THE JOURNAL OF PROSTHETIC DENTISTRY

SYSTEMATIC REVIEW

Evaluation of maxillary anterior teeth width: A systematic review

Peixi Liao, BDS,[a] Yuwei Fan, MS, PhD,[b] and Dan Nathanson, DDS, MSD[c]

ABSTRACT

Statement of problem. Estimating the width of the maxillary anterior teeth when creating an esthetic smile can be challenging. Valid metrics to assist in this process are needed.

Purpose. The purpose of this systematic review was to evaluate the validity of interalar distance and inner canthal distance with the golden proportion, golden mean, and recurring esthetic dental proportion in predicting intercanine distance and the combined width of central incisors to potentially provide a guide for tooth restoration.

Material and methods. A literature search was conducted using PubMed, Medline, Google Scholar, EMBASE, CNKI, Web of Science, and the Cochrane Collaboration, identifying English- and non–English-language articles reporting on interalar width, inner canthal width, and maxillary anterior tooth width. Additional studies were identified by searching reference lists of the articles identified. Only studies that fulfilled inclusion criteria were included. Two examiners independently performed the literature search and data extraction. Using a meta-analysis software program, data extracted from each selected study were statistically combined using the random-effects model. Weighted mean differences, 95% confidence intervals, and heterogeneity were calculated for each measurement.

Results. The search strategy resulted in a total of 282 articles, but only 41 articles fulfilling the inclusion criteria were included in the meta-analysis. The interalar distance was found to be significantly larger than intercanine distance, and the inner canthal distance was found to be substantially smaller than the intercanine distance. When predicting the central incisors combined width by interalar distance, both the golden proportion and golden mean predicted value were larger than the combined width of the central incisors. Only the recurring esthetic dental proportion (70%) predicted value showed no significant difference from the combined width of central incisors. When predicting the central incisors combined width by inner canthal distance, the golden proportion predicted value was larger than the combined width of central incisors, whereas both the golden mean and recurring esthetic dental proportion (70%) predicted value were found to be significantly smaller than the combined width of central incisors.

Conclusions. By analyzing the data from the literature, only the recurring esthetic dental proportion (70%) with interalar distance could be an accurate method for predicting the combined width of central incisors. Neither interalar distance nor inner canthal distance could directly be used to predict the intercanine distance. (J Prosthet Dent 2019;122:275-81)

Maxillary anterior teeth are essential for an attractive face and pleasant smile. Loss of maxillary anterior teeth not only affects the facial appearance but can also create psychological trauma. Therefore, an esthetically pleasing and functional replacement of missing teeth should be provided.[1] When replacing natural teeth, the correct anterior tooth size must be selected to restore optimal dentolabial relations in harmony with overall facial appearance.[2] Usually, the dentist designs the anterior teeth by the width and height of the natural teeth. The width of these teeth is more difficult to estimate than their height because the length of the upper lip and the smile line can be reliable anatomical parameters to select the height of the maxillary anterior teeth.[3]

Different face-related factors have been introduced to evaluate the width of maxillary anterior teeth. By using anatomic references, it is possible to replace the anterior teeth within average values but also permitting individual esthetics and physiologic variations.[4] According to dental-facial restorations, the interalar distance (IAD) and inner canthal distance (ICD) are commonly used to estimate the combined width of the 6 maxillary anterior teeth, the intercanine distance (tip-to-tip distance [TTD]).[5] A direct match of IAD, ICD, and TTD

[a]Resident, Advanced Graduate Program in Prosthodontics, Henry M. Goldman School of Dental Medicine, Boston University, Boston, Mass.
[b]Research Assistant Professor, Department of Restorative Sciences and Biomaterials, Henry M. Goldman School of Dental Medicine, Boston University, Boston, Mass.
[c]Professor and Chair, Department of Restorative Sciences and Biomaterials, Henry M. Goldman School of Dental Medicine, Boston University, Boston, Mass.

Clinical Implications

When selecting facial measurement data to evaluate the maxillary anterior tooth width, measuring interalar width and using the recurring esthetic dental proportion are recommended in evaluating the combined width of the central incisors. The existing evidence indicates that the predicted central incisors combined width using the recurring esthetic dental proportion (70%) by interalar distance has nearly the same value as the combined width of the central incisors, which provide a substantial evidence of validity. It could be both used by the programmer and impact on the computer-aided design and computer-aided manufacturing (CAD-CAM) community.

has been reported.[6-8] The TTD is said to be equal to IAD and ICD, which make these factors a useful tool to evaluate the maxillary anterior tooth width. However, others have reported that IAD and ICD may not be reliable means of determining the width of maxillary anterior teeth.[9,10]

To appear attractive, the maxillary central incisor also needs to be in proportion to facial morphology. The golden proportion (GP), golden mean (GM), and recurring esthetic dental (RED) proportion have been recommended as measures to determine the combined width of central incisors (CIW) with a proportion relationship to IAD and ICD.[11,12] Levin[13] introduced GP into dental esthetics. Based on the theory that a relationship exists between beauty in nature and mathematics, it states that CIW should be 61.8% of IAD or ICD as viewed from the front. Another proposed theory of dental esthetic proportion, as defined by Snow,[14] is the GM, which states that the CIW should be 50% of the front view of IAD or ICD. Recently, a more complex proportion was reported as RED proportion. The RED proportion states that the proportion of the successive widths of maxillary teeth as viewed from the front should remain constant, progressing distally depending on the width-to-height ratio of the maxillary central incisor.[15] The 70% RED proportion has been recommended for normal-length teeth (78% width-to-height ratio).[16] When using the 70% RED proportion, the width of the maxillary lateral incisor is 70% of the frontal view width of the maxillary central incisor, so as the relationship of the maxillary canine and the maxillary lateral incisor, which means that the CIW should have a constant proportion of the total maxillary anterior tooth width, as well as IAD and ICD.

The purpose of this systematic review was to evaluate the literature concerning the relationship of IAD, ICD, intercanine distance (TTD), and the CIW in general populations. The hypothesis was that the IAD and ICD could be reliable factors for evaluating the width of maxillary anterior teeth, and these 2 facial factors could determine the CIW by using the GP, GM, and RED proportion.

MATERIAL AND METHODS

An electronic literature search was performed through PubMed, Medline, Google Scholar, EMBASE, CNKI, Web of Science, and the Cochrane Collaboration. Terms used in the search included "interalar distance," "inner canthal distance," and "maxillary anterior tooth width." No language, publication date, or publication status restrictions were imposed. The search was expanded by searching reference lists of articles consulted to identify other relevant articles. Full texts of all potentially related articles were obtained from available sources on the internet. The last search was performed in the fourth week of March 2017.

Articles selected for inclusion were based on the following inclusion criteria: human studies; examination of maxillary anterior tooth width and its relationship of interalar width or inner canthal width; mesiodistal tooth, interalar and inner canthal measurements present; only permanent teeth were measured; number of participants mentioned; descriptive statistics with mean and standard deviation for all the data mentioned; presenting well-arranged intact anterior teeth; and participants had to be free from congenital facial defects and have had no orthodontic and/or crown restorations of the maxillary anterior teeth.

Articles excluded were based on the following exclusion criteria: a sample of fewer than 10 participants or not mentioned; deciduous teeth measured; insufficient statistics; participants with a particular disease; and no explanation of the measurement method.

In the case of more than one publication about the same participant group, the most informative and relevant article was included. Two examiners (P.L., Y.F.) independently performed the literature search to maximize the number of studies retrieved. The 2 examiners assessed all selected articles for the predefined inclusion criteria and conducted independent eligibility assessments. Discussion and consensus resolved any disagreement.

