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REVIEW ARTICLE

Determination of Correlation of Width of Maxillary Anterior Teeth using Extraoral and Intraoral Factors in Indian Population: A Systematic Review

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ABSTRACT

Introduction: Various anthropometric measurements have been used to determine the size of maxillary anterior teeth. However, which anthropometric measurement is the most reliable indicator to determine the width of maxillary anterior teeth remains unclear.

Aims and objectives: To evaluate which anthropometric measurement is the most reliable indicator in determining the width of maxillary anterior teeth.

Materials and methods: An electronic search was conducted for scholarly articles discussing various anthropometric measurements used for determination of width of maxillary anterior teeth, written in English or translated into English listed with PubMed, Cochrane Library, ScienceDirect, Wiley Online Library, and Google scholar databases. The search strategy yielded 119 articles. Out of them, 70 were excluded following reading of abstract, and 49 were selected for full-text reading. Of these, 21 were excluded based on exclusion criteria. Finally, 28 articles were included for final search. Due to heterogenicity of studies, a meta-analysis was not performed.

Results: High degree of correlation was seen between interalar width (IAD), interpupillary distance (IPD), bizygomatic width (BW), and width of maxillary anterior teeth, in Indian population, whereas in Saudi population, intercanthal distance (ICD) has high degree of correlation to the width of maxillary anterior teeth, and in Brazilian (mulatto and blacks) population, high degree of correlation was seen between intercommissural width (ICOW) and width of maxillary anterior teeth.

Conclusion: The anthropometric measurement used depends on the population group in which it is being used. There is no single anthropometric measurement that can be used to determine the width of maxillary anterior teeth. Hence, more studies with large sample size and different population groups need to be conducted.

Clinical significance: In Indian population, high degree of correlation was seen between IAD, IPD, BW, and width of maxillary anterior teeth. The results of the previous study should be validated by including a large population size spread over entire Indian subcontinent. This would also help to generate multiplication factor for various anthropological measurements for use limited to the Indian population.

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INTRODUCTION

The comfort, function, and esthetics must be restored altogether while treating a completely edentulous patient. One of the main objectives in selecting and arranging artificial teeth is to produce a prosthesis that defies detection.[1] The anterior teeth are the ones primarily selected to satisfy esthetics. The selection requires scientific knowledge as well as artistic skill of the dentist. Teeth that are of a proper size are essential in achieving a natural looking denture.[2-5] Patients requiring complete dentures usually expect comfort first, followed by harmonious appearance and efficiency. Besides, on receiving their first dentures, patients often expect to appear similar to when they had their natural teeth. Therefore, correct selection of artificial teeth is essential to achieve a pleasant esthetic outcome.[6-10] The width of the maxillary anteriors is difficult to correlate with the facial measurements than the height of the maxillary anteriors. In addition, the generation approaching 70 years of age recognizes that maintaining their natural dentition improves appearance and smile and serves as a visible sign of successful aging.[11,12] Many efforts have been made to accurately quantify the selection of the anterior teeth. Some of the more familiar ones are BW, IPD, ICD, IAD, and ICOW), and some newer anatomical measurements, such as philtral width, pterygomaxillary notch (PMN), circumference of skull (COS), maxillary arch length (MAL), and maxillary arch width (MAW) have also been studied. However, little agreement on an effective method has been reached. There is no consensus of data regarding a single esthetic factor that can be used reliably as an aid for artificial tooth selection.[13-19] Hence, this systematic review was carried out to try and identify a single, reliable anthropometric

measurement that can be used to determine the size of the anterior teeth in various population groups.

Aim

The aim of this systematic review was to evaluate which anthropometric measurement is the most reliable indicator to determine the width of the maxillary anterior teeth in various population groups.

Null Hypothesis

There is no reliable anthropometric measurement to determine the width of maxillary anterior teeth.

Alternative Hypothesis

There is reliable anthropometric measurement to determine the width of maxillary anterior teeth.

Objective

The objective of the study was to identify a reliable anthropometric measurement which has a high degree of correlation with the width of maxillary anterior teeth.

MATERIALS AND METHODS

Sources used

An electronic search was conducted for scholarly articles discussing various anthropometric measurements used for determination of width of maxillary anterior teeth, written in English or translated into English, listed with PubMed, Cochrane Library, ScienceDirect, Wiley Online Library, and Google Scholar databases.

