Cephalometric standard values of Iraqi Arab population, a cross sectional study

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ABSTRACT
Is to find the accurate stranded cephalometric norms among the most significant sample of Iraqi adult's population and to see the racial variability between the Iraqi population cephalometric normative values and their counterparts of Caucasians population. A cephalometric analytic studies of Iraqi adults for period confined between 1988 to 2017 was conducted—twenty-seven studies from ninety-two. Collected studies were met the inclusion criteria. The selected studies have involved the published master theses, all of them exhibit numerical data for both genders of the Iraqi Arab population who have class I skeletal pattern with normal occlusion. Selection of 35 parameters took place, included most used skeletaldental cephalometric measurements to be evaluated and compared. Statistical tests were applied to describe the means and SD, also to find out the statistical ethnic difference between the Iraqis Arab and Caucasians population. Study show standard norms of many cephalometric parameters exhibited a significant gender difference in Iraqi adults’ individuals, with higher linear hard tissue measurements in males, while non-significant gender differences appeared in facial soft tissue profile. On the other hands, most of the elected cephalometric parameters showed statistically significant differences between the Iraqi Arab and Caucasians compares. Generally, the Iraqis had smaller craniofacial dimensions, maxillary and mandibular skeletal retrusion, and more convex profile.

INTRODUCTION
Accurate diagnosis is needed by assessment of craniofacial morphology. History taking, clinical examination, and evaluation of study model, extra and intra-oral radiograph and photographs for the information for the orthodontic diagnosis and treatment plan basics, with the discovery of cephalometric. It had become possible to identify and analyze both vertical and anteroposterior relationship among the different areas of the craniofacial region. The cephalometric analysis helps in finding out the difference craniofacial anatomy, magnitude and direction change of growth, treatment efficacy, perception for underlying skeletal and dental con-
figuration for an individual which contribute to the existing malocclusion and treatment planning and outcomes assessment (Rickettes, 1957)

Numerous studies had been conducted by many researchers to find out cephalometric analyses which mainly considered hard tissues relationship (Tweed, 1953). These studies and reports had found allot of points, linear and angular measurements that were used in the analysis and exploration of the combination of dentofacial components. Other cephalometric benefits had invented, which was measuring the facial soft tissues, and analyzing the inter-relationship between the various soft tissues parts (Holdaway, 1983). Finally, the comprehensive cephalometric analysis became the skeletal, dental and soft tissue relationships (Scheidemann et al., 1980).

The difference between males and female’s standards, values of numerous Dentofacial cephalometric parameters had been explained in several studies (Bell et al., 1980). For this, genders specified standard values for many parameters had been planned.

Many authors explored a wide morphological disparity in the craniofacial features among the different races. These studies explain the ethnic variances in dimensions and angular measures within the craniofacial region (Gonzalez et al., 2013). For this reason, average values of different cephalometric analyses have been modified to result in several lists of standard norms, each one of them belonged to a distinct ethnic group, with common recommendations to adopt race specified cephalometric analysis (Wu et al., 2007).

The Arab population, as an ethnic group, have distinct skeletal, dental, and soft-tissue characters when compared to other world races, particularly the Caucasians (Hamdan and Rock, 2001). However, not all Arab populations represent an identical ethnic entity (Alshammery et al., 2016). A lot of studies had investigated the craniofacial dimensions and morphology of the Iraqi Arab population. Still, only a few reviews, including a specific cephalometric analysis, had compared the Iraqi people with the other of European and American ancestry (Al-Khawaja et al., 2015).

Most of the cephalometric analysis of an orthodontic patient is generally done depending on the available Caucasian standards, which could be lead to inaccurate or unsatisfactory results regarding diagnosis and treatment planning if they use in population belonged to a different ethnical group, including the Iraqis population. For this, a necessary demand needs to find standard values more specific to adult Iraqi population patients. Based on this, this analysis study aimed to found the exacted stranded cephalometric mean values norms among a most significant sample of Iraqi adult’s population, including both genders and to find the racial variability between the Iraqi population cephalometric normative values and their counterparts of Caucasians population.

MATERIALS AND METHODS

In this study, related to cephalometric norms had done on Arad Iraqi population regarding period confined between 1988 to 2017 to research the skeletal, dental and soft tissues cephalometric patterns in Iraqi Arab population was collected to compose the database of this analytical study. This studies involved (92) master theses or research articles submitted to the orthodontic department in the college of dentistry of Baghdad University, most of them were the published articles in different Iraqi journals. From this thesis (27) hard tissue with (8) soft tissue measurements were elected so that they would offer a comprehensive cephalograms interpretation studies were chosen in this study. The selected research studies were met with specific criteria

1. Lateral cephalometric research.
2. The sample includes Iraqi adults, Arab in origin, aged (18-33 years old).
3. Skeletal Class I jaws relationship with natural, normal occlusion.
4. Clinically symmetrical faces with no history of orthodontic, orthopaedic treatment and maxillofacial surgery.
5. Study shows cephalometric norms of hard and soft tissues, both males and females.

