

Comparison of the Mesiodistal Crown Dimensions of Upper And Lower Central Incisors Between the Natural Dentition and Artificial Teeth in Iran

Original Article

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Abstract

Introduction:

The aim of this study was to compare the ratios of the mesiodistal width of the upper and lower central incisors between natural teeth and those produced artificially by Ideal Makoo, Ivoclar, and Vitapan, in Iran.

Materials and methods:

The mesiodistal width of the upper and lower central incisors was measured in 120 students, using calipers placed at the height of contour of the teeth. The widths of the upper and lower central incisors, and their ratios, in the artificial teeth were determined using the tooth catalogs of Ideal Makoo, Vitapan, and Ivoclar products.

Results:

The average mesiodistal width of the upper and lower central incisors, in the natural dentition, was 8.54 ± 0.76 (mean \pm standard deviation (SD)), and 5.29 ± 0.57 (mean \pm SD), respectively, while the ratio of the widths of the upper central incisors to the lower central incisors was 1.63 ± 0.21 (mean \pm SD).

Conclusion:

Considering the similarities in the widths of the upper and lower central incisors, their ratios, and the esthetics, between the natural dentition and the commercially available artificial teeth, dentists in northern Iran are advised to use the A36 A7, A66 A7, A26 A7, A14 A7, and A56 A7 sets from Ivoclar products as well as the Z85 L13, Z84 L9, and Z74 L9 sets from Vitapan products for males. Furthermore, sets Z61 L3 and Z51 L3 from Vitapan products are recommended for females, whereas the sets A54 I5 from Ideal Makoo products and A24B A5, A12 A5, A13 A5, and A54 A5 from Ivoclar products are recommended for general use in dentures.

Key words: •Tooth •Artificial •Denture
•Complete •Esthetics •Dental

Introduction

Esthetics is one of the major concerns for patients requiring prosthetic dental treatment.⁽¹⁾ As anterior teeth play a major role in enhancing facial appearance,⁽²⁾ the selection of maxillary anterior teeth is one of the primary concerns in denture esthetics.^(3, 4)

The maxillary central incisor occupies a strategic anatomical position in the front and center of the upper jaw.⁽⁵⁾ Accurate positioning as well as measurements of the anterior teeth guarantees the achievement of ideal esthetics and oral rehabilitation.^(6, 7) The unnatural appearance of a denture may be attributed to the incorrect selection of maxillary anterior teeth; the artificial teeth selected are often smaller than the natural teeth being replaced.⁽⁸⁻¹⁰⁾ Furthermore, it is harder to estimate the width of the crown when compared with the length of the artificial anterior tooth.^(11, 12)

The selection of appropriately sized artificial teeth for dentures may prove to be a challenging task, particularly when there are no pre-extraction records, such as photography or dental casts, available.⁽¹³⁾ However, in such cases, several anatomical landmarks have been used as guides.⁽¹⁴⁾ A relationship between the widths of the six maxillary anterior teeth and the width of a single maxillary central incisor has been demonstrated by Gomes et al.⁽¹⁵⁾ Sinavarat et al. also reported a relationship between the anterior teeth and facial anatomical landmarks.⁽¹⁶⁾

However, in a study conducted in North America, no significant relationships were observed between intercommissural, interalar or interpupillary widths.⁽¹⁷⁾

The lack of positive correlations between intercommissural widths has also been reported in other studies.^(6,18) Mesiodistal widths (MDW) of upper central incisors have been examined by several authors.^(19, 20, 21) In addition, their association with gender,^(12, 22, 23) and racial differences⁽²²⁻²⁴⁾ have also been widely investigated by researchers. The position of the canine, based on facial anatomical structures, has been associated with the race of an individual.⁽¹⁶⁾

The present study was conducted to compare the ratio of the mesiodistal widths of upper and lower central incisors in the natural dentition with those produced commercially by Ideal Makoo,

Ivoclar, and Vitapan, in northern Iran. Owing to the wide range of sets available from these three companies in Iran, the present study may help dentists in choosing the appropriate sets for their patients, particularly with regards to esthetics.

