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A Comparative Study of Tooth Size and Dental Arch Dimensions between Iraqi Arabs and Kurds with Class I Normal Occlusion

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الخلاصة

الأهداف: تهدف الدراسة إلى التحري عن وجود اختلافات في حجم الأسنان و أبعاد القوس السني بين العراقيين العرب و الأكراد.**المواد و طرائق العمل**: تم استخدام قوالب سنية لكل من الفك الأعلى و الفك الأسفل لأربعين فرد من العرب وكذلك أربعين فرد من الأكراد. تراوحت أعمار العينة بين (14-18) عام ومقسمين بالتساوي بين كلا الجنسين. تم قياس حجم الأسنان و كذلك أبعاد القوس السني المتمثلة بالطول وكل من العرض و المحور. **النتائج**: كشفت الدراسة أن أسنان الذكور و الإناث من الأكراد كانت اكبر من أقرانهم العرب. كذلك كانت أبعاد القوس السني اكبر عند الكرد.لوحظ أيضا أن حجم الأسنان و أبعاد القوس السني للذكور اكبر مما هي عليه عند الإناث لكل من العرب و الأكراد. **الاستنتاجات**: أن مقاييس حجم الأسنان و أبعاد القوس السني للعراقيين العرب لا تنطبق على أقرانهم الأكراد.

ABSTRACT

Aims: To search for any differences in tooth size and dental arch dimensions between Iraqi Arabs and Kurds. **Materials and Methods:** Upper and lower dental casts of 40 Kurdish and 40 Arabic subjects ranging in age between 14-18 years and equally divided between males and females, were measured for mesiodistal tooth size as well as for dental arch width, length and perimeter. **Results:** Kurdish males and females showed larger values for mesiodistal tooth size and dental arch width, perimeter and length than their Arabic counterpart. The majority of differences were significant. Males in both Arabic and Kurdish population had greater tooth and dental arch size than females. **Conclusions:** Data of tooth size and dental arch dimensions for Iraqi Arabs is not applied to Iraqi Kurdish subjects.

Key words: Tooth size, arch width, arch length, arch perimeter, ethnic differences

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INTRODUCTION

Tooth size exhibits a continuous range of variation among individuals and between populations. The size of teeth, as well as amount, shape and morphology are genetically determined,[1] although there are attitudes that determining the size of teeth is multifactorial, important factor.[2]

Members of various races and ethnic backgrounds show differences in teeth size. Persons of black race have bigger teeth than persons of white race,[3] while in persons of yellow race the size of teeth is slightly smaller compared to members of white race.[4]

The size of teeth not only varies between sexes, races and populations, so does between generations. Ebling *et al.*[5] suggested that there is an upward trend in the mesiodistal size of teeth. Harris *et al.*[6] attributed this positive gain in tooth size to the increase in growth rate, while health and nutrition improve.

The size and shape of the dental arches have considerable implications in orthodontic diagnosis and treatment planning, as it affects the space available, dental aesthetics, and stability of the dentition. These considerations, in association with the anteroposterior movements of the dentition will determine the requirements for extraction or non-extraction treatment.[7] Many factors such as heredity, growth of the bone, eruption and inclination of the teeth, external influences, function and ethnic backgrounds could affect the size and shape of the dental arches.[8]

Most studies indicate that normal measurements for one group may not be considered normal for other race or ethnic group. Different racial groups must be treated according to their own characteristic.[9]As people from different ethnic groups present with different morphological conditions, the clinician should anticipate the difference in size and form rather treating all cases to a single ideal.[10]

MATERIALS AND METHODS

This study was a case control study using 80 pairs of study models divided in to two groups. The first group consisted of 40 pairs of study models of Arabic subjects and the other 40 pairs for Kurdish subjects. Each group included 20 males and 20 females. The age range of the subjects was chosen between14-18 years with mean of age16.7years. The study subjects were those attending the dental clinics of the college of dentistry, university of Mosul for various kinds of dental treatment. All the subjects had full set of permanent teeth (except third molars), class I (canine and molar) relationship, normal overjet and overbite (3-4 mm), no spacing or crowding and no restorative treatment other than simple class I restorations. In addition, none had abnormalities of size and shape of teeth or had undergone any form of orthodontic treatment.[11]

Complete dental impressions were obtained for the upper and lower arches, using alginate (Zhemack, Italy) with perforated plastic tray that had been disinfected. The impressions were poured with yellow stone (Zhemack, Italy).