Hard and soft tissue cephalometric norms help in diagnosis and treatment planning in orthodontics were chosen. The chosen cephalometric hard tissue measurements in this study describe the dimensions of the cranial base, maxilla, mandible; anteroposterior jaw’s relationships, facial heights, dental relationship; and growth axis. On the other hands, the soft tissues cephalometric variables revealed several commonly used angular and dimensions of the facial soft tissue envelope. All the selected angular and linear Skeletodental measurements are shown in figures (1,2) and soft tissue measurements are shown in Figure 3.
Table 1: Descriptive statistics and Gender difference between Iraqi Arab adults male and female

| Craniofacial area | Measurement | Total | Males | Females | P value | Sig. |
|-------------------|-------------|-------|-------|---------|---------|------|
| Cranial base      |             |       |       |         |         |      |
| S-N               | 72.03       | 74.52 | 3.37  | 69.53   | .008    | S    |
| S-Ar              | 34.79       | 36.94 | 3.75  | 32.63   | .000    | S    |
| S-Ba              | 44.89       | 46.31 | 3.71  | 43.46   | .034    | S    |
| N-Ba              | 102.54      | 106.05| 4.15  | 99.04   | .001    | S    |
| N.S.Ba            | 128.24      | 127.76| 4.85  | 128.72  | .293    | NS   |
| N.S.Ar            | 123.78      | 123.1 | 5.33  | 124.46  | .020    | S    |
| Maxilla           |             |       |       |         |         |      |
| SNA               | 82.23       | 82.74 | 3.25  | 81.71   | .028    | S    |
| ANS-PNS           | 52.81       | 55.03 | 3.13  | 50.59   | .000    | S    |
| PP/SN             | 8.63        | 7.89  | 2.9   | 9.36    | .000    | S    |
| Mandible          |             |       |       |         |         |      |
| SNB               | 79.06       | 79.65 | 3.06  | 78.47   | .004    | S    |
| Ar-Go             | 49.48       | 52.21 | 4.57  | 46.76   | .000    | S    |
| Go-Me             | 74.02       | 76.49 | 4.83  | 71.54   | .004    | S    |
| Ar.Go.Me          | 124.63      | 124.36| 5.59  | 124.89  | .754    | NS   |
| Intermaxillary    |             |       |       |         |         |      |
| ANB               | 2.73        | 2.69  | 1     | 2.76    | .643    | NS   |
| MP/PP             | 24.78       | 24.56 | 5.44  | 24.99   | .693    | NS   |
| Facial height     |             |       |       |         |         |      |
| N-ANS             | 52.98       | 54.71 | 3.36  | 51.25   | .002    | S    |
| ANS-Me            | 68.54       | 71.29 | 4.98  | 65.79   | .003    | S    |
| N-Me              | 122.47      | 126.55| 6.63  | 118.39  | .001    | S    |
| S-Go              | 81.1        | 85.37 | 5.96  | 76.83   | .000    | S    |
| PFH/AFH           | 65.73       | 66.88 | 3.96  | 64.59   | .287    | NS   |
| Growth axis       |             |       |       |         |         |      |
| N.S.Gn            | 68.58       | 68.07 | 3.85  | 69.1    | .223    | NS   |
| Dentition         |             |       |       |         |         |      |
| UI/PP             | 112.68      | 112.0 | 5.03  | 112.67  | .976    | NS   |
| LI/MP             | 93.69       | 93.8  | 5.28  | 93.56   | .846    | NS   |
| UI/LI             | 128.96      | 129.4 | 7.99  | 128.52  | .738    | NS   |
| LI/A-Pog          | 3.8         | 4     | 1.35  | 3.6     | .354    | NS   |
| Soft tissues      |             |       |       |         |         |      |
| Nasolabial angle  | 103.31      | 100.96| 10.1  | 105.65  | .050    | S    |
| Mentolabial angle| 124.61      | 122.06| 11.03 | 127.16  | .384    | NS   |
| G-Sn-Pog          | 14.39       | 13.39 | 4.66  | 15.38   | .326    | NS   |
| Z-angle           | 75.98       | 74.98 | 4.71  | 76.99   | .364    | NS   |
| Sn-Sto            | 20.81       | 21.43 | 2.29  | 20.19   | .137    | NS   |
| Sto-sm            | 18.91       | 19.55 | 2.64  | 18.27   | .249    | NS   |
| U-lip thickness   | 13.01       | 14.21 | 1.73  | 11.8    | .000    | S    |
| L-lip thickness   | 13.61       | 14.82 | 1.26  | 12.4    | .000    | S    |
### Table 2: Descriptive statistics and Ethnic difference between Iraqi Arab females and Caucasian females