Materials and Methods

In this descriptive-analytical study, 120 native students (60 males, 60 females; from Mazandaran, Golestan, and Gilan districts; academic year of 2013–2014) were randomly selected from Babol University of Medical Sciences, Babol, Iran. In addition, contemporary brands of artificial teeth produced by Ideal Makoo, Vitapan and Ivoclar were also investigated. The criteria for selecting the subjects in the study were as follows: native of northern Iran; age 20–30 years; presence of all upper and lower anterior teeth; absence of dental anomalies; completion of orthodontic treatment (if any); Class I canine relation; no broken, decayed (class III or IV), or artificially restored (including crown) teeth in the maxillary and mandibular anterior region; no diastema or crowding; no abnormally sized teeth (such as Bolton's tooth-size discrepancies); and no parafunctional habits. The reason for choosing this age group was because by this time the face is fully developed, and the processes of ageing such as (abrasion), have not begun yet.

The MDW of the natural upper and lower central incisors were measured through a direct (intraoral) approach, with a pair of flexible, pointed-jaw digital calipers (kunststoff-Digital-Scheibere584–51, Germany). At least three measurements were taken, and average values were calculated. The widest MDW at the height of contour of the tooth was measured by placing the pointed tips of the calipers in the contact areas between adjacent teeth such that the calipers were perpendicular to the vestibule, and horizontal to the axis of the tooth. The distance between the two tips of the caliper was recorded by a specialist, with a precision of 0.01 mm.

Subsequently, the widths of upper and lower central incisors in the artificial teeth sets were determined using the catalogs obtained from Ideal Makoo, Vitapan and Ivoclar. The ratios of the MDW were calculated based on the manufacturer's recommendation regarding the most accurate pairing of the upper incisors with the lower incisors, and the data was entered into the

software SPSS 18 for analysis. The widths, and the ratios resulting from measurements of the upper and lower central incisors, in the natural dentition and the artificial teeth, were compared with each other. To calculate the mean and standard deviation, all of the criteria were determined using 95% confidence interval. The measurements were also compared between males and females in this study, using the independent t-test ($p < 0.05$).

Results

The MDW measurements, ratios and combination charts of the upper and lower central incisors obtained from the Vitapan, Ideal Makoo, and Ivoclar product catalogs, are illustrated in Tables 1, 2, and 3, respectively.

Table 4 depicts the MDW measurements and ratios of the natural upper and lower central incisors, in the 120 students.

The MDW of the upper central incisors were not significantly different between the males and the females ($p = 0.06$), whereas, the MDW of the lower incisors were significantly higher in the males than in the females in the present study ($p < 0.001$). Furthermore, MDW ratios of the upper incisors to the lower central incisors were significantly different between males and females ($p = 0.03$)

Table 1. Combination chart, mesiodistal width, and ratio of mesiodistal widths of the upper and lower central incisors obtained from the Vitapan products catalog. (The numbers in parentheses show the tooth width in millimeters.)