Population, Intervention, Comparision, and Outcome Analysis

Search Methodology

The search strategy yielded 119 articles. Of them, 70 were excluded following reading the extract, and 49 were selected for full-text reading. Of these 21 were excluded based on exclusion criteria. Finally, 28 articles were included for final search. Data extraction was done from the selected articles. The extracted data were analyzed statistically.

Population

The study population included patients undergoing replacement of missing anterior teeth/posterior teeth from different population groups: Such as adult human beings, dentulous mouth, male, female, Indian adults, South Indian adults, Brazilian ethnology, European ancestry, Asian continental ancestry group, African continental ancestry group, Canadian population, Arab population, and Saudi population.

Intervention

Various anthropometric measurements were taken: IPD, ICD, nose width, combined width of maxillary anterior teeth, IAD, ICOW, BW, circumference of head, anterior teeth width, facial width, mouth width, bridge of the nose width, base of the nose width, maxillary central incisor width (CIW), cervical width of maxillary central incisor, contact point width of maxillary central incisor, incisal width of maxillary central incisor, arch length, and arch width.

Comparison

Combined width of maxillary anterior teeth was found.

Outcome

Significant estimation and correlation between IPD, ICD, nose width, IAD, ICOW, BW, circumference of head, facial width, mouth width, bridge of the nose width, base of the nose width, arch length, arch width with maxillary CIW, and combined width of maxillary anterior teeth was determined.

Variables of Interest

Correlation between the anthropometric measurement and width of the maxillary anterior teeth was considered significant to be determined.

Selection of Studies

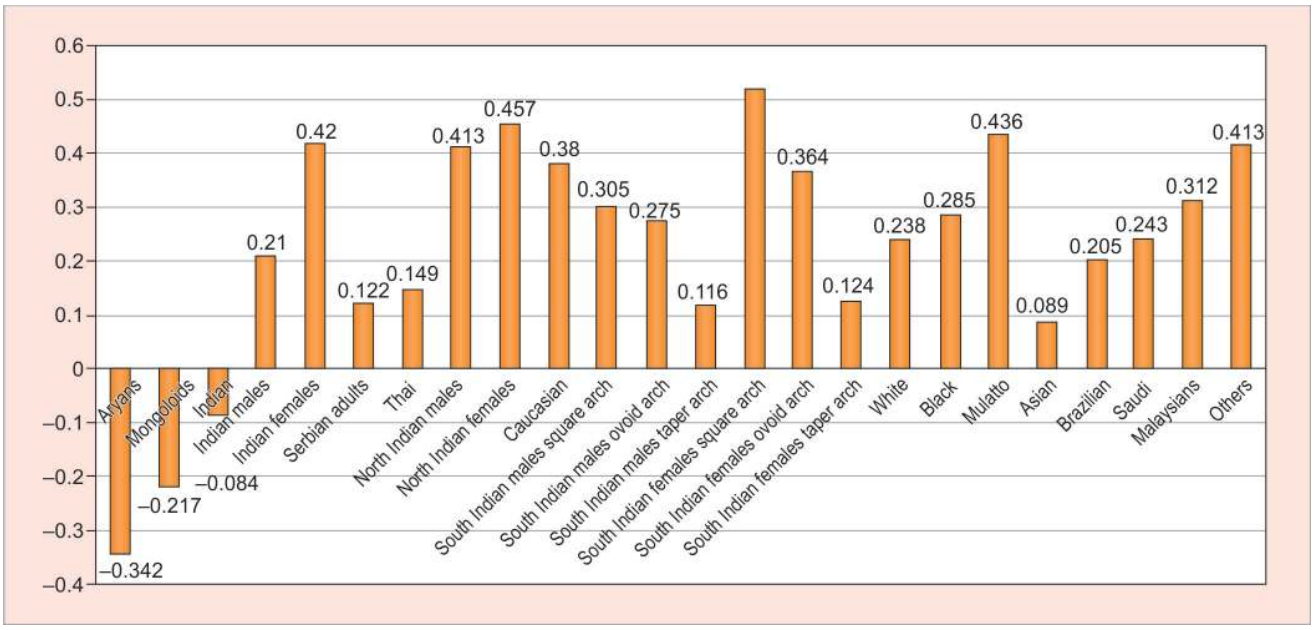
The review process consisted of two phases. In the first phase, titles and abstract of the search were initially screened for relevance and the full text of relevant abstract were obtained and accessed. The hand search of selected journals as well as search of references in the selected studies was also done. The articles that were obtained after first step of review process using the following inclusion and exclusion criteria were screened in second phase and relevant and suitable articles were isolated for further processing and data extraction. There were no language restrictions.