Measurements were made directly on the study models. An electrical digital caliper with fine tips measuring within 0.01mm (Mitutoyo Co., Utsumomiya, Japan),was used to measure the following parameters on the maxillary and mandibular study models:

1. The largest mesiodistal dimension of each tooth (except the second and third molars) on each arch. The measurements were made for both right and left individual tooth type and then the mean of the two measurements were taken .The procedure of measuring tooth crown dimension was performed as described by Hunter and Priest. [12] The caliper peaks were inserted from the buccal-labial aspect and held occlusally parallel to the long axis of the tooth.

2. Arch widths [11]

The following representative measurements of arch width were obtained: Intercanine width (ICW): between the cusp tips of right and left canines.

Interpremolar width I (IPWI): Between the bucccal cusp tips of right and left first premolars.

Interpremolar width II (IPWII): Between the bucccal cusp tips of right and left second premolars.

Intermolar width I (IMWI): between the tips of mesiobuccal cusps of right and left first molars.

Intermolar width II (IMWII): Between the central fossae of the right and left first molars.

3. Arch length: To measure the arch length a line was drawn from a point midway to central incisors perpendicular to the tangent touching the distal surfaces of the first molars. [13] To facilitate measuring the arch length a thin clear glass slab was placed on the occlusal surface of the study casts with an acetate paper. [14]

4. Arch perimeter: It's a line drawn from the distal surface of the first molar around the arch over the contact points and incisal edges in a smooth curve to the distal surface of the first molar on the opposite side.[15] A brass wire was used for measuring arch length.

The data was analyzed using SPSS® software version 12 (Inc., Chicago, IL, USA). Independent t-test was used for comparing means of measurements. A *p*-values ≤ 0.05 was considered the level of significance.

RESULTS

The comparison of mesiodistal dimension of maxillary teeth between Arabs and Kurds and between males and females are shown in Table (1) and for mandibular teeth are shown in Table (2).

Table (1): Comparison of maxillary tooth size between &within Arabs and Kurds.

tooth	Kurdish males Mean(SD)	Kurdish females Mean(SD)	Arab males Mean(SD)	Arab females Mean (SD)	Comparison		
					groups	T-value	*P*-value
U1	9.06(0.75)	8.76(0.71)	8.82(0.69)	8.36(0.73)	KM.KF	1.779	NS
					AM.AF	2.049	0.05
					KM.AM	1.049	NS
					KF.AF	2.04	0.05
U2	7.11(0.31)	6.87(0.29)	6.96(0.27)	6.57(0.28)	KM.KF	2.575	0.02
					AM.AF	4.487	0.001
					KM.AM	1.663	NS
					KF.AF	3.330	0.002
U3	8.12(0.42)	7.75(0.41)	7.94(0.44)	7.38(0.40)	KM.KF	2.821	0.01
					AM.AF	4.066	0.001
					KM.AM	1.324	NS
					KF.AF	2.781	0.01
U4	7.53(0.210	7.12(0.20)	7.21(0.23)	6.93(0.24)	KM.KF	6.336	0.001
					AM.AF	3.783	0.001
					KM.AM	4.637	0.001
					KF.AF	2.753	0.01
U5	7.42(0.39)	6.86(0.42)	7.06(0.41)	6.73(0.42)	KM.KF	4.375	0.001
					AM.AF	2.519	0.02
					KM.AM	2.848	0.01
					KF.AF	0.979	NS
U6	11.30(0.48)	10.57(0.47)	10.84(0.44)	10.24(0.44)	KM.KF	4.863	0.001
					AM.AF	4.207	0.001
					KM.AM	3.003	0.005
					KF.AF	2.308	0.05

Measurements in mm, U-upper arch, U1-central incisor, U2-lateral incisor, U3-canine, U4-1st premolar, U5- 2nd premolar, U6-1st molar.K-Kurdish, A-Arabs, M-male, F-Female, NS-not significant

Table (2): Comparison of mandibular tooth size between &within Arabs and Kurds.