A methodological quality assessment was performed according to the standards described in the Cochrane Handbook for Systematic Reviews of Interventions (v5.1.0).[17] Two reviewers (P.L., Y.F.) evaluated the selected trials independently, and disagreements were resolved through discussion or consultation with a third reviewer (D.N.). The Newcastle-Ottawa quality assessment scale was also used for further analysis of the selected article.[18]

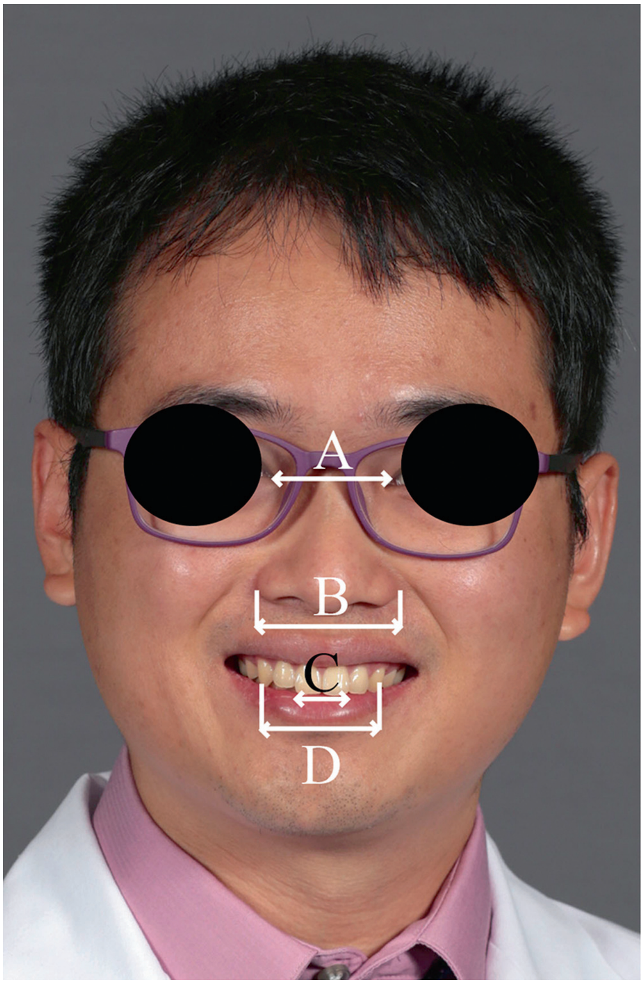


Figure 1. Facial and teeth measurements. (A) ICD (inner canthal distance), distance between medial angles of palpebral fissures. (B) IAD (interalar distance), distance between widest points of alar of nose. (C) CIW (combined width of central incisors), mesiodistal width of both central incisors. (D) TTD (intercanine distance), distance between tips of maxillary canines (in straight line).

Information was extracted from each included study on the following characteristics: number and sex of participants; means and standard deviations for IAD (the distance between the widest points of the alar of the nose) and ICD (the distance between the medial angles of the palpebral fissures) in face measurements; means and standard deviations for intercanine distance (the distance between the tips of the maxillary canines in a straight line), and CIW (the mesiodistal width of both central incisors) in teeth measurements (Fig. 1).

The data were subsequently entered into the meta-analysis software of the Cochrane Collaboration (RevManv5.3.5). Using the random-effects model, forest plots were drawn, and significance tests were carried out (calculating *P* values) comparing the following items: IAD and intercanine distance (TTD); ICD and intercanine distance (TTD); predicted central incisors combined width using the GP by IAD (GPIAD) and CIW; predicted central incisors combined width using the GM by IAD (GMIAD) and CIW; predicted central incisors combined width using the 70% RED proportion by IAD (REDIAD) and CIW; predicted central incisors combined width using the GP by ICD (GPICD) and CIW; predicted central incisors combined width using the GM by ICD (GMICD) and CIW; predicted central incisors combined width using the 70% RED proportion by ICD (REDICD) and CIW.

Table 1. Formulas used to predict the combined width of central incisors

Proportion	Predicted Combined Width of Central Incisors
Golden proportion	*IAD or ICD* × 0.618
Golden mean	*IAD or ICD* × 0.5
70% RED	*IAD or ICD* × $(1/[0.7^2 + 0.7 + 1])$

IAD, interalar distance; ICD, inner canthal distance; RED, recurring esthetic dental.

As per the RED proportion definition, the combination width of central incisors was $(1/[0.7^2+0.7+1])$ of the total width of maxillary anterior tooth, which can be measured as ICD or IAD. The predicted central incisors combined width using the RED proportion (70%) was calculated by ICD or IAD with the formula mentioned previously.

The results were compared in 3 groups (mixed-sex, male, and female). The formulas used to determine the predicted CIW in each proportion are seen in Table 1. Heterogeneity tests were also performed. Statistical tests for heterogeneity are available. These include χ^2 tests as well as the calculation of I^2. A low *P* value (or a large χ^2 statistic relative to its degree of freedom) provides evidence of heterogeneity of treatment effects (variation in effect estimates beyond chance). A more useful statistic for quantifying inconsistency which is present in the forest plots is I^2. It describes the percentage of the variability in effect estimates that is due to heterogeneity rather than sampling error (chance). A value greater than 50% may be considered substantial heterogeneity.[19-21]

RESULTS

The search strategy resulted in a total of 282 articles. The articles were narrowed down to 54 after the initial exclusion based on the content of the abstracts. These 54 articles were read and examined in detail, and based on the inclusion criteria, a total of 41 articles were identified for inclusion in the meta-analysis. Figure 2 provides an overview of the literature search and article selection in the form of a flow diagram. Supplemental Table 1 gives a summary of the studies included in the meta-analysis. Using the risk-of-bias analysis (Supplemental Tables 2 and 3, Fig. 3) 3 of the studies were classified as having a low risk of bias, and 20 of the studies were classified as having a medium risk of bias, whereas 24 of the studies

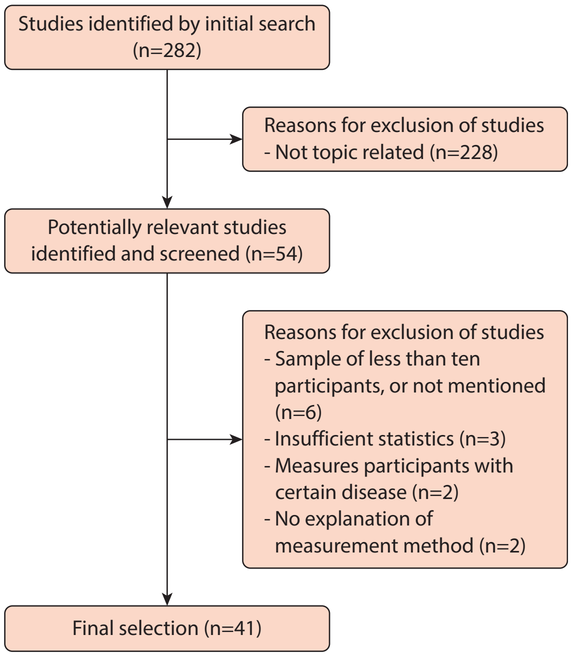


Figure 2. Flow diagram summarizing literature search and article selection.

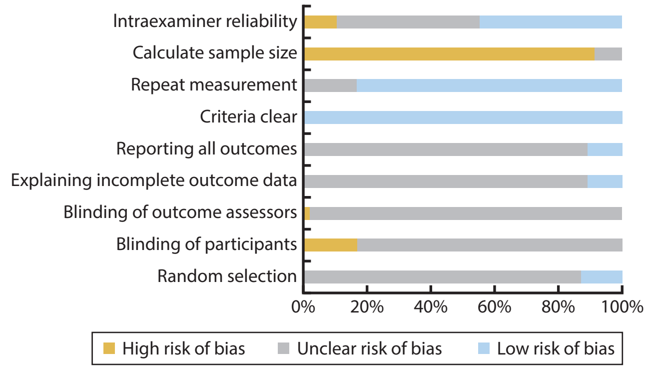


Figure 3. Risk of bias graph.

were classified as having a high risk of bias. For the summary of the results, refer Tables 2 and 3.

Comparing IAD with the intercanine distance in population, several differences were identified. In the mixed-sex group and the male group, IAD was significantly larger than TTD. Meanwhile, in the female group, IAD was smaller than TTD, and the data did not show a significant difference. All of these results presented low homogeneity.

When comparing ICD with intercanine distance in population, the following difference was identified: In the mixed-sex group, male group, and female group, ICD was significantly smaller than TTD. However, these results showed low homogeneity.

When comparing the predicted central incisors combined width using the GP by IAD versus the CIW, differences were identified. In all 3 groups, GPIAD was significantly larger than CIW, and all the outcomes showed low homogeneity.

When comparing the predicted central incisors combined width using the GM by IAD versus the CIW, a similar trend was seen for the GPIAD and CIW. In all 3 groups, GMIAD was significantly larger than CIW, and all the outcomes showed low homogeneity.

When comparing the predicted central incisors combined width using the 70% RED proportion by IAD versus the CIW (Supplemental Table 4), several differences were identified. In the mixed-sex group, REDIAD was slightly smaller than CIW, whereas the differences could not be detected. In the male group, REDIAD was larger than CIW with no significant differences. However, in the female group, REDIAD was significantly smaller than CIW. These results presented low homogeneity.

When comparing the predicted central incisors combined width using the GP by ICD versus the CIW, a similar trend was seen for the GPIAD and CIW. In all 3 groups, GPICD was significantly larger than CIW, and all the outcomes showed low homogeneity.

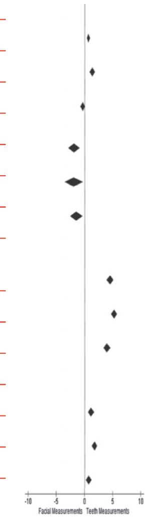
When comparing the predicted central incisors combined width using the GM by ICD versus the CIW, one can see the differences. In the mixed-sex group, male group, and female group, GMICD was significantly smaller than CIW. However, these results showed low homogeneity.