Inclusion Criteria

The articles discussing the following parameters were included for systematic review.

Types of Participants

- Dentulous subjects with natural permanent maxillary teeth in good alignment
- Subjects with Angle's Class I molar and canine relationships



Graph 1: Measurement of IAD in various population groups

- Patients with no history of orthodontic treatment or extraction
- Subjects whose teeth were morphologically normal
- Patients above 18 years of age, so facial growth was completed
- Dentate individuals from various population groups, such as Brazilians, Indians, Chinese, Caucasians, blacks, and Mulattos.

Types of Studies

- Cross-sectional studies
- Descriptive studies.

Types of Outcome Measurement

- Correlation between the anthropometric measurement and the width of maxillary anterior teeth.

Exclusion Criteria

Articles and manuscripts discussing the following parameters were excluded:

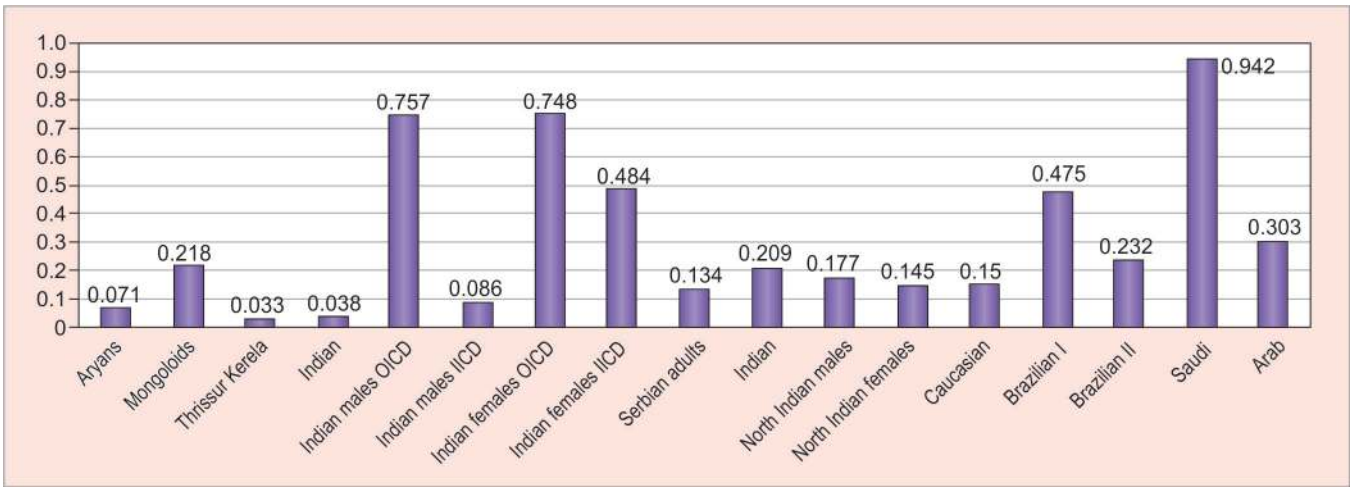
- Artificial crowns are placed on the upper teeth
- Maxillary anterior teeth with gingival inflammation or hypertrophy
- Subjects below 18 years of age
- Facial asymmetry (congenital or surgical facial defects)
- Animal studies
- *In vitro* studies
- Sample size <50.