tooth	Kurdish males mean(SD)	Kurdish females Mean(SD)	Arab males Mean(SD)	Arab females Mean (SD)	Comparison		
					groups	T-value	*P*-value
L1	5.54(0.36)	4.93(0.51)	5.37(0.39)	4.35(0.46)	KM.KF	4.388	0.001
					AM.AF	7.572	0.001
					KM.AM	1.434	NS
					KF.AF	6.649	0.001
L2	6.21(0.29)	5.84(0.32)	6.03(0.28)	5.47(0.31)	KM.KF	3.838	0.001
					AM.AF	6.002	0.001
					KM.AM	2.00	NS
					KF.AF	3.718	0.001
L3	7.35(0.25)	6.63(0.27)	7.18(0.51)	6.31(0.43)	KM.KF	8.759	0.001
					AM.AF	5.838	0.001
					KM.AM	1.347	NS
					KF.AF	2.821	0.01
L4	7.5(0.22)	6.88(0.32)	6.94(0.25)	6.29(0.46)	KM.KF	7.151	0.001
					AM.AF	5.560	0.001
					KM.AM	7.526	0.001
					KF.AF	4.712	0.001
L5	7.58(0.32)	6.95(0.37)	7.43(0.38)	6067(0.42)	KM.KF	5.921	0.001
					AM.AF	6.010	0.001
					KM.AM	1.387	NS
					KF.AF	2.240	0.05
L6	11.28(0.42)	10.75(0.38)	11.01(0.46)	10.39(0.37)	KM.KF	4.189	0.001
					AM.AF	4.700	0.001
					KM.AM	1.921	NS
					KF.AF	3.037	0.005

Measurements in mm, L-lower arch, L1-central incisor, L2-lateral incisor, L3-canine, L4-1st premolar, L5-2nd premolar, L6-1st molar.K-Kurdish, A-Arabs, M-male, F-Female, NS-not significant

The majority of maxillary teeth in Kurdish males and females showed significantly larger values than their Arabic counterpart. However, the upper anterior teeth didn't show significant differences between Arabic and Kurdish males and the second premolar didn't showed significant differences between Arabic and Kurdish females.

For all mandibular teeth and for both sexes, Kurds showed greater tooth size than Arabs. The difference between Arabic and Kurdish males failed to reach a significant level, with the exception of first premolar.

The difference between Arabic and Kurdish females was significant for all teeth.

In both Arabs and Kurds, males showed significantly greater tooth size than females for all mandibular teeth and most of the maxillary teeth. Maxillary arch dimensions for Arabs and Kurds are shown in (Table 3).

Table (3): Comparison of Maxillary dental arch dimensions between & within Arabs and Kurdish

Arch dimension	Kurdish males Mean(SD)	Kurdish females Mean(SD)	Arab males Mean(SD)	Arab females Mean (SD)	Comparison		
					groups	T-value	*P* value
Arch length	38.29(1.86)	35.26(1.94)	36.41(2.00)	34.94(2.21)	KM.KF AM.AF KM.AM KF.AF	2.121 2.207 3.080 0.487	0.05 0.05 0.005 NS
Arch perimeter	95.67(4.31)	93.21(4.60)	94.18(4.86)	92.06(4.42)	KM.KF AM.AF KM.AM KF.AF	1.746 1.445 1.026 0.807	NS NS NS NS
ICW	36.73(2.63)	33.56(2.45)	35.46(2.53)	33.26(2.39)	KM.KF AM.AF KM.AM KF.AF	3.948 2.828 1.558 0.395	0.001 0.01 NS NS
IPWI	43.84(2.67)	39.47(3.18)	41.36(3.30)	38.69(3.07)	KM.KF AM.AF KM.AM KF.AF	3.623 2.651 2.028 0.789	0.002 0.02 0.05 NS
IPWII	48.09(2.89)	45.45(3.05)	46.52(3.17)	44.18(3.47)	KM.KF AM.AF KM.AM KF.AF	2.812 2.228 1.637 1.230	0.01 0.05 NS NS
IMWI	54.36(3.26)	50.42(3.13)	52.21(2.89)	49.86(3.25)	KM.KF AM.AF KM.AM KF.AF	3.902 2.418 2.209 2.331	0.001 0.05 0.05 0.05
IMWII	49.17(3.6)	46.25(3.30)	47.36(3.18)	45.27(2.96)	KM.KF AM.AF KM.AM KF.AF	2.676 2.153 1.686 0.989	0.02 0.05 NS NS