When comparing the predicted central incisors combined width using the 70% RED proportion by ICD versus the CIW (Supplemental Table 5), a similar trend was seen as for the GMICD and CIW. In all 3 groups, REDICD was significantly smaller than CIW, and all the outcomes showed low homogeneity.

DISCUSSION

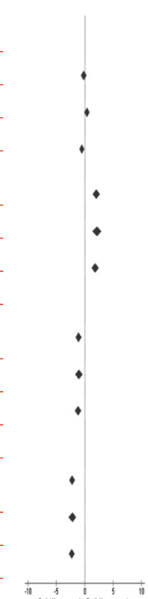
This study was one of the first few to use meta-analysis in oral anthropometry studies. Using the meta-analyses methodology, which consists of a precisely formulated question and explicit methods to identify, select, and analyze relevant research,[22] the present study demonstrated that only the IAD modified by 70% RED proportion provided a reliable predictor of the maxillary anterior tooth width. The IAD or ICD could not be used directly to evaluate the tooth width, consistent with most previous studies. This was an unexpected finding as it seems to contradict the widely held belief that sex may influence the evaluation of maxillary anterior tooth width. In the present study, the result showed the same tendency of different sex when predicting the maxillary anterior tooth width with IAD and ICD. The inconsistency of the present finding might be because of biases arising from small sample sizes of individual studies and an overgeneralization when it comes to the interpretation of results.

Table 2. Forest plots summary of comparison between facial measurement and teeth measurement (part I)

Subgroups	Test for Overall Effect and Heterogeneity	Studies	Participants	Mean Difference IV
Interalar distance and intercanine distance				
Mixed-sex	P<.001, I^2=97%	27	5177	
Male	P<.001, I^2=95%	21	2136	
Female	P=.16, I^2=96%	21	2477	
Inner canthal distance and intercanine distance				
Mixed-sex	P=.006, I^2=99%	10	1467	
Male	P=.02, I^2=99%	7	585	
Female	P=.01, I^2=98%	7	682	
Predicted central incisors combined width using golden proportion by interalar distance and combined width of central incisors				
Mixed-sex	P<.001, I^2=99%	15	2002	
Male	P<.001, I^2=98%	12	893	
Female	P<.001, I^2=99%	12	948	
Predicted central incisors combined width using golden mean by interalar distance and combined width of central incisors				
Mixed-sex	P<.001, I^2=99%	15	2002	
Male	P<.001, I^2=98%	12	893	
Female	P=.004, I^2=99%	12	948	

Diamond symbol represents overall mean and 95% confidence interval for each group of comparisons. P<.05 or mean including 0 represents 2 measurements not statistically, significantly different. Positive values of mean indicate facial measurements larger than tooth measurements; negative values of mean indicate facial measurements smaller than tooth measurements.

Table 3. Forest plots summary of comparison between facial measurement and teeth measurement (part II)

Subgroups	Test for Overall Effect and Heterogeneity	Studies	Participants	Mean Difference IV
Predicted central incisors combined width using 70% recurring esthetic dental proportion by interalar distance and combined width of central incisors				
Mixed-sex	P=.56, I^2=99%	15	2002	
Male	P=.09, I^2=98%	12	893	
Female	P=.05, I^2=99%	12	948	
Predicted central incisors combined width using golden proportion by inner canthal distance and combined width of central incisors				
Mixed-sex	P<.001, I^2=99%	14	2992	
Male	P<.001, I^2=99%	12	1402	
Female	P<.001, I^2=99%	12	1481	
Predicted central incisors combined width using golden mean by inner canthal distance and combined width of central incisors				
Mixed-sex	P<.001, I^2=99%	14	2922	
Male	P<.006, I^2=99%	12	1402	
Female	P<.001, I^2=99%	12	1481	
Predicted central incisors combined width using 70% recurring esthetic dental proportion by inner canthal distance and combined width of central incisors				
Mixed-sex	P<.001, I^2=99%	14	2992	
Male	P<.001, I^2=99%	12	1402	
Female	P<.001, I^2=99%	12	1481	

Diamond symbol represents overall mean and 95% confidence interval for each group of comparisons. P<.05 or mean including 0 represents 2 measurements not statistically, significantly different. Positive values of mean indicate facial measurements larger than tooth measurements; negative values of mean indicate facial measurements smaller than tooth measurements.

In this study, nearly all the groups showed that IAD was significantly larger than maxillary anterior tooth width, except for the female group in IAD and TTD and the mixed-sex and male groups in REDIAD and CIW, which showed no significant difference. Compared with these results, most ICD groups showed significantly smaller maxillary anterior tooth width, which meant IAD and ICD did not have the same value in the general population, and their reliability of maxillary anterior tooth width prediction was variable. Meanwhile, not all groups showed that IAD was significantly different from the maxillary anterior tooth width with or without the modification, including the female group in IAD and TTD and the mixed-sex and male groups in REDIAD and CIW, in which differences could not be detected. However, all the groups in ICD showed a significant difference in the maxillary anterior tooth width, making it a less reliable predictor. The less divergent and more stabilized tendency of IAD prediction was confirmed, IAD was supposed to be more reliable than ICD when using it as a predictor of the maxillary anterior tooth width.

Comparing the results of these 3 modification methods, it is observed that the GP did not seem to be a suitable method for predicting the maxillary anterior tooth width. Because both the evaluated data of GPIAD and GPICD were significantly different from those of the CIW, which also presented the greatest value of the difference in all 3 groups, the predicted value of the maxillary anterior tooth width with the GP might not be reliable. According to most studies in different populations, it is concluded that the GP did not exist in a natural dentition.[23,24]

The GM predicted value did not tend to be the same as CIW. However, in the ICD group, GMICD showed a smaller diversity than other methods. The finding concerning the GM was expected and consistent with previous findings by Murthy and Ramani.[25] In their study of participants with esthetic smiles, they evaluated the existence of the GP, GM, and RED proportion (70%) in natural teeth and concluded that the GM was more applicable in the natural dentition.

Despite the 70% RED proportion noted for its consideration of width-to-height ratio, some studies maintain that the RED proportion was not seen in the natural dentition.[26,27] In this study, the RED was the only modification method that did not show significant differences in predicting the maxillary anterior tooth width, especially in REDIAD and CIW groups, in which the difference could not be detected. However, when using the RED proportion to predict CIW by ICD, the predicted value of maxillary center incisor width was significantly reduced. This indicated that the RED might not be a stable prediction method for different facial measurements.

This study has some limitations. Heterogeneity of included studies existed in all groups and suggests that results should be interpreted with caution. Ideally, if the data from all the included studies came from the same group of patients, it would be able to provide more reliable results. However, most studies had different inclusion criteria and did not use the commonly accepted rules to follow, which made it difficult to establish a subgroup as recommended. The differences detected in this study could face the statistical conundrum. There has been no established value for how small a difference of the maxillary anterior teeth could be acceptable, and it may be varied on patients. The differences found in this study are statistically significant, which are defined only in the statistic field. The presence of Type II error is limited as most of the differences detected had a small *P* value.

Although using the RED proportion with IAD provided an accurate result of CIW, the complexity of calculation might limit the application of this technique. Hence, a convenient method should be developed according to the result of the present study. The IAD is always slightly larger than the intercanine distance as viewed from the front, and the IAD divided by 2 (according to the GM) is always slightly larger than the CIW. Meanwhile, the value of ICD shows a reduction of intercanine distance, and half of the ICD also have the same tendency.

CONCLUSIONS

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

1. Neither IAD nor ICD could be used directly to predict the intercanine distance.
2. Predicting the CIW using the RED proportion (70%) by IAD was an accurate method for width evaluation of the maxillary anterior tooth.
3. The IAD was larger than the intercanine distance, and the ICD was smaller than the intercanine distance.
4. The GP was not a reliable method for evaluating the maxillary anterior tooth width.
5. IAD divided by 2 is always slightly larger than the CIW, and the 50% value of ICD shows a reduction of the CIW.