RESULTS

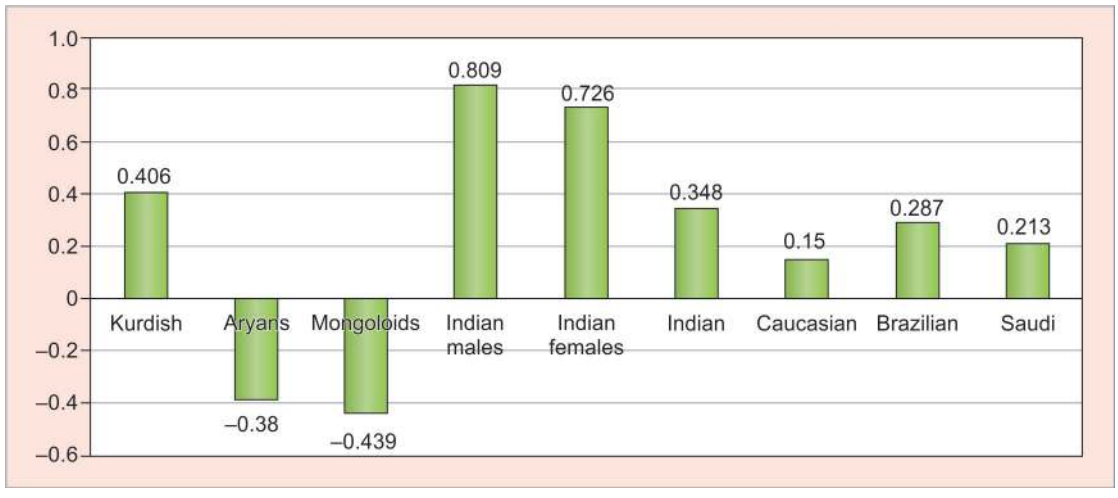
Among 28 articles which were included for final search, data extraction was done from the selected articles and was analyzed statistically. Indian population showed the highest correlation with IAD***, mainly South Indian females with square-shaped arch (r = 0.52), followed by North Indian females (r = 0.457), and least correlation was found in Asian population (r = 0.089), whereas negative correlation was seen in Aryans (r = −0342) and Mongoloids (r = −0.217) (Graph 1). Saudi population showed the highest correlation with ICD (r = 0.932), whereas Indian population (Thrissur, Kerala) showed the least correlation (r = 0.033) (Graph 2). Indian population showed highest correlation with IPD as well, mainly Indian males (r = 0.809) followed by Indian females (r = 0.726), and least correlation was found in Caucasian population (r = 0.15), whereas negative correlation was found in Aryans (r = −0.38) and Mongoloids (r = −0.439) (Graph 3). Mulatto (r = 0.518) and blacks (r = 0.516) showed the highest correlation with ICOW, whereas Caucasians (r = 0.16) showed least correlation, and Aryans (r = −0.337) and Mongoloids (r = −0.316) showed negative correlation (Graph 4). Indian population showed the highest correlation with BW, mainly Indian males (r = 0.50) followed by Indian females (r = 0.447), and least correlation was found in British population (r = 0.29) (Graph 5).

DISCUSSION

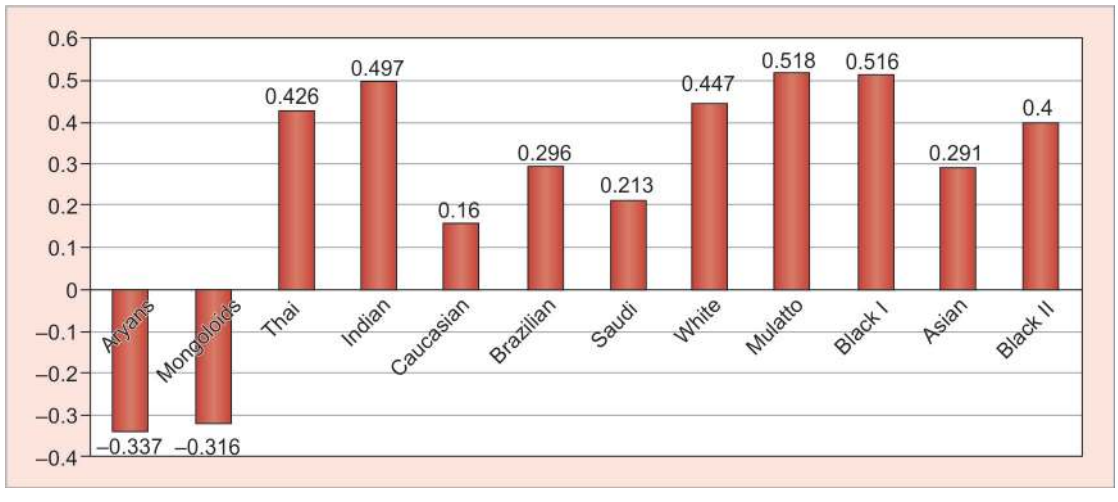
In case of absence of preextraction records, selection of upper anterior artificial teeth for edentulous patients is difficult. According to professional sources, a scientific and universally accepted method for accurately determining the mesiodistal width of anterior artificial teeth has not yet been found. Discussions on this topic are present in the contemporary professional literature.[20-28] Reviews of the recent scientific literature reveal studies