Measurements in mm,K-Kurdish, A-Arabs, M-male, F-Female, NS-not significant, ICW-Intercanine width, IPWI-first Interpremolar width, IPWII-second Interpremolar width ,IMWI-mesiobuccal cusp Intermolar width ,IMWII-fossae Intermolar width

Arch perimeter showed no significant differences between Arabs and Kurds (in both sexes).The arch length was significantly greater in Kurdish males than Arabic males. No significant difference for arch length was noted between Arabic and Kurdish females. The arch width showed no significant differences between Kurds and Arabs at all levels, except at IMWI (for both sexes) and IPWI (for males). The maxillary arch width was greater in males as compared to females at all levels in both Arabs and Kurds. Mandibular arch dimensions are presented in (Table 4)

Table (4): Comparison of mandibular dental arch dimensions between & within Arabs and K -urds

Arch dimen-sion	Kurdish males mean(SD)	Kurdish females Mean(SD)	Arab males Mean(SD)	Arabfe-males Mean (SD)	Comparison		
					groups	T-value	*P*-value
Arch length	36.17(1.97)	34.62(2.43)	35.38(1.68)	33.78(2.37)	KM.KF	2.217	0.05
					AM.AF	2.465	0.02
					KM.AM	1.366	NS
					KF.AF	1.108	NS
Arch perime-ter	91.20(3.66)	89.36(2.95)	90/24(4.12)	88.22(3.15)	KM.KF	1.752	NS
					AM.AF	1.743	NS
					KM.AM	0.780	NS
					KF.AF	1.183	NS
ICW	26.75(2.00)	25.63(1.97)	26.13(2.41)	24.35(2.36)	KM.KF	1.945	NS
					AM.AF	2.361	0.05
					KM.AM	0.886	NS
					KF.AF	1.718	NS
IPWI	35.72(2.17)	34.30(2.53)	35.02(3.07)	33.65(3.18)	KM.KF	1.907	NS
					AM.AF	1.401	NS
					KM.AM	0.833	NS
					KF.AF	0.724	NS
IPWII	40.77(3.01)	39.30(3.46)	40.03(2.97)	38.36(3.17)	KM.KF	1.435	NS
					AM.AF	1.721	NS
					KM.AM	0.783	NS
					KF.AF	0.896	NS
IMWI	50.54(3.14)	46.92(2.88)	47.64(3.26)	45.63(3.13)	KM.KF	3.803	0.001
					AM.AF	1.994	NS
					KM.AM	2.868	0.01
					KF.AF	1.357	NS
IMWII	42.60(2.95)	41.18(3.16)	41.32(3.52)	40.35(2.92)	KM.KF	1.470	NS
					AM.AF	0.949	NS
					KM.AM	1.384	NS
					KF.AF	0.863	NS

Measurements in mm,K-Kurdish, A-Arabs, M-male, F-Female, NS-not significant, ICW-Intercanine width, IPWI-first Interpremolar width, IPWII-second Interpremolar width ,IMWI-mesiobuccal cusp Intermolar width ,IMWII-fossae Intermolar width

The arch length and perimeter showed no significant differences between Arabs and Kurds. The arch length was significantly greater in males than females in both Arabs and Kurds, while the arch perimeter showed no gender differences.

Mandibular arch width showed no significant differences between Arabs and Kurds (for both sexes) with the exception of IMWI which was significantly greater in Kurdish males than Arabic males. When comparing between males and females the arch width was greater in the former than the latter , but showed no significant differences, except IMWI which was significantly greater in Kurdish males than females and ICW which was significantly greater in Arabic males than females.

DISCUSSION

The age range of the subjects in the present study was between 14-18 years. Researchers, who studied growth changes in arch width, found little or no change occurred in the Intercanine and Intermolar widths after the age of 14 years.[16, 17] Arch length also roughly stabilizes by age 14 in most individuals with the eruption of permanent second molars. [18] Therefore, it was assumed that arch length and width of the subjects selected in the present study were stable.