REFERENCES

1. Esposito SJ. Esthetics for denture patients. J Prosthet Dent 1980;44:608-15.
2. Frush JP, Fisher RD. Introduction to the dentogenic concept. J Prosthet Dent 1955;5:586-90.
3. Krajicek DD. Natural appearance for the individual denture patient. J Prosthet Dent 1960;10:205-14.
4. Kern BE. Anthropometric parameters of tooth selection. J Prosthet Dent 1967;17:431-7.
5. Sarver D, Jacobson RS. The aesthetic dentofacial analysis. Clin Plast Surg 2007;34:369-94.
6. Strajnic L, Vuletic I, Vucinic P. The significance of biometric parameters in determining anterior teeth width. Vojnosanit Pregl 2013;70:653-9.
7. 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;20:391-8.
8. Patel JP, Rajesh S, Naveen YG, Mitul HS. A comparative evaluation of the relationship of inner-canthal distance and inter-alar width to the inter-canine width amongst the Gujarati population. J Adv Oral Res 2011;2:31-8.
9. Singh KD, Rao J, Kumar L, Singh S. Comparative evaluation of facial landmarks and their correlation in the natural teeth of North Indian and northeast Indian people - a cohort study. J Oralfacial Health Sci 2012;3:1-11.
10. 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.
11. Agarwal B, Kumar M, Alvi HA, Arora V, Agarwal S. Relating central incisor to inner canthal distance - A flexible approach adaptable to different population groups. Int J Contemp Med 2013;1:8-11.
12. Bali P, Singh S, Singh AP, Goyal RR. Biometric relationship between inner canthal distance and geometric progression for the

prediction of maxillary central incisor width. Indian J Dent Sci 2013;5: 53-6.
13. Levin EI. Dental esthetics and the golden proportion. J Prosthet Dent 1978;40:244-52.
14. Snow SR. Esthetic smile analysis of maxillary anterior tooth width: the golden percentage. J Esthet Dent 1999;11:177-84.
15. Ward DH. Proportional smile design using the recurring esthetic dental (RED) proportion. Dent Clin North Am 2001;45:143-54.
16. Ward DH. Using the RED proportion to engineer the perfect smile. Dent Today 2008;27:112-7.
17. Higgins JPT, Green S. Cochrane handbook for systematic reviews of interventions. Version 5.1.0. The Cochrane Collaboration; 2011.
18. Wells GA, Shea B, O'Connell D. The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses. Ottawa, ON: Ottawa Hospital Research Institute; 2011.
19. Egger M, Smith GD, Phillips AN. Meta-analysis: principles and procedures. Br Med J 1997;315:1533-7.
20. Barza M, Trikalinos TA, Lau J. Statistical considerations in meta-analysis. Infect Dis Clin North Am 2009;23:195-210.
21. Haase SC. Systematic reviews and meta-analysis. Plast Reconstr Surg 2011;127:955-66.
22. Papadopoulos MA, Gkiaouris I. A critical evaluation of meta-analyses in orthodontics. Am J Orthod Dentofacial Orthop 2007;131:589-99.
23. Al-Marzok MI, Majeed KB, Ibrahim K. Evaluation of maxillary anterior teeth and their relation to the golden proportion in Malaysian population. BMC Oral Health 2013;13:9.
24. Ali Fayyad M, Jamani KD, Agrabawi J. Geometric and mathematical proportions and their relations to maxillary anterior teeth. J Contemp Dent Pract 2006;7:62-70.
25. Murthy BV, Ramani N. Evaluation of natural smile: golden proportion, RED or golden percentage. J Conserv Dent 2008;11:16-21.
26. Shetty S, Pitti V, Satish Babu C, Surendra Kumar G, Jnanadev K. To evaluate the validity of recurring esthetic dental proportion in natural dentition. J Conserv Dent 2011;14:314-7.
27. Ward DH. A study of dentists' preferred maxillary anterior tooth width proportions: Comparing the recurring esthetic dental proportion to other mathematical and naturally occurring proportions. J Esthet Restor Dent 2007;19:324-37.

Corresponding author:
Dr Peixi Liao
Department of Restorative Sciences and Biomaterials
Henry M. Goldman School of Dental Medicine
Boston University
Housman Medical Research Center (R Building)
72 E. Concord Street, R520
Boston, MA 02118
Email: liaopx@bu.edu

https://doi.org/10.1016/j.prosdent.2018.10.015

Noteworthy Abstracts of the Current Literature

Randomized controlled clinical trial comparing cemented versus screw-retained single crowns on customized zirconia abutments: 3-year results

Heierle L, Wolleb K, Hämmerle CH, Wiedemeier DB, Sailer I, Thoma DS

Int J Prosthodont 2019 Mar/Apr;32:174-6

Purpose. To assess the biologic and technical responses to cemented and screw-retained all-ceramic single-tooth implant-supported reconstructions at 3 years postinsertion.

Material and Methods. Thirty-four patients with single-tooth implants were randomly restored with either a cemented lithium disilicate crown on a customized zirconia abutment (CEM) or a screw-retained crown with a directly veneered zirconia abutment (SCREW). At baseline examination and after 3 years of loading, marginal bone level and technical parameters were assessed. Differences in marginal bone loss were tested using Mann-Whitney U test at baseline and at 3 years, and changes within each group between baseline and 3 years were tested using Wilcoxon signed rank test.

Results. The median changes between baseline and the 3-year follow-up amounted to -0.1 mm (CEM; intragroup P=.36) and -0.0 mm (SCREW; intragroup P=.58). Intergroup comparisons did not reveal statistically significant differences at 3 years (P=.20) or over time (P=.70).

Conclusions. At 3 years, screw-retained and cemented reconstructions rendered largely the same radiographic and technical outcomes.

Supplemental Table 1. Characteristics of included studies

Study ID Author (Year)[b]	Measure Material[a]	Method of Tooth Size Measurements	No. of Participants (Male/Female)	Age of Participants (Mean)	Origin of Patients	Type of Study
Agarwal et al (2013)[1]	ICD, CIW	ICD: on face; CIW: intraoral	309 (173/136)	20-30	North India	Case-control
Bali et al (2013)[2]	ICD, CIW	ICD: on face; CIW: intraoral	250 (121/129)	18-25 (21.49)	India	Case-control
Dharap et al (2013)[3]	IAD, TTD	IAD: on face; TTD: intraoral	168 (51/117)	Male: 18-24 (19.98); Female: 18-23 (19.57)	Arab	Case-control
Kini and Angadi (2013)[4]	ICD, TTD	ICD and TTD: On photo	70 (24/46)	18-23	India	Case-control
Strajnic et al (2013)[5]	IAD, ICD, TTD, CIW	IAD and ICD: on face; TTD and CIW: intraoral	89 (23/66)	19-34 (25)	Serbia	Case-control
Ahamdian et al (2012)	IAD, CIW	IAD: on photo; CIW: on study cast	100 (50/50)	>18	Iran	Case-control
Shuchita et al (2012)[6]	IAD, ICD, TTD	IAD and ICD: on photo; TTD: on model wax	100 (50/50)	17-33 (21)	North India	Case-control
Singh et al (2012)[7]	IAD, TTD	IAD: on face; TTD: intraoral	60 (30/30)	20-25	Northeast India	Cohort
Ellakwa et al (2011)[8]	IAD, ICD, CIW	IAD and ICD: on photo; CIW: on study cast	98 (55/43)	>18	Australia	Case-control
Ricardo (2011)	IAD, TTD, CIW	IAD, TTD, and CIW: on photo	60 (30/30)	20-34	Portugal	Case-control
Tripathiet et al (2011)[9]	IAD, ICD, TTD	IAD and ICD: on face; TTD: on model wax	100 (50/50)	17-21	India	Case-control
Bonakdarchian and Ghorbani-pour (2010)[10]	IAD, TTD	IAD: on face; TTD: on study cast	120 (60/60)	>18	Iran	Case-control
EL-Sheikh et al (2010)[11]	ICD, TTD	ICD: on face; TTD: on study cast	114 (45/69)	18-46	Sudan	Case-control
George and Bhat (2010)[12]	ICD, CIW	ICD: on face; CIW: intraoral	300 (144/156)	18-26	South India	Case-control
Isa et al (2010)[13]	IAD, ICD, CIW	IAD and ICD: on photo; CIW: on study cast	60 (22/38)	18-36	Malay and China	Case-control
Miglani (2010)	IAD, ICD, CIW	IAD and ICD: on face; CIW: on study cast	200 (100/100)	>18	India	Case-control
Rai (2010)[14]	IAD, TTD	IAD: on face; TTD: on study cast	108 (53/55)	18-25	India	Case-control
Chen et al (2009)	ICD, TTD	ICD: on photo; TTD: on study cast	116 (50/66)	18-23 (20.17)	China	Case-control
Gomes et al (2009)[15]	IAD, TTD	IAD and TTD: on photo	81 (37/44)	17-33 (21)	Brazil	Case-control
Lucas et al (2009)[16]	ICD, TTD	ICD and TTD: on photo	80 (37/43)	17-33	Brazil	Case-control
Pereira et al (2008)	IAD, ICD, CIW	IAD and ICD: on photo; CIW: on study cast	49 (20/29)	17-33 (20)	Brazil	Case-control
Suwannachat (2008)	IAD, TTD	IAD: on face; TTD: intraoral	100 (38/62)	Male: 18-63 (39.6); Female: 19-56 (36.7)	Thailand	Case-control
Tawfiq and Isa (2008)	ICD, TTD	ICD: on photo; TTD: on study cast	50	N.A.	Malay	Case-control
Varjao and Nogueira (2006)[17]	IAD, TTD	IAD: on face; TTD: on study cast	40	18-33	Brazil	Case-control
Jansisyanont et al (2005)	IAD, ICD, CIW	IAD and ICD: on face; CIW: intraoral	117 (46/71)	18-30	Thailand	Case-control
Kassab (2005)[18]	IAD, ICD, CIW	IAD and ICD: on face; CIW: intraoral	100 (50/50)	19-24	Iraq	Case-control
Sulun et al (2005)[19]	IAD, CIW	IAD: on photograph; CIW: intraoral	138 (73/65)	22.2	Turkey	Case-control
Yodsuwan et al (2003)	IAD, TTD	IAD: on face; TTD: intraoral	74 (36/38)	18-25	Thailand	Case-control
Ahn et al (2002)	IAD, TTD, CIW	IAD: on photograph; TTD and CIW: on study cast	91 (49/42)	Male: 24.0; Female: 23.6	Korea	Case-control
Berksun et al (2002)[20]	ICD, CIW	ICD: on face; CIW: intraoral	259 (120/109)	19-24 (21.46)	Saudi	Case-control
Osmar (2002)	IAD, CIW	IAD: on face; CIW: on study cast	52 (16/36)	18-34	Portugal	Case-control
Al Wazzan (2001)[21]	ICD, CIW	ICD: on face; CIW: intraoral	443 (203/240)	19-55	Arab	Case-control