Graph 2: Measurement of ICD in various population groups

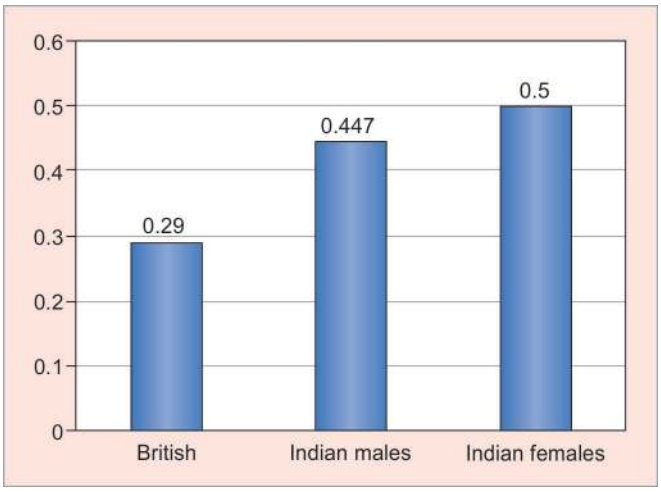


Graph 3: Measurement of IPD in various population groups



Graph 4: Measurement of ICOW in various population groups

that were carried out using different methodology and sample size, different face and natural teeth parameters,[8,10-13,15,19,20] casts,[5,16-18,21,22] or photographs,[5,14,16,17,20] as well as various types of gauge which make the comparison of results very difficult. The authors here used a variety of instruments to determine the measurements. The instruments varied from a traditional Boley's guage, digital Vernier calipers, Willis Guage, War wins foldable scale, modified dividers, and flexible rulers to an image processing software (HL Image).



Graph 5: Measurement of BW in various population groups

Out of 28 finally selected articles, 15 articles studied the IAD as an anthropometric parameter in determining the width of the maxillary anteriors, of which only 13 articles were studied because in 2 studies correlation coefficient was not mentioned. The population groups included in the studies were Aryans, Mongoloids, Indians, Serbian, Caucasians, White, Mulatto, Asian, Blacks, Brazilian, Saudi, and Malaysians. When the CIW was correlated with IAD, Caucasians showed greater correlation (r = 0.21)[13] than Serbian adults (r = 0.12).[9] When maxillary anterior teeth width was correlated with IAD, Indian population showed the highest correlation with IAD, mainly South Indian females with square-shaped arch (r = 0.52)[16] followed by North Indian females (r = 0.457),[14] and the least correlation was found in Asian population (r = 0.089),[21] whereas negative correlation was seen in Aryans (r = −0342) and Mangoloids (r = −0.217).[5] Facial proportions can vary in different ethnic groups.[13,28] South Indian population has the highest correlation with IAD, which could be due to Dravidian ethnic group. Dravidians are one of the non-Aryan races of Southeast Asia and are distributed mainly in South India with dominant characteristics of the faces with wider nasal width. Epicanthic folds and oblique palpebral fissures are common among Mongoloid individuals. Mongoloid individuals have straight, black hair and dark brown almond-shaped eyes, and have broad, relatively flat faces which could be the reason for weak and negative correlation.

Fourteen articles studied the ICD as an anthropometric parameter in determining the width of the maxillary anterior, of which only 12 articles were studied because in 2 studies correlation coefficient was not mentioned. The population groups included in the studies were Aryans, Mongoloids, Indians, Caucasians, Brazilian, Saudi, and Arab. When the CIW was correlated with ICD, Caucasians showed weaker correlation (r = 0.12)[13] than Serbian adults (r = 0.13).[9] When maxillary anterior teeth width was correlated with ICD, Saudi population showed the highest correlation with ICD (r = 0.932),[24] followed by Indian population (r = 0.757),[7] whereas in another study, Indian population (Thrissur, Kerala) showed the least correlation (r = 0.033),[3] this could be due to people with Indian nationality may be of ethnic differences. Some may be a mixture of Hindu, Muslim, Sikh, or Isai (Christian), which are predominant religious communities in India.