Ovoid Tooth Moulds			Triangular Tooth Moulds			Square Tooth Moulds			Rectangular Tooth Moulds		
Upper central	Lower central	Proportion	Upper central	Lower central	Proportion	Upper central	Lower central	Proportion	Upper central	Lower central	Proportion
013 (7.9)	L 4 (4.7)	1.68	T 36 (8.1)	L 4 (4.7)	1.72	X 13 (7.7)	L 4 (4.7)	1.63	Z 51 (8.3)	L 3 (5)	1.66
025 (8.1)	L 3 (5.0)	1.62	T 53 (8.1)	L 5 (5.2)	1.55	X 66 (8.9)	L 9 (5.6)	1.58	Z 61 (8.2)	L 3 (5)	1.64
034 (8)	L 3 (5.0)	1.60	T 56 (8.3)	L 5 (5.2)	1.59	X 77 (8.5)	L 11 (5.7)	1.49	Z74 (8.8)	L 9 (5.6)	1.57
035 (8)	L 3 (5.0)	1.60	T 66 (8.3)	L 5 (5.2)	1.59	X 87 (8.9)	L 11 (5.7)	1.56	Z 84 (8.7)	L 9 (5.6)	1.55
043 (8.2)	L 5 (5.2)	1.57	T 67 (8.4)	L 4 (4.7)	1.78	X 96 (9.3)	L 10 (5.9)	1.57	Z 85 (8.6)	L 13 (5.6)	1.53
086 (8.9)	L 11 (5.7)	1.56	T76 (8.2)	L 7 (5.4)	1.51	X 99 (9.4)	L 15 (5.7)	1.64	Z 97 (9.5)	L 12 (6.2)	1.53
097 (9.0)	L 8 (5.8)	1.55	T 77 (8.5)	L 11 (5.7)	1.49	-	-	-	-	-	-
098 (9.0)	L 13 (5.6)	1.60	T 88 (8.7)	L 11 (5.7)	1.52	-	-	-	-	-	-
099 (9.8)	L 14 (6.1)	1.60	T 98 (9.3)	L 15 (5.7)	1.63	-	-	-	-	-	-
-	-	-	T 99 (9.0)	L 11 (5.7)	1.57	-	-	-	-	-	-

Mesiodistal width of upper and lower central

Table 2. Combination chart, mesiodistal width, and ratio of mesiodistal widths of the upper and lower central incisors obtained from the Ideal Makoo products catalog. (The numbers in parentheses show the tooth width in millimeters.)

Square Tooth Moulds			Triangular Tooth Moulds			Oval Tooth Moulds		
Upper central	Lower central	Proportion	Upper central	Lower central	Proportion	Upper central	Lower central	Proportion
A11 (8)	I3 (4.7)	1.70	A41 (8.1)	I3 (4.7)	1.72	A31 (7.8)	I3 (4.7)	1.65
A12 (8.4)	I5 (5.2)	1.61	A44 (7.6)	I3 (4.7)	1.61	A32 (8.3)	I3 (4.7)	1.76
A13 (8.3)	I5 (5.2)	1.59	A23 (9)	I7 (5.7)	1.57	A32 (8.3)	I5 (5.2)	1.59
A14 (8.8)	I6 (5)	1.76	-	-	-	A52 (7.6)	I1 (4.4)	1.72
A15 (9)	I8 (5.7)	1.57	-	-	-	A52 (7.6)	I3 (4.7)	1.61
A68 (9.2)	I7 (5.7)	1.61	-	-	-	A56 (8.8)	I6 (5)	1.76
A68 (9.2)	I8 (5.7)	1.61	-	-	-	A56 (8.8)	I7 (5.7)	1.54
A66 (8.7)	I6 (5)	1.74	-	-	-	A54 (8.6)	I5 (5.2)	1.61
A66 (8.7)	I5 (5.2)	1.67	-	-	-	-	-	-
A17 (9.8)	I8 (5.7)	1.71	-	-	-	-	-	-

Table 3. Combination chart, mesiodistal width, and ratio of mesiodistal widths of the upper and lower central incisors obtained from the Ivoclar products catalog. (The numbers in parentheses show the tooth width in millimeters.)