(*continued on next page*)

Supplemental Table 1. (*Continued*) Characteristics of included studies

Study ID Author (Year)[b]	Measure Material[a]	Method of Tooth Size Measurements	No. of Participants (Male/Female)	Age of Participants (Mean)	Origin of Patients	Type of Study
Ibrahimagic et al (2001)[22]	IAD, TTD	IAD: on face; TTD: intraoral	2000 (920/1080)	17-25	Croatia	Case-control
Dharap and Tanuseputro (1997)[23]	IAD, TTD	IAD: on face; TTD: intraoral	266 (111/155)	Male: 18-25 (20.54); Female: 17-23 (20.21)	Malay	Case-control
Jin et al (1996)	IAD, CIW	IAD: on face; CIW: intraoral	100 (50/50)	18-30	China	Case-control
Li and Lv (1995)	IAD, ICD, TTD, CIW	IAD and ICD: on face; TTD and CIW: intraoral	338 (126/212)	14-73 (34.19)	China	Case-control
Zhang et al (1994)	IAD, ICD, TTD, CIW	IAD and ICD: on face; TTD and CIW: intraoral	410 (241/169)	14-73 (34.2)	China	Case-control
Yang and Shu (1992)	IAD, TTD	IAD: on face; TTD: on study cast	50 (29/21)	14-37	China	Case-control
Yao et al (1992)	IAD, TTD	IAD: on face; TTD: on study cast	146 (83/63)	18-30	China	Case-control
Hoffman et al (1986)[24]	IAD, TTD	IAD: on face; TTD: on model wax	340	13-82 (31.3)	America	Case-control
Mavroskoufis and Ritchie (1981)[25]	IAD, TTD	IAD: on face; TTD: on study cast	64	>18	Britain	Case-control

[a]IAD (interalar distance), distance between widest points of alar of nose. ICD (inner canthal distance), distance between medial angles of palpebral fissures. TTD (intercanine distance), distance between tips of maxillary canines (in straight line). CIW (combined width of central incisors), mesiodistal width of both central incisors. [b]Citations refer to Supplemental References.

Supplemental Table 2. Methodological quality of selected studies

Study ID Author (Year)	Question No.[a]									Risk of Bias[b]
	1	2	3	4	5	6	7	8	9	
Ellakwa et al (2011)	Yes	No	Unclear	Yes	Yes	Yes	Yes	No	Yes	Low
Miglani (2010)	Yes	Unclear	Unclear	Yes	Yes	Yes	Yes	No	Yes	Low
Chen et al (2009)	Yes	Unclear	Unclear	Yes	Yes	Yes	Yes	No	Yes	Low
Agarwal et al (2013)	Unclear	Unclear	Unclear	Unclear	Unclear	Yes	Yes	No	Yes	Medium
Dharap et al (2013)	Yes	Unclear	Unclear	Unclear	Unclear	Yes	Yes	No	No	Medium
Strajnic et al (2013)	Unclear	Unclear	Unclear	Unclear	Unclear	Yes	Yes	No	Yes	Medium
Shuchita et al (2012)	Unclear	Unclear	Unclear	Unclear	Unclear	Yes	Yes	No	Yes	Medium
Tripathiet et al (2011)	Unclear	Unclear	Unclear	Unclear	Unclear	Yes	Yes	No	Yes	Medium
EL-Sheikh et al (2010)	Unclear	No	No	Unclear	Unclear	Yes	Yes	No	Yes	Medium
Isa et al (2010)	Unclear	No	Unclear	Unclear	Unclear	Yes	Yes	No	Yes	Medium
Gomes et al (2009)	Unclear	Unclear	Unclear	Unclear	Unclear	Yes	Yes	No	Yes	Medium
Lucas et al (2009)	Unclear	Unclear	Unclear	Unclear	Unclear	Yes	Yes	No	Yes	Medium
Varjao and Nogueira (2006)	Unclear	No	Unclear	Unclear	Unclear	Yes	Yes	No	Yes	Medium
Kassab (2005)	Unclear	Unclear	Unclear	Yes	Yes	Yes	Yes	No	No	Medium
Berksun et al (2002)	Unclear	Unclear	Unclear	Unclear	Unclear	Yes	Yes	No	Yes	Medium
Al-Wazzan (2001)	Yes	Unclear	Unclear	Unclear	Unclear	Yes	Yes	No	No	Medium
Ibrahimagic et al (2001)	Unclear	Unclear	Unclear	Unclear	Unclear	Yes	Yes	No	Yes	Medium
Dharap and Tanuseputro (1997)	Yes	Unclear	Unclear	Yes	Yes	Yes	Yes	No	No	Medium
Jin et al (1996)	Unclear	Unclear	Unclear	Unclear	Unclear	Yes	Yes	No	Yes	Medium
Hoffman et al (1986)	Unclear	Unclear	Unclear	Unclear	Unclear	Yes	Yes	No	Yes	Medium
Bali et al (2013)	Unclear	Unclear	Unclear	Unclear	Unclear	Yes	Yes	No	Unclear	High
Kini and Angadi (2013)	Unclear	No	Unclear	Unclear	Unclear	Yes	Yes	No	Unclear	High
Ahamdian et al (2012)	Unclear	Unclear	Unclear	Unclear	Unclear	Yes	Yes	No	Unclear	High
Singh et al (2012)	Unclear	Unclear	Unclear	Unclear	Unclear	Yes	Unclear	Unclear	Unclear	High
Ricardo (2011)	Unclear	Unclear	Unclear	Unclear	Unclear	Yes	Yes	No	Unclear	High
Bonakdarchian and Ghorbanipour (2010)	Unclear	Unclear	Unclear	Unclear	Unclear	Yes	Yes	No	Unclear	High
George and Bhat (2010)	Unclear	Unclear	Unclear	Unclear	Unclear	Yes	Yes	No	Unclear	High
Rai (2010)	Unclear	Unclear	Unclear	Unclear	Unclear	Yes	Yes	No	Unclear	High
Pereira et al (2008)	Unclear	Unclear	Unclear	Unclear	Unclear	Yes	Yes	No	Unclear	High
Suwannachat (2008)	Unclear	Unclear	Unclear	Unclear	Unclear	Yes	Yes	No	Unclear	High
Tawfiq and Isa (2008)	Unclear	Unclear	Unclear	Unclear	Unclear	Yes	Unclear	Unclear	Unclear	High
Jansisyanont et al (2005)	Unclear	Unclear	Unclear	Unclear	Unclear	Yes	Yes	No	Unclear	High
Sulun et al (2005)	Unclear	Unclear	Unclear	Unclear	Unclear	Yes	Unclear	Unclear	Unclear	High
Yodsuwan et al (2003)	Unclear	Unclear	Unclear	Unclear	Unclear	Yes	Yes	No	Unclear	High
Ahn et al (2002)	Unclear	Unclear	Unclear	Unclear	Unclear	Yes	Unclear	No	Unclear	High
Osmar (2002)	Unclear	Unclear	Unclear	Unclear	Unclear	Yes	Yes	No	Unclear	High
Li and Lv (1995)	Unclear	Unclear	Unclear	Unclear	Unclear	Yes	Unclear	No	No	High
Zhang et al (1994)	Unclear	Unclear	Unclear	Unclear	Unclear	Yes	Yes	No	Unclear	High
Yang and Shu (1992)	Unclear	Unclear	Unclear	Unclear	Unclear	Yes	Unclear	No	Yes	High
Yao et al (1992)	Unclear	Unclear	Unclear	Unclear	Unclear	Yes	Unclear	No	Yes	High
Mavroskoufis and Ritchie (1981)	Unclear	Unclear	Unclear	Unclear	Unclear	Yes	Yes	No	Unclear	High

[a]The following criteria were evaluated as "yes", "no", or "unclear".

