 10 mm to ala width for determining canine position, this study examines the relationship between the ala of the nose and both the canine tip (CT) and canine distal contact points (DC).[13]

Contrary to traditional denture teachings, none of the line accurately predicts the location of the canine distal contact point(DC).[14] Additionally, the P line consistently falls distal to the canine's distal contact point, indicating its inadequacy for estimating canine position. Statistical analysis shows that in males, both the A line and IA line are closer to the canine tip compared to the P line, whereas in females, the IA line demonstrates the closest proximity to the tip. Therefore, the IA line emerges as a more reliable guide for determining the merged width of the six anterior maxillary teeth in the Indian population. However, considerations such as jaw ridge morphology and patient aesthetic preferences must also be taken into account when determining tooth position in complete denture construction.

Miranda *et al*.'s evaluation of the consistency of interalar width and intercommissural width for determining artificial maxillary anterior teeth supports the findings of this study.[10] They also noted relationships between the distance between the nostrils and the distance between the canine teeth, as well as between the distance between the corners of the mouth and the distance between the furthest points of the canine teeth. In a study by Paras D *et al*. on the examination of reliable extraorallandmarks in relation to maxillary canines in dentulous subjects, they concluded a significant correlation exists between extraoral landmarks and canine position. This finding suggests that these landmarks can serve as reliable guides for locating the position of canines in dental procedures.[15] In a study conducted by Sinavarat P *et al*., it was concluded that there exists a correlation between canine position and facial landmarks. This suggests that certain facial landmarks can be indicative of the position of the canines, providing valuable guidance for dental procedures.[16]

Numerous studies in the literature have highlighted the utility of inter alar width as a valuable guideline for selecting and replacing anterior teeth in edentulous patients. However, it's essential to note that while inter alar width provides valuable guidance, achieving pleasing and harmonious outcomes in complete denture construction requires consideration not only of anatomical measurements but also of esthetic and phonetic factors.[17-20] Therefore, a comprehensive approach that combines facial landmarks with aesthetic and phonetic considerations is recommended for optimal denture outcomes. Limitations of this study encompassed its focus solely on the Indian population, which may exhibit craniofacial dimensions distinct from other ethnic groups. Hence, future research should encompass diverse populations and compare different ethnic groups to advance complete denture prosthodontics.

5. Conclusion

Based on the findings of this clinical study, the following conclusions were drawn:

1. Among Indian males, both the IA line and A line are effective in locating the canine tip. In females, the IA line is reliable for determining the canine tip's location.
2. Neither line could pinpoint the location of the canine distal contact point in males or females.
3. The IA line and A line are closer to canine landmarks compared to the P line in both genders. Consequently, the P line

lacks accuracy in determining the canine's position.

6. References

1. Saintrain MV, Souza EH. Impact of tooth loss on the quality of life. Gerodontology 2011; 29:1741-2358.
2. Engelmeier RL. Complete denture esthetics. Dent Clin North Am 1996;40: 71-84.
3. Wehner PJ, Hickey JC, Boucher CO. Selection of artificial teeth. J Prosthet Dent 1967;18:222-32.
4. Young HA. Denture esthetics. J Prosthet Dent 1956;6:748-55.
5. Zarb GA, Bolender CL, Eckert S, Jacob R. Prosthodontic treatment for edentulous patients: complete dentures and implant-supported prostheses. 13th ed. St. Louis: Mosby/Elsevier; 2013. p. 204-12.
6. Halperin AR, Graser GN, Rogoff GS. Mastering the art of complete denture. Chicago: Quintessence Publishing Co, Inc; 1988. p. 107-18.
7. Hamilton WJ, Mossman HW. Human embryology. 4th ed. Cambridge: W Heffer and Sons; 1993. p. 325-32.
8. Moore KL, Persaud TVN, Torchia MG. The developing human: clinically oriented embryology. 6th ed. Philadelphia: Saunders/Elsevier; 2008. p. 237-53.
9. Deogade SC, Mantri SS, Sumathi K, Rajoriya S. The relationship between innercanthal dimension and interalar width to the intercanine width of maxillary anterior teeth in central Indian population. J Indian Prosthodont Soc 2018;15:91-7.
10. Miranda GA, D'Souza M. Evaluating the reliability of the interalar width and intercommissural width as guides in selection of artificial maxillary anterior teeth: a clinical study. J Interdiscip Dent 2016;6:64-70.
11. Hoffman W Jr, Bomberg TJ, Hatch RA. Interalar width as a guide in dental tooth selection. J Prosthet Dent 1986;55:219-21.
12. Varjao FM, Nogueira SS. Nasal width as a guide for the selection of maxillary complete denture anterior teeth in four racial groups. J Prosthodont 2006;15: 353-8.
13. McCord JF, Grant AA. Registration: stage IIIeselection of teeth. Br Dent J 2000;188:660-6.
14. Özkan YK. Complete denture prosthodontics: treatment and problem solving. Cham: Springer International Publishing; 2018. p. 6-7.
15. Paras D, Riddhi S, Kumar S. Identification of Reliable Extraoral Anatomical Landmarks in Relation to Maxillary Canines in Dentulous Subjects: An *in Vivo* Study. Journal of Coastal Life Medicine. 2023 May 29;11:1095-106.
16. Sinavarat P, Anunmana C, Hossain S. The relationship of maxillary canines to the facial anatomical landmarks in a group of Thai people. The journal of advanced prosthodontics. 2013 Nov;5(4):369.
17. Maskey S, Shrestha R, Yadav R, Yadav N. Relation between Inter alar width and inter canine distance in aid for the replacement of artificial maxillary anterior teeth. JMSCR. 2018;6:624-8.
18. Gomes VL, Gonçalves LC, Costa MM, DE LIMA LUCAS BA. Interalar distance to estimate the combined width of the six maxillary anterior teeth in oral rehabilitation treatment. Journal of Esthetic and Restorative Dentistry. 2009 Feb;21(1):26-35.
19. Rai R. Correlation of nasal width to inter-canine distance in various arch forms. The Journal of Indian Prosthodontic Society. 2010 Jun;10:123-7.
20. Hossain S, Islam KZ, Islam KM. Correlation between maxillary canines and facial anatomical landmarks in a group of Bangladeshi people. City Dent Coll J. 2012 Oct 21;9:12-4.