Oval Tooth Moulds			Triangular Tooth Moulds			Square Tooth Moulds		
Upper central	Lower central	Proportion	Upper central	Lower central	Proportion	Upper central	Lower central	Proportion
A11 (7.94)	A3 (4.76)	1.67	A32 (8.38)	A3 (4.76)	1.76	A22 (7.84)	A3 (4.76)	1.64
A12 (8.48)	A5 (5.24)	1.61	A32 (8.38)	A5 (5.24)	1.59	A24 (8.40)	A2 (4.84)	1.73
A13 (8.46)	A5 (5.24)	1.61	A36 (8.64)	A7 (5.60)	1.54	A24B (8.42)	A4 (4.82)	1.74
A14 (8.84)	A6 (5.04)	1.68	A37 (9.02)	A7 (5.60)	1.61	A24B (8.42)	A5 (5.24)	1.60
A14 (8.84)	A7 (5.60)	1.57	A37 (9.02)	A8 (5.76)	1.56	A25 (8.72)	A9 (5.72)	1.52
A15 (8.96)	A8 (5.76)	1.55	A54 (8.66)	A5 (5.24)	1.65	A26 (8.78)	A7 (5.60)	1.56
A16 (9.40)	A9 (5.72)	1.58	A56 (8.84)	A7 (5.60)	1.57	A27 (8.92)	A8 (5.76)	1.54
A17 (9.84)	A9 (5.72)	1.72	A56 (8.84)	A8 (5.76)	1.53	A41 (8.08)	A3 (4.76)	1.69
A66 (8.70)	A5 (5.24)	1.66	-	-	-	A41 (8.08)	A5 (5.24)	1.54
A66 (8.70)	A7 (5.60)	1.55	-	-	-	A42 (7.86)	A5 (5.24)	1.50
A68 (9.28)	A7 (5.60)	1.65	-	-	-	-	-	-
A69 (9.50)	A7 (5.60)	1.69	-	-	-	-	-	-
A69 (9.50)	A8 (5.76)	1.64	-	-	-	-	-	-

Table 4. Average width and ratio of the upper and lower central incisors in natural teeth measured in the 120 students from northern Iran. (The numbers in the table show the mean ± standard deviation (confidence interval was 95%))

Groups	Parameter	Proportion	Upper central width	Lower central width
Male		5.54 ± 0.49 (5.41,5.67)	8.74 ± 0.71 (8.56,8.93)	1.59 ± 0.20 (1.53,1.64)
	Female	5.04 ± 0.53 (4.90,5.18)	8.36 ± 0.77 (8.16,8.56)	1.67 ± 0.21 (1.61,1.73)
P-value		0.03	0.06	<0.001
Overall		5.29 ± 0.57 (5.19 ± 5.39)	8.54 ± 0.76 (8.41,8.69)	1.63 ± 0.21 (1.59,1.67)

Table 5. Concordance between the width of upper and lower central incisors in natural teeth and that of Vita-Pan, Ivoclar, and Ideal Makoo products with 95% confidence interval.

Groups	Parameter	Ideal Makoo	Vita Pan	Ivoclar
Upper centrals (Males)		A36, A54, A14, A66, A26, A25, A56, A27	O86, X66, X87, T88, Z84, Z74, Z85	A66, A14, A56
Upper centrals (Females)		A13, A24, A24B, A32, A12	O43, T76, Z61, T56, T66, Z51, T67, T77, X77	A12, A13, A32
Lower centrals (Males)		A7	L13	-
Lower centrals (Females)		A6	L3, L5L	I6
Upper central incisors (students in this study)		A13, A24B, A12, A36, A54	X77, T77, Z85	A54
Lower central incisor (students in this study)		A5	L5	I5

Table 6. Concordance between the ratio of width of upper to lower central incisors in natural teeth and that of Vita Pan, Ivoclar, and Ideal Makoo products with the confidence interval 95%