1. Were the people chosen randomly?
2. Were the participants blinded to the intervention?
3. Were the outcome assessors blinded to the intervention?
4. Was the withdrawal/dropout rate described and clearly explained?
5. Does it clearly report all expected outcomes, including those that were prespecified?
6. Were the inclusion/exclusion criteria clear?
7. Was the parameter measured several times?
8. Was the sample size calculation reported?
9. Was the data recorded by the same operator? Or do they have the test of intraexaminer reliability?

[b]A study was graded to have a low risk of bias if it yielded 6 or more "yes" answers to the 9 questions, moderate risk if it yielded 3 to 5 "yes" answers, and high risk if it yielded 2 "yes" answer or less.

Supplemental Table 3. Newcastle-Ottawa quality assessment of selected studies

Study ID Author (Year)	Selection	Comparability	Outcome
Ellakwa et al (2011)	****	**	***
Miglani (2010)	****	**	***
Chen et al (2009)	****	**	***
Agarwal et al (2013)	***	*	**
Dharap et al (2013)	***	*	***
Strajnic et al (2013)	***	**	**
Shuchita et al (2012)	***	**	**
Tripathiet et al (2011)	****	*	*
EL-Sheikh et al (2010)	****	*	***
Isa et al (2010)	***	*	***
Gomes et al (2009)	***	*	**
Lucas et al (2009)	***	*	***
Varjao and Nogueira (2006)	***	**	**
Kassab (2005)	***	*	***
Berksun et al (2002)	****	*	**
Al-Wazzan (2001)	***	*	**
Ibrahimagic et al (2001)	****	*	**
Dharap and Tanuseputro (1997)	**	**	***
Jin et al (1996)	***	*	**
Hoffman et al (1986)	***	*	**
Bali et al (2013)	**	*	**
Kini and Angadi (2013)	***		*
Ahamdian et al (2012)	***		**
Singh et al (2012)	***	*	*
Ricardo (2011)	**	*	**
Bonakdarchian and Ghorbanipour (2010)	***		*
George and Bhat (2010)	**	*	**
Rai (2010)	**	*	**
Pereira et al (2008)	**	*	**
Suwannachat (2008)	***	**	*
Tawfiq and Isa (2008)	**	**	*
Jansisyanont et al (2005)	**	*	*
Sulun et al (2005)	*	*	**
Yodsuwan et al (2003)	*	**	**
Ahn et al (2002)	**	*	**
Osmar (2002)	**	*	**
Li and Lv (1995)	**		**
Zhang et al (1994)	***		**
Yang and Shu (1992)	***		**
Yao et al (1992)	**	*	*
Mavroskoufis and Ritchie (1981)	**		*

Newcastle-Ottawa: a quality assessment scale.

Selection:

1. Is the case definition adequate? a) yes, with independent validation*; b) yes, record linkage or based on self-reports; c) no description.
2. Representativeness of the cases: a) consecutive or obviously representative series of cases*; b) potential for selection biases or not stated.
3. Selection of controls: a) community controls*; b) hospital controls; c) no description.
4. Definition of controls: a) no history of disease (endpoint)*; b) no description of source.

Comparability:

Comparability of cases and controls on the basis of the design or analysis: a) study controls for general population*; b) study controls for any additional factor*.

Exposure:

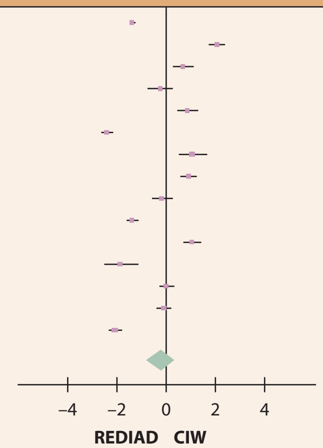
1. Ascertainment of exposure: a) secure record*; b) structured interview where blind to case/control status*; c) interview not blinded to case/control status; d) written self-report or medical record only; e) no description.
2. Same method of ascertainment for cases and controls: a) yes*; b) no.
3. Nonresponse rate: a) same rate for both groups*; b) nonrespondents described; c) rate different and no designation.

Supplemental Table 4. Forest plots representing comparison of predicted central incisors combined width using 70% recurring esthetic dental proportion by interalar distance (REDIAD) and combined width of central incisors (CIW).

Comparison: Predicted central incisors combined width using 70% recurring esthetic dental proportion by interalar distance and the combined width of central incisors -Mixed-sex group

	REDIAD			CIW				Mean Difference
Study or Subgroup	**Mean**	**SD**	**Total**	**Mean**	**SD**	**Total**	**Weight**	**IV, Random, 95% CI**
Strajnic et al. (2013)	15.295	0.253	89	16.65	0.27	89	6.8%	−1.35 (−1.43, −1.28)
Ahamdian et al. (2012)	18.858	1.37	100	16.8	0.8	100	6.7%	2.06 (1.75, 2.37)
Ellakwa et al.(2011)	17.475	1.735	98	16.78	0.98	98	6.6%	0.70 (0.30, 1.09)
Ricardo (2011)	16.187	1.51	60	16.416	1.094	60	6.6%	−0.23 (−0.70, 0.24)
Isa et al.(2010)	17.973	1.425	60	17.1	0.52	60	6.7%	0.87 (0.49, 1.26)
Miglani (2010)	14.315	1.123	200	16.69	1.11	200	6.8%	−2.38 (−2.59, −2.16)
Pereira et al.(2008)	18.584	1.585	49	17.513	1.179	49	6.5%	1.07 (0.52, 1.62)
Jansisyanont et al.(2005)	18.064	1.379	117	17.16	1	117	6.7%	0.90 (0.60, 1.21)
Kassab (2005)	16.066	1.183	100	16.234	1.531	100	6.7%	−0.17 (−0.55, 0.21)
Sulun et al.(2005)	16.233	0.235	138	17.605	1.155	138	6.8%	−1.37 (−1.57, −1.18)
Ahn et al.(2002)	17.283	1.046	91	16.22	1.34	91	6.7%	1.06 (0.71, 1.41)
Osmar (2002)	15.068	2.205	52	16.9	1.08	52	6.3%	−1.83 (−2.50, −1.16)
Jin et al.(1996)	16.438	1.233	100	16.4	0.6	100	6.7%	0.04 (−0.23, 0.31)
Li and Lv(1995)	16.793	1.467	338	16.891	2.107	338	6.7%	−0.10 (−0.37, 0.18)
Zhang et al.(1994)	16.763	1.466	410	18.83	2.09	410	6.7%	−2.07 (−2.31, −1.82)
Total (95% CI)			**2002**			**2002**	**100.0%**	**−0.19 (−0.82, 0.44)**

Mean Difference IV, Random, 95% CI

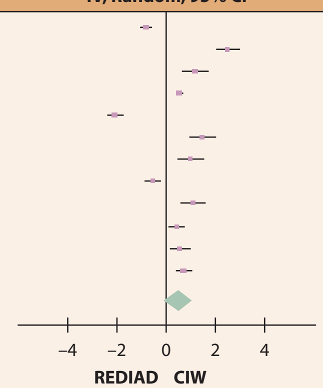


Heterogeneity: τ^2=1.53; χ^2=1317.28, *df*=14 (*P*<.00001);I^2=99%
Test for overall effect: Z=.58 (*P*=.56)

Comparison: Predicted central incisors combined width using 70% recurring esthetic dental proportion by interalar distance and the combined width of central incisors -Male group