Doris *et al* [2] indicated that early permanent dentition provides the best sample for tooth size measurements because early adulthood dentition has less mutilation and less attrition in most individuals. Consequently, the effect of these factors on the actual mesiodistal tooth width will be minimum.

The analyses of dental size and arch dimensions establish human biological characteristics, such as genetic relationship between populations and the adaptation of humans to their place of residence. It's well known that all men belong to a single species, but those inhabitating different parts of the world are not alike.

No previous study was performed to compare the teeth and dental arch dimensions between Iraqi Arabs and Kurds, the two main ethnic groups of the northern Iraqi community. The Kurds belong to Aryan ethnicity and completely differ from Arabs that belong to Sami origin.

The findings of the present study indicate that Iraqi Kurds had larger teeth and also greater arch dimensions as compared to their Arabic counterpart. The measurements that failed to reach a significant level in males are maxillary anterior teeth and all mandibular teeth(except lower first premolars), whereas in females only upper second premolars was not significant. Most of dental arch dimensions, although larger in Kurds than Arabs, but failed to reach a significant level.

The majority of our conclusions come in accordance to those of Koyoumdjisky-Kaye *et al.* [19] who compared teeth and dental arch dimensions between Jewish population of Kurdish and Yemenites descent. They measured the dental casts of 99 Kurdish and 98 Yemenite Jewish children, aged 12 years, for mesio-distal tooth dimensions, and arch depth and width. They found that dental dimension showed significant differences between the two groups in certain permanent teeth. The dental arch form in Kurdish children was more rounded due to significantly bigger arch width, while arch depth was not significantly different from Yemenites Jewish.

It has been suggested that tooth-size discrepancies differed between racial or ethnic Groups. Lavelle *et al* [20] studied tooth-size ratio on 120 subjects among them 40 were Caucasoid (British), 40 Negroid and 40 Mongloids. These three terms for these racial groups are originally anthropological and based on skull dimensions. They can be considered equivalent to the terms white, black and Far East. The tooth size was greater in Negroid than Caucasoid, those for Mongloids was intermediate.

As Kurdish males had appreciably larger mesiodistal crown dimension of maxillary posterior teeth than Arab males, so it's not surprising to find that the arch length, also is larger in Kurds. Although all lower teeth are larger in Kurdish females than Arabic ones, no significant difference of mandibular arch length was noted between them. This is probably because arch length is also influenced by alterations in arch width, rather than linked solely to tooth dimensions. [13]

All arch width measurements were smaller in Arabs, and the Kurds-Arabs difference is greatest in the first molar region measured between the mesiobuccal cusp tips of first permanent molars.

Several studies on the arch width in different racial groups with different occlusal categories reported racial difference in arch width measurements between British and Nigerian, [21] between Egyptian, Philippino, and Saudi, [22] and between black and white Americans. [23] Comparison between these studies is difficult due to differences in criteria of sample selection, method, and measuring devices.

The results between males and females in both ethnic groups differed with respect to the size of the teeth. Males showed larger

tooth dimensions than females. This finding comes in accordance to the findings of many previous studies;[24-26] however other studies showed no gender differences with respect to teeth [27-29] and dental arch dimensions. [30] It's interesting to note that maxillary arch dimensions were significantly greater in males than females in both ethnic groups, while for the majority mandibular dental arch dimensions no statistically significant differences were noted.

CONCLUSIONS

Kurdish males and females had larger tooth size and dental arch dimensions in comparison to their Arabic counterpart. However, most of differences in individual tooth size was not significant between Kurdish and Arabic males, Whereas the majority of individual tooth size differences were significant between Kurdish and Arabic females .

Mandibular dental arch dimensions ,although larger in Kurds than in Arabs, but didn't reached a significant level with the exception of IMWI which was significantly greater in Kurdish males than Arabic males.

For maxillary dental arch dimensions the measurements that were significantly greater in Kurdish males than Arabic males are: Arch length, IPWI, IMWI. Although all maxillary dental arch dimensions were greater in Kurdish females than Arabic ones, only IMWI reached a significant level. Hence, data for Arabs should not be considered normal for Kurds.

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