Eight articles studied the IPD as an anthropometric parameter in determining the width of the maxillary anterior, of which only seven articles were studied because in one study correlation coefficient was not mentioned. The population groups included in the studies were Kurdish, Aryans, Mongoloids, Indians, Caucasians, Brazilian, and Saudi. When the CIW was correlated with IPD, only Caucasians showed weak to moderate correlation (r = 0.13).[13] When maxillary anterior teeth width was correlated with IPD, the Indian population showed highest correlation with IPD, mainly Indian males (r = 0.809) followed by Indian females (r = 0.726),[7] the reason may be due to the male physique dominance over the females irrespective of the age group, and least correlation was found in Caucasian population (r = 0.15),[13] whereas weak and negative correlation was found in Aryans (r = −0.38) and Mongolids (r = −0.439).[5]

Eight articles studied the intercomissural distance as an anthropometric parameter in determining the width of the maxillary anteriors. The population groups included in the studies were Aryans, Mongoloids, Indians, Caucasians, Brazilian, Saudi, Arab, and Serbians. When the CIW was correlated with ICOW, only Caucasians showed weak to moderate correlation (r = 0.08).[13] When maxillary anterior teeth width was correlated with ICOW, Mulatto (r = 0.518) and blacks (r = 0.516) showed the highest correlation with ICOW,[23] whereas Caucasians (r = 0.16) showed least correlation,[13] and Aryans (r = −0.337) and Mongoloids (r = −0/316) showed negative correlation.[5]

Three articles studied the BW as an anthropometric parameter in determining the width of the maxillary anteriors. The population groups included in the studies were Indians and British. When the CIW was correlated with BW, only British White showed low correlation (r = 0.29).[2] When maxillary anterior teeth width was correlated with BW, Indian males showed the moderate correlation with BW (r = 0.50) followed by Indian females (r = 0.447).[7]

One article each studied the PMN, COS, MAL, and width as an anthropometric parameter in determining

the width of the maxillary anteriors. When CIW was correlated with MAL in Caucasians, it showed weak to moderate correlation on both right (r = 0.36) and left (r = 0.36) sides of maxillary arch, whereas combined width of maxillary anteriors showed moderate correlation on Caucasians' right side of arch (r = 0.38), and weak correlation on Caucasians' left side of arch (r = 0.36).[13] Similarly, weak to moderate correlation was shown in Caucasians between CIW and MAW (r = 0.29) and the combined width of maxillary anteriors and MAW (r = 0.41).[13] Both COS in Indian population (r = 0.17)[20] and PMN in Turkish population (r = 0.28)[17] revealed a very weak correlation with the maxillary anterior teeth width. However, in male population the circumference of head showed a positive correlation with the width of maxillary anterior teeth (r = 0.55) (Tables 1 to 4).

To some extent, the variations between the measurements in different studies may be attributed to the differences in measuring techniques, in the ethnicities of the populations studied, number of samples studied, gender-based variations, and various limitations, such as inaccuracies common to the making of the dental casts

Table 1: Determination of width of maxillary anterior teeth using COS

Author/year	*Population studied*	*Sample size*	*COS width*		*CIW*		*Combined width of six maxillary anterior teeth/intercanine width*		*Correlation coefficient*	*Inference*
			Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*		
Shalini Kalia, Indian Journal of Dental Research, 2008	Indian	100	M = 550.9 F = 506.94	M = 15.54 F = 17.63	–	–	M = 48.89 F = 47.0	M = 2.76 F = 2.70	M = 0.55 F = 0.17	Significant correlation exists

SD: Standard deviation

Table 2: Determination of width of maxillary anterior teeth using PMNs

Author/year	*Population studied*	*Sample size*	*PMN width*		*CIW*		*Combined width of six maxillary anterior teeth/ intercanine width*		*Correlation coefficient*	*Inference*
			Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*		
Guldag, Journal of Prosthodontics, 2010	Turkish	110 M = 67 F = 43	42.38	3.47	–	–	46.02	2.80	R = 0.28	Strong correlations exist