	REDIAD			CIW				Mean Difference
Study or Subgroup	**Mean**	**SD**	**Total**	**Mean**	**SD**	**Total**	**Weight**	**IV, Random, 95% CI**
Strajnic et al. (2013)	16.21	0.356	23	17	0.372	23	8.5%	−0.79 (−1.00, −0.58)
Ahamdian et al. (2012)	19.498	1.37	50	17	0.8	50	8.2%	2.50 (2.06, 2.94)
Ellakwa et al.(2011)	18.183	1.525	55	17	1.06	55	8.1%	1.18 (0.69, 1.67)
Ricardo (2011)	16.954	0.257	30	16.434	0.213	30	8.6%	0.52 (0.40, 0.64)
Miglani (2010)	14.863	1.21	100	16.92	1.13	100	8.4%	−2.06 (−2.38, −1.73)
Jansisyanont et al.(2005)	18.813	1.516	46	17.34	1	46	8.1%	1.47 (0.95, 2.00)
Kassab (2005)	17.443	1.187	50	16.46	1.34	50	8.1%	0.98 (0.49, 1.48)
Sulun et al.(2005)	17.215	0.237	73	17.75	1.21	73	8.5%	−0.54 (−0.82, −0.25)
Ahn et al.(2002)	17.758	0.982	49	16.66	1.4	49	8.2%	1.10 (0.62, 1.58)
Jin et al.(1996)	17.032	0.913	50	16.6	0.6	50	8.4%	0.43 (0.13, 0.73)
Li and Lv(1995)	17.683	1.246	126	17.125	1.855	126	8.3%	0.56 (0.17, 0.95)
Zhang et al.(1994)	17.749	1.037	241	17.04	2.05	241	8.5%	0.71 (0.42, 1.00)
Total (95% CI)			**893**			**893**	**100.0%**	**0.49 (−0.08, 1.07)**

Mean Difference IV, Random, 95% CI

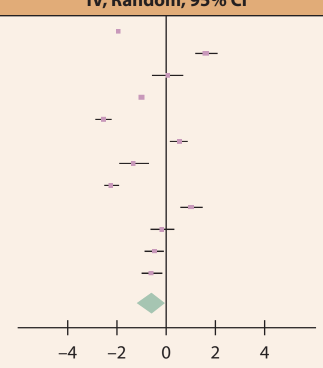


Heterogeneity: τ^2=1.00; χ^2=506.19, *df*=11 (*P*<.00001);I^2=98%
Test for overall effect: Z=1.67 (*P*=.09)

Comparison: Predicted central incisors combined width using 70% recurring esthetic dental proportion by interalar distance and the combined width of central incisors -Female group

	REDIAD			CIW				Mean Difference
Study or Subgroup	**Mean**	**SD**	**Total**	**Mean**	**SD**	**Total**	**Weight**	**IV, Random, 95% CI**
Strajnic et al. (2013)	14.379	0.206	66	16.3	0.225	66	8.6%	−1.92 (−1.99, −1.85)
Ahamdian et al. (2012)	18.219	1.37	50	16.6	0.8	50	8.2%	1.62 (1.18, 2.06)
Ellakwa et al.(2011)	16.566	1.776	43	16.5	0.86	43	7.9%	0.07 (−0.52, 0.66)
Ricardo (2011)	15.42	0.219	30	16.4	0.189	30	8.6%	−0.98 (−1.08, −0.88)
Miglani (2010)	14.05	0.982	100	16.57	1.08	100	8.5%	−2.52 (−2.81, −2.23)
Jansisyanont et al.(2005)	17.58	1.032	71	17.04	0.98	71	8.4%	0.54 (0.21, 0.87)
Kassab (2005)	14.689	1.178	50	16.008	1.7	50	8.0%	−1.32 (−1.89, −0.75)
Sulun et al.(2005)	15.251	0.233	65	17.46	1.09	65	8.5%	−2.21 (−2.48, −1.94)
Ahn et al.(2002)	16.726	0.831	42	15.72	1.08	42	8.3%	1.01 (0.59, 1.42)
Jin et al.(1996)	15.845	1.553	50	16	0.4	50	8.2%	−0.15 (−0.60, 0.29)
Li and Lv(1995)	16.277	1.333	212	16.758	2.234	212	8.4%	−0.48 (−0.83, −0.13)
Zhang et al.(1994)	16.306	1.297	169	16.89	2.21	169	8.3%	−0.58 (−0.97, −0.20)
Total (95% CI)			**948**			**948**	**100.0%**	**−0.59 (−1.17, −0.01)**

Mean Difference IV, Random, 95% CI



Heterogeneity: τ^2=1.01; χ^2=889.12, *df*=11 (*P*<.00001);I^2=99%
Test for overall effect: Z=2.00 (*P*=.05)

Studies are listed in chronological order and refer to studies summarized in Table 3. Shown for every study is the sample size (total), mean difference (mean), and standard deviation (SD) between interalar distance and intercanine distance, as well as weight and 95% confidence interval (95% CI) for each measurement. Diamonds represent overall mean and 95% CI. I^2 values and χ^2 values (for heterogeneity) and *P* value (for statistical significance) are shown below each forest plot

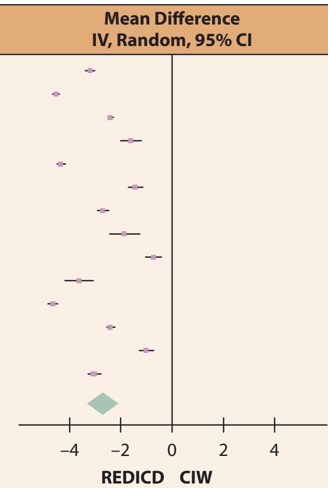
Supplemental Table 5. Forest plots representing comparison of predicted central incisors combined width using 70% recurring esthetic dental proportion by inner canthal distance (REDICD) and combined width of central incisors (CIW).

Comparison: Predicted central incisors combined width using 70% recurring esthetic dental proportion by interalar distance and the combined width of central incisors -Mixed-sex group

Study or Subgroup	REDICD Mean	REDICD SD	REDICD Total	CIW Mean	CIW SD	CIW Total	Weight	Mean Difference IV, Random, 95% CI
Agarwal et al. (2013)	14.386	1	309	17.59	1.148	309	7.2%	−3.20 (−3.37, −3.03)
Bali et al. (2013)	13.084	0.628	250	17.6	0.941	250	7.2%	−4.52 (−4.66, −4.38)
Strajnic et al. (2013)	14.263	0.246	89	16.65	0.27	89	7.3%	−2.39 (−2.46, −2.31)
Ellakwa et al. (2011)	15.178	1.735	98	16.78	0.98	98	7.1%	−1.60 (−2.00, −1.21)
George and Bhat (2010)	14.466	0.994	300	18.8	0.978	300	7.2%	−4.33 (−4.49, −4.18)
Isa et al. (2010)	15.689	0.982	60	17.1	0.52	60	7.2%	−1.41 (−1.69, −1.13)
Miglani (2010)	14.005	1.041	200	16.69	1.11	200	7.2%	−2.69 (−2.90, −2.47)
Pereira et al. (2008)	15.656	1.632	49	17.513	1.179	49	6.9%	−1.86 (−2.42, −1.29)
Jansisyanont et al. (2005)	16.452	1.406	117	17.16	1	117	7.1%	−0.71 (−1.02, −0.40)
Kassab (2005)	12.63	2.327	100	16.234	1.531	100	6.9%	−3.60 (−4.15, −3.06)
Berksun et al. (2002)	12.912	0.906	229	17.56	0.896	229	7.2%	−4.65 (−4.81, −4.48)
Al Wazzan (2001)	14.575	1.279	443	16.95	1.1	443	7.2%	−2.38 (−2.53, −2.22)
Li and Lv (1995)	15.885	1.33	338	16.891	2.107	338	7.2%	−1.01 (−1.27, −0.74)
Zhang et al. (1994)	15.799	1.342	410	18.83	2.09	410	7.2%	−3.03 (−3.27, −2.79)
Total (95% CI)			**2992**			**2992**	**100.0%**	**−2.67 (−3.30, −2.05)**

Heterogeneity: τ^2=1.39; χ^2=2042.40, *df*=13 (*P*<.00001); I^2=99%

Test for overall effect: Z=8.43 (*P*<.00001)

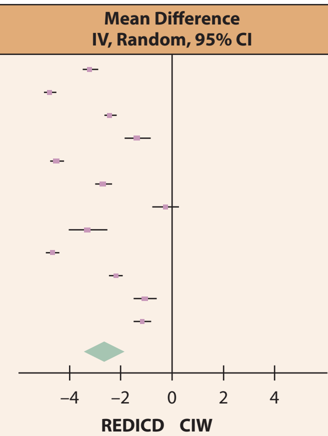


Comparison: Predicted central incisors combined width using 70% recurring esthetic dental proportion by interalar distance and the combined width of central incisors -Male group