Groups	Parameter	Ideal Makoo	Vita Pan	Ivoclar
Ratio of upper to lower central incisors in males		A56 A8, A27 A8, A41 A5, A36 A7, A15 A8, A66 A7, A37 A8, A26 A7, A14 A7, A56 A7, A16 A9, A32 A5, A24B A5, A12 A5, A13 A5, A37 A7, A44 A3, A69 A8, A22 A3	Z85 L13, Z97 L12, O97 L8, T53 L5, Z84 L9, O86 L11, X87 L11, O43 L5, X96 L10, T99 L11, Z74 L9, T56 L5, O34 L3, O35 L3, O98 L13, O99 L14, O25 L3, X13 L4, T98 L15, X99 L15, Z61 L3	A15 I8, A23 I7, A32 I5, A13 I5, A12 I5, A68 I7, A68 I8, A44 I3, A52 I3, A56 I7
Ratio of upper to lower central incisors in females		A12 A5, A13 A5, A37 A7, A44 A3, A69 A8, A22 A3, A68 A7, A54 A5, A66 A5, A11 A3, A14 A6, A69 A7, A41 A3, A17 A9, A24 A2	O25 L3, X13 L4, T98 L15, X99 L15, Z61 L3, Z51 L3, O13 L4, T36 L4	A66 I5, A31 I3, A51 I5, A11 I3, A52 I1, A41 I3, A17 I8, A12 I5, A68 I7, A68 I8, A44 I3, A52 I3
Ratio of upper to lower central incisors in both genders		A32 A5, A24B A5, A12 A5, A13 A5, A37 A7, A44 A3, A69 A8, A22 A3, A68 A7, A54 A5, A66 A5, A11 A3	T56 L5, T66 L5, O34 L3, O35 L3, O98 L13, O99 L14, O25 L3, X99 L15, Z61 L3, Z51 L3	A32 I5, A12 I5, A68 I5, A44 I3, A52 I3, A31 I3, A54 I5, A66 I5

Discussion

The average MDW of the upper central incisor in males, in the present study, was similar to that reported in previous studies.^(12, 21, 25, 27) Cesario et al. achieved reported an average MDW of 8.92 mm in white males and 9.02 mm in black males, in their study.⁽²³⁾

The average of MDW of the upper central incisor in females was also in accordance with that reported in white females.⁽²¹⁻²³⁾ However, Lavelle⁽²²⁾ had reported MDW values of 9.21 mm in black females, and 8.57 in Asian females. Furthermore, our results were not in accordance with those reported by Abdollah et al.⁽¹²⁾ and Cesario et al.⁽²³⁾ wherein, the average MDW in black females was 8.69 and 9.13, respectively. In addition, the average MDW of the lower central incisor, in the present study, was inconsistent with those described in some of the previous studies^(19, 20, 25), and may be attributed to the racial differences.

The ratio of the average MDWs of the upper to the lower central incisors, in this study, was similar to that reported by McArthur et al.⁽²⁵⁾ and Black et al.⁽²⁰⁾ who reported values of 1.62 and 1.67, respectively. Nevertheless, it was not in accordance with the values reported by Ballard⁽¹⁹⁾ who obtained a ratio of 1.57, and Khodadadi⁽²⁶⁾ who reported a value of 1.55.

The concordance between the products of Vita-Pan, Ivoclar and Ideal Makoo and the widths and ratios of upper and lower central incisors are presented in Tables 5 and 6.

Conclusion

Based on the findings from this study, dentists in the north of Iran are recommended to use the sets A36 A7, A66 A7, A26 A7, A14 A7, and A56 A7 from Ivoclar, and Z85 L13, Z84 L9, and Z74 L9 from Vitapan for males, and Z61 L3 and Z51 L3 from Vitapan, for females. Furthermore, the sets A54 I5 from Ideal Makoo,, and A24B A5, A12 A5, A13 A5, and A54 A5 from Ivoclar, give entures a more natural appearance, by taking into consideration the compatible of widths of the upper and lower central incisors, and their ratio.