SD: Standard deviation

Table 3: Determination of width of maxillary anterior teeth using MAL

Author/year	*Population studied*	*Sample size*	*MAL*		*CIW*		*Combined width of six maxillary anterior teeth/distal surface of canines*		*Correlation coefficient*	*Inference*
			Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*		
Ayman Ellakwa, Journal of Contemporary Dental Practice, 2011	Caucasian	98	Males L = 46.32 R = 46.61 Females L = 43.86 R = 44.23	Males L = 2.71 R = 2.45 Females L = 3.38 R = 3.07	M = 8.50 F = 8.25	M = 0.53 F = 0.43	M = 35.62 F = 33.95	M = 2.22 F = 1.71	Left R = 0.36 (CAW) R = 0.38 (CIW) Right R = 0.38 (CAW) R = 0.38 (CIW)	Weak to moderate correlation exists

SD: Standard deviation; CAW: Combined width of anterior teeth

Table 4: Determination of width of maxillary anterior teeth using MAW

Author/year	*Population studied*	*Sample size*	*MAW*		*CIW*		*Combined width of six maxillary anterior teeth/ distal surface of canines*		*Correlation coefficient*	*Inference*
			Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*		
Ayman Ellakwa, Journal of Contemporary Dental Practice, 2011	Caucasian	98	M = 49.74 F = 46.32	M = 3.42 F = 3.40	M = 8.50 F = 8.25	M = 0.53 F = 0.43	M = 35.62 F = 33.95	M = 2.22 F = 1.71	R = 0.41 (CAW) R = 0.29 (CIW)	Weak to moderate correlation exists

SD: Standard deviation; CAW: Combined width of anterior teeth

and minor positional differences that can occur during photography that may have affected the measurements. The available evidence shows that one particular anthropometric measurement cannot be used to determine the width of maxillary anteriors across various populations. Hence, more studies with large sample size and different population groups need to be conducted. Future studies should involve a broad clinical research program that would include the same analysis for an edentulous population, and then define a mathematical relationship of such structures.

CONCLUSION

Within the limitations of this systematic review, the following conclusions can be drawn:

- The anthropometric measurement used depends on the population group in which it is being used.
- There is no single anthropometric measurement that can be used to determine the width of maxillary anterior teeth.
- In Indian population, high degree of correlation was seen between IAD, IPD, BW, and width of maxillary anterior teeth. The results of the previous study should be validated by including a large population size spread over the entire Indian subcontinent. This would also help to generate multiplication factor for various anthropological measurements for use limited to the Indian population.
- In Saudi population, ICD has a high degree of correlation to the width of maxillary anterior teeth.
- In Brazilian (mulatto and blacks) population, a high degree of correlation was seen between ICOW and width of maxillary anterior teeth.