Study or Subgroup	REDICD Mean	REDICD SD	REDICD Total	CIW Mean	CIW SD	CIW Total	Weight	Mean Difference IV, Random, 95% CI
Agarwal et al. (2013)	14.854	1.059	173	18.02	1.24	173	8.4%	−3.17 (−3.41, −2.92)
Bali et al. (2013)	13.63	0.671	121	18.36	1.02	121	8.4%	−4.73 (−4.95, −4.51)
Strajnic et al. (2013)	14.612	0.338	23	17	0.372	23	8.4%	−2.39 (−2.59, −2.18)
Ellakwa et al. (2011)	15.662	1.543	55	17	1.06	55	8.2%	−1.34 (−1.83, −0.84)
George and Bhat (2010)	14.881	1.002	144	19.36	1.055	144	8.4%	−4.48 (−4.72, −4.24)
Miglani (2010)	14.247	1.119	100	16.92	1.13	100	8.4%	−2.67 (−2.98, −2.36)
Jansisyanont et al. (2005)	17.11	1.269	46	17.34	1	46	8.2%	−0.23 (−0.70, 0.24)
Kassab (2005)	13.196	2.297	50	16.46	1.34	50	7.9%	−3.26 (−4.00, −2.53)
Berksun et al. (2002)	13.1	0.815	120	17.744	1	120	8.4%	−4.64 (−4.87, −4.41)
Al Wazzan (2001)	15.041	1.219	203	17.21	1.01	203	8.4%	−2.17 (−2.39, −1.95)
Li and Lv (1995)	16.093	1.371	126	17.125	1.855	126	8.3%	−1.03 (−1.43, −0.63)
Zhang et al. (1994)	15.913	1.347	241	17.04	2.05	241	8.4%	−1.13 (−1.44, −0.82)
Total (95% CI)			**1402**			**1402**	**100.0%**	**−2.61 (−3.42, −1.80)**

Heterogeneity: τ^2=2.02; χ^2=1091.34, *df*=11 (*P*<.00001); I^2=99%

Test for overall effect: Z=6.31 (*P*<.00001)

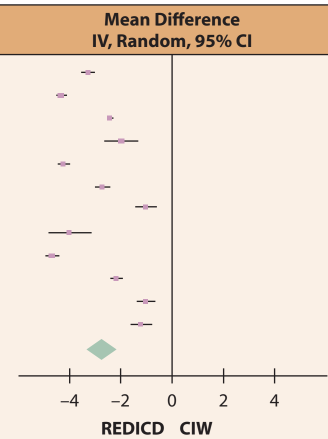


Comparison: Predicted central incisors combined width using 70% recurring esthetic dental proportion by interalar distance and the combined width of central incisors -Female group

Study or Subgroup	REDICD Mean	REDICD SD	REDICD Total	CIW Mean	CIW SD	CIW Total	Weight	Mean Difference IV, Random, 95% CI
Agarwal et al. (2013)	13.918	0.918	136	17.16	1.02	136	8.5%	−3.24 (−3.47, −3.01)
Bali et al. (2013)	12.539	0.584	129	16.84	0.86	129	8.5%	−4.30 (−4.48, −4.12)
Strajnic et al. (2013)	13.913	0.205	66	16.3	0.225	66	8.6%	−2.39 (−2.46, −2.31)
Ellakwa et al. (2011)	14.553	1.959	43	16.5	0.86	43	7.9%	−1.95 (−2.59, −1.31)
George and Bhat (2010)	14.05	0.987	156	18.24	0.9	156	8.5%	−4.19 (−4.40, −3.98)
Miglani (2010)	13.89	0.986	100	16.57	1.08	100	8.4%	−2.68 (−2.97, −2.39)
Jansisyanont et al. (2005)	16.027	1.333	71	17.04	0.98	71	8.3%	−1.01 (−1.40, −0.63)
Kassab (2005)	12.064	2.356	50	16.008	1.7	50	7.6%	−3.94 (−4.75, −3.14)
Berksun et al. (2002)	12.724	0.997	109	17.376	0.764	109	8.5%	−4.65 (−4.89, −4.42)
Al Wazzan (2001)	14.571	1.329	240	16.72	1.12	240	8.5%	−2.15 (−2.37, −1.93)
Li and Lv (1995)	15.766	1.293	212	16.758	2.234	212	8.4%	−0.99 (−1.34, −0.64)
Zhang et al. (1994)	15.717	1.338	169	16.89	2.21	169	8.3%	−1.17 (−1.56, −0.78)
Total (95% CI)			**1481**			**1481**	**100.0%**	**−2.72 (−3.37, −2.07)**

Heterogeneity: τ^2=1.29; χ^2=1112.18, *df*=11 (*P*<.00001); I^2=99%

Test for overall effect: Z=8.20 (*P*=.00001)



The studies are listed in chronological order and refer to the studies summarized in Table 3. Shown for every study is the sample size (total), mean difference (mean), and standard deviation (SD) between the interalar distance and intercanine distance, as well as the weight and 95% confidence interval (95% CI) for each measurement. Diamonds represent the overall mean and 95% CI. I^2 values and χ^2 values (for heterogeneity) and *P* values (for statistical significance) are shown below each forest plot

SUPPLEMENTAL REFERENCES

1. Agarwal B, Kumar M, Alvi HA, Arora V, Agarwal S. Relating central incisor to inner canthal distance - A flexible approach adaptable to different population groups. Int J Contemp Med 2013;1:8-11.
2. Bali P, Singh S, Singh AP, Goyal RR. Biometric relationship between inner canthal distance and geometric progression for the prediction of maxillary central incisor width. Indian J Dent Sci 2013;5:53-6.
3. Dharap A, Salem AH, Fadel R, Osman M, Chakravarty M, Latif NA, et al. Facial anthropometry in an Arab population. Bahrain Med Bull 2013;35:69-73.
4. Kini AY, Angadi GS. Biometric ratio in estimating widths of maxillary anterior teeth derived after correlating anthropometric measurements with dental measurements. Gerodontology 2013;30:105-11.
5. Strajnic L, Vuletic I, Vucinic P. The significance of biometric parameters in determining anterior teeth width. Vojnosanit Pregl 2013;70:653-9.
6. Shuchita S, Archana N, Verma P. Correlation between facial measurements and the mesiodistal width of the maxillary anterior teeth. Indian J Dent Sci 2012;4:20-4.
7. Singh KD, Rao J, Kumar L, Singh S. Comparative evaluation of facial landmarks and their correlation in the natural teeth of North Indian and northeast Indian people. - A cohort study. J Oral Health Sci 2012;3:1-11.
8. Ellakwa A, McNamara K, Sandhu J, James K, Arora A, Klineberg I, et al. Quantifying the selection of maxillary anterior teeth using intraoral and extraoral anatomical landmarks. J Contemp Dent Pract 2011;12:414-21.
9. 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;20:391-8.
10. Bonakdarchian M, Ghorbanipour R. Relationship between width of maxillary anterior teeth and interalar distance. Dent Anthropol 2010;23:53-6.
11. EL-Sheikh NA, Mendilawi LB, Khalifa N. Intercanthal distance of a Sudanese population sample as a reference for selection of maxillary anterior teeth size. Sudan JMS 2010;5:117-22.
12. 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;21:491-5.
13. Isa ZM, Tawfiq OF, Noor NM, Shamsudheen MI, Rijal OM. Regression methods to investigate the relationship between facial measurements and widths of the maxillary anterior teeth. J Prosthet Dent 2010;103:182-8.
14. Rai R. Correlation of nasal width to inter-canine distance in various arch forms. J Indian Prosthodont Soc 2010;10:123-7.
15. Gomes VL, Goncalves LC, Costa MM, Lucas BL. Interalar distance to estimate the combined width of the six maxillary anterior teeth in oral rehabilitation treatment. J Esthet Restor Dent 2009;21:26-35.
16. Lucas BL, Bernardino R, Goncalves LC, Gomes VL. Distance between the medialis angles of the eyes as an anatomical parameter for tooth selection. J Oral Rehabil 2009;36:840-7.
17. 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.
18. Kassab NH. The selection of maxillary anterior teeth width in relation to facial measurements at different types of face form. Al-Rafidain Dent J 2005;5:15-23.
19. Sulun T, Ergin U, Tuncer N. The nose shape as a predictor of maxillary central and lateral incisor width. Quintessence Int 2005;36:603-7.
20. Berksun S, Hasanreisoglu U, Gokdeniz B. Computer-based evaluation of sex identification and morphologic classification of tooth face and arch forms. J Prosthet Dent 2002;88:578-84.
21. Al-Wazzan KA. The relationship between intercanthal dimension and the widths of maxillary anterior teeth. J Prosthet Dent 2001;86:608-12.
22. Ibrahimagic L, Celebic A, Jerolimov V, Seifert D, Kardum-Ivic M, Filipovic I. Correlation between the size of maxillary frontal teeth, the width between alae nasi and the width between corners of the lips. Acta Stomatol Croat 2001;35:168-79.
23. Dharap AS, Tanuseputro H. A comparison of interalar width and intercanine distance in Malay males and females. Anthropol Anz 1997;55:63-8.
24. Hoffman W, Bomberg TJ, Hatch RA. Interalar width as a guide in denture tooth selection. J Prosthet Dent 1986;55:219-21.
25. Mavroskoufis FR, Ritchie GM. Nasal width and incisive papilla as guides for selection and arrangement of maxillary anterior teeth. J Prosthet Dent 1981;45:592-7.