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References

1. De Lucena SC, Gomes SG, Da Silva WJ, Del Bel Cury AA. Patients' satisfaction and functional assessment of existing complete dentures: correlation with objective masticatory function. *J Oral Rehabil* 2011;38(6):440-6.
2. Ellakwa A, McNamara K, Sandhu J, et al. Quantifying the selection of maxillary anterior teeth using intraoral and extraoral anatomical landmarks. *J Contemp Dent Pract*. 2011 1;12(6):414-21.
3. Scandrett FR, Kerber PE, Umrigar ZR. A clinical evaluation of techniques to determine the combined width of the maxillary anterior teeth and the maxillary central incisor. *J Prosthet Dent* 1982;48(1):15-22.
4. Hobkirk J, Zarb G. The Edentulous State. In: Zarb G., Hobkirk JA, Eckert SE, and Jacob RF. *Prosthodontic Treatment for Edentulous Patients*. 13th Ed. USA: Elsevier; 2012. pp. 215-230.
5. Kaushal S, Patnaik V, Agnihotri G, Jain R. Maxillary central incisor morphometry in north indians-A dimorphic study. *J Punjab Acad Forensic Med Toxicol* 2005;5(5):13-7.
6. Hasanreisoglu U, Berksun S, Aras K, Arslan I. An analysis of maxillary anterior teeth: facial and dental proportions. *J Prosthet Dent* 2005;94(6):530-8.
7. Varjao FM, Nogueira SS. Intercomissural width in 4 racial groups as a guide for the selection of maxillary anterior teeth in complete dentures. *Int J Prosthodont* 2005 Nov;18(6):513-5.
8. Baer ML, Reynolds MA. Comparison of anterior tooth width in natural and artificial dentitions. *J Prosthodont* 1992;1:84-7.
9. Woodhead CM. The mesiodistal diameter of permanent maxillary central incisor teeth and their prosthetic replacements. *J Dent* 1977;5(2):93-8.
10. McArthur DR. Determining approximate size of maxillary anterior artificial teeth when mandibular anterior teeth are present. Part II: set selection. *J Prosthet Dent* 1985;53:369-73.
11. McArthur DR. Determining approximate size of maxillary anterior artificial teeth when mandibular anterior teeth are

present. Part I: size relationship. *J Prosthet Dent* 1985;53:216-8.

12. Abdullah MA. Inner canthal distance and geometric progression as a predictor of maxillary central incisor width. *J Prosthet Dent* 2002;88:16-20.
13. Fabiana M, Varjao 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;107:400-404.
14. Goncalves LC, Gomes VL, Lucas Bde L, Monteiro SB. Correlation between the Individual and the Combined Width of the Six Maxillary Anterior Teeth. *J Esthet Restor Dent* 2009;21(3):182-91.
15. Gomes VL, Gonçalves LC, Costa MM, Lucas Bde L. Interalar distance to estimate the combined width of the six maxillary anterior teeth in oral rehabilitation treatment. *J Esthet Restor Dent* 2009;21(1):26-35; 36.
16. Sinavarat T, Anunmana C, Hossain Sh. The relationship of maxillary canines to the facial anatomical landmarks in a group of Thai people. *J Adv Prosthodont* 2013;5(4):369-73.
17. Latta GH Jr, Weaver JR, Conkin JE. The relationship between the width of the mouth, interalar width, bizygomatic width, and interpupillary distance in edentulous patients. *J Prosthet Dent* 1991;65(2):250-4.
18. 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;21(84):7-10.
19. Ballard ML. Asymmetry in tooth size: a factor in the etiology, diagnosis and treatment of malocclusion. *Orthodontics and Oral Surgery Am J* 1946;32(4):239-40.
20. Black GV. Descriptive anatomy of the human teeth. 4th ed. Philadelphia: SS White Manufacturing co; 1902.pp. 520-2.
21. Al Wazzan KA. The relationship between intercanthal dimension and the widths of maxillary anterior teeth. *J Prosthet Dent* 2001;86(6):608-12.
22. Lavelle CL. Maxillary and mandibular tooth size in different racial groups and in different occlusal categories. *Am J Orthod* 1972;61(1):29-37.
23. Cesario VA Jr, Latta GH Jr. Relationship between the mesiodistal width of the maxillary central incisor and interpupillary distance. *J Prosthet Dent* 1984 Nov;52(5):641-3.
24. Keene H J Mesiodistal crown diameters of permanent teeth in male American Negroes. *Am J Orthod* 1979;76(1):95-9.
25. McArthur DR. Determination of approximate size of maxillary anterior denture teeth when mandibular anterior teeth are present. Part III: relationship of maxillary to mandibular central incisor widths. *J Prosthet Dent* 1985;53(4):540-2.
26. Khodadi R, Sadeghi MA, Geravand Sh. Assessment of proportion of central incisor width in the maxilla to that in the mandible in natural and artificial teeth. *Journal of Isfahan Dental School* 2011; 7(1): 39-46.[Persian]