REFERENCES

1. Parciak EC, Dahiya AT, AlRumaih HS, Kattadiyil MT, Baba NZ, Goodacre CJ. Comparison of maxillary anterior tooth width and facial dimensions of 3 ethnicities. J Prosthet Dent 2017 Oct;118(4):504-510.
2. Radia S, Sherriff M, McDonald F, Naini FB. Relationship between maxillary central incisor proportions and facial proportions. J Prosthet Dent 2016 Jun;115(6):741-748.
3. Attokaran G, Shenoy K. Correlation between innercanthal distance and mesiodistal width of maxillary anterior teeth in a Thrissur, Kerala, India, Population. J Contemp Dent Pract 2016 May;17(5):382-387.
4. A L-Kaisy N, Garib BT. Selecting maxillary anterior tooth width by measuring certain facial dimensions in the Kurdish population. J Prosthet Dent 2016 Mar;115(3):329-334.
5. Mishra MK, Singh RK, Suwal P, Parajuli PK, Shrestha P, Baral D. A comparative study to find out the relationship between the inner inter-canthal distance, interpupillary distance, inter-commissural width, inter-alar width, and the width of maxillary anterior teeth in aryans and mongoloids. Clin Cosmet Investig Dent 2016 Feb;8:29-34.
6. 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 2015 Apr-Jun;15(2):91-97.
7. Shivhare P, Shankarnarayan L, Basavaraju SM, Gupta A, Vasan V, Jambunath U. Intercanine width as a tool in two dimensional reconstruction of face: an aid in forensic dentistry. J Forensic Dent Sci 2015 Jan-Apr;7(1):1-7.
8. Sinavarat P, Anunmana C, Hossain S. The relationship of maxillary canines to the facial anatomical landmarks in a group of Thai people. J Adv Prosthodont 2013 Nov;5(4):369-373.
9. Strajnić L, Vuletić I, Vucinić P. The significance of biometric parameters in determining anterior teeth width. Vojnosanit Pregl 2013 Jul;70(7):653-659.
10. Kini AY, Angadi GS. Biometric ratio in estimating widths of maxillary anterior teeth derived after correlating anthropometric measurements with dental measurements. Gerodontology 2013 Jun;30(2):105-111.
11. Varjão FM, Nogueira SS. Correlating the curve distance between the distal of the canines to the combined width of the six anterior teeth when selecting denture teeth for different ethnic groups. J Prosthet Dent 2012 Jun;107(6):400-404.
12. Esan TA, Oziegbe OE, Onapokya HO. Facial approximation: evaluation of dental and facial proportions with height. Afr Health Sci 2012 Mar;12(1):63-68.
13. Ellakwa A, McNamara K, Sandhu J, James K, Arora A, Klineberg I, El-Sheikh A, Martin FE. Quantifying the selection of maxillary anterior teeth using intraoral and extraoral anatomical landmarks. J Contemp Dent Pract 2011 Nov;12(6):414-421.
14. Tripathi S, Aeran H, Yadav S, Singh SP, Singh RD, Chand P. Canine tip marker: a simplified tool for measuring intercanine distance. J Prosthodont 2011 Jul;20(5):391-398.
15. George S, Bhat V. Inner canthal distance and golden proportion as predictors of maxillary central incisor width in south Indian population. Indian J Dent Res 2010 Oct-Dec;21(4): 491-495.
16. Rai R. Correlation of nasal width to inter-canine distance in various arch forms. J Indian Prosthodont Soc 2010 Jun;10(2): 123-127.
17. Guldag MU, Büyükkaplan US, Sentut F, Ceylan G. Relationship between pterygomaxillary notches and maxillary anterior teeth. J Prosthodontc 2010 Apr;19(3):231-234.
18. Lucas BL, Bernardino-Júnior R, Gonçalves LC, Gomes VL. Distance between the medialis angles of the eyes as an anatomical parameter for tooth selection. J Oral Rehabil 2009 Nov;36(11):840-847.
19. Gomes VL, Gonçalves LC, Costa MM, Bde LL. Interalar distance to estimate the combined width of the six maxillary anterior teeth in oral rehabilitation treatment. J Esthet Restor Dent 2009 Feb;21(1):26-35.
20. Kalia S, Shetty SK, Patil K, Mahima VG. Stature estimation using odontometry and skull anthropometry. Indian J Dent Res 2008 Apr-Jun;19(2):150-154.
21. Varjão FM, Nogueira SS. Nasal width as a guide for the selection of maxillary complete denture anterior teeth in four racial groups. J Prosthodont 2006 Nov-Dec;15(6):353-358.
22. Gomes VL, Gonçalves LC, do Prado CJ, Junior IL, de Lima Lucas B. Correlation between facial measurements and the mesiodistal width of the maxillary anterior teeth. J Esthet Restor Dent 2006;18(4):196-205.

23. Varjão FM, Nogueira SS. Intercommissural width in 4 racial groups as a guide for the selection of maxillary anterior teeth in complete dentures. Int J Prosthodont 2005 Nov-Dec;18(6): 513-515.
24. Abdullah MA. Inner canthal distance and geometric progression as a predictor of maxillary central incisor width. J Prosthet Dent 2002 Jul;88(1):16-20.
25. Al Wazzan KA. The relationship between intercanthal dimension and the widths of maxillary anterior teeth. J Prosthet Dent 2001 Dec;86(6):608-612.
26. al-el-Sheikh HM, al-Athel MS. The relationship of interalar width, interpupillary width and maxillary anterior teeth width in Saudi population. Odontostomatol Trop 1998 Dec;21(84): 7-10.
27. Dharap AS, Tanuseputro H. A comparison of interalar width and intercanine distance in Malay males and females. Anthropol Anz 1997 Mar;55(1):63-68.
28. Hoffman W Jr, Bomberg TJ, Hatch RA. Interalar width as a guide in denture tooth selection. J Prosthet Dent 1986 Feb;55(2):219-221.