| Parameter          | Iraqi Arab Females | Caucasian Females | P value | Sig. |
|--------------------|--------------------|-------------------|---------|------|
| **Craniofacial area** |                    |                   |         |      |
| Cranial base       |                    |                   |         |      |
| S-N                | 69.53              | 3.3               | 71.93(8)| 3.65 | .068 | NS  |
| S-Ar               | 32.63              | 3.14              | 33.51(8)| 3.22 | .001 | S   |
| S-Ba               | 43.46              | 2.28              | 45.56(8)| 3    | .050 | S   |
| N-Ba               | 99.04              | 3.84              | 109(8)  | 5.2  | .007 | S   |
| N.S.Ba             | 128.72             | 5.15              | 129.3(8)| 4.84 | .570 | NS  |
| N.S.Ar             | 124.47             | 5.12              | 124.5(8)| 5.03 | .933 | NS  |
| Maxilla            |                    |                   |         |      |
| SNA                | 81.71              | 2.95              | 82.56(8)| 2.8  | .010 | S   |
| ANS-PNS            | 50.59              | 2.62              | 53.1(44)| 2.9  | .001 | S   |
| PP/SN              | 9.36               | 2.83              | 7.62(8) | 3.27 | .000 | S   |
| Mandible           |                    |                   |         |      |
| SNB                | 78.47              | 2.8               | 80.03(8)| 2.83 | .000 | S   |
| Ar-Go              | 46.76              | 4.2               | 50.5(8) | 4.49 | .000 | S   |
| Go-Me              | 71.54              | 4.56              | 76.7(44)| 3.8  | .000 | S   |
| Ar.Go.Me           | 124.89             | 5.79              | 126.5(44)| 5    | .237 | NS  |
| MP-SN              | 34.49              | 5.61              | 30.68(8)| 4.87 | .000 | S   |
| S.N.Pog            | 78.73              | 3.38              | 81.15(8)| 2.79 | .001 | S   |
| Intermaxillary     |                    |                   |         |      |
| MP/PP              | 24.99              | 5.14              | 23.06(8)| 4.58 | .042 | S   |
| ANB                | 2.66               | 1                 | 2.52(8) | 1.41 | .050 | S   |
| Facial height      |                    |                   |         |      |
| N-ANS              | 51.25              | 2.9               | 53.1(8) | 2.57 | .014 | S   |
| ANS-Me             | 65.79              | 4.52              | 66.88(8)| 4.16 | .380 | NS  |
| N-Me               | 118.39             | 6.01              | 118.72(8)| 4.82 | .852 | NS  |
| S-Go               | 76.83              | 5.26              | 80.2(8) | 5.62 | .003 | S   |
| PFH/AFH            | 64.27              | 3.87              | 67(8)   | 4    | .108 | NS  |
| Growth Axis        |                    |                   |         |      |
| N.S.Gn             | 69.1               | 3.74              | 65.2(8) | 2.9  | .000 | S   |
| Dentition          |                    |                   |         |      |
| UI/PP              | 112.66             | 4.94              | 108.7(44)| 5.3  | .002 | S   |
| LI/MP              | 93.57              | 5.22              | 95.6(44)| 6.7  | .067 | NS  |
| UI/LI              | 128.52             | 8.61              | 132.9(44)| 8.4  | .043 | S   |
| LI/A-Pog           | 3.6                | 1.17              | 1.79(8) | 1.68 | .027 | S   |
| Soft tissues       |                    |                   |         |      |
| Nasolabial angle   | 105.65             | 9.39              | 111.9(44)| 8.4  | .013 | S   |
| Mentolabial angle  | 127.16             | 11.29             | 127.9(44)| 12.3 | .852 | NS  |
| G-Sn-Pog           | 15.38              | 4.34              | 11(44)  | 4.8  | .033 | S   |
| Z-angle            | 76.99              | 5.44              | 71.3(45)| 7.7  | .009 | S   |
| Sn-Sto             | 20.19              | 2.14              | 22.4(44)| 1.6  | .025 | S   |
| Sto-sm             | 18.27              | 2.38              | 18.9(44)| 2.1  | .568 | NS  |
| U-lip thickness    | 11.8               | 1.41              | 12.6(46)| 1.8  | .025 | S   |
| L-lip thickness    | 12.4               | 1.02              | 13.6(46)| 1.4  | .001 | S   |
Table 3: Descriptive statistics and Ethnic difference between Iraqi Arab males and Caucasian Males

| Craniofacial Parameter area | Iraqi Arab Males Mean | SD | Caucasian Males Mean | SD | P value | Sig. |
|-----------------------------|-----------------------|----|----------------------|----|---------|------|
| Cranial base                |                       |    |                      |    |         |      |
| S-N                         | 74.52                 | 3.43| 78.12(8)             | 3.65| .012    | S    |
| S-Ar                        | 36.93                 | 4.36| 37.71(8)             | 3.76| .073    | NS   |
| S-Ba                        | 46.31                 | 3.13| 49.77(8)             | 3.79| .043    | S    |
| N-Ba                        | 106.05                | 4.46| 114.5(8)             | 4.2 | .001    | S    |
| N.S.Ba                      | 127.76                | 4.55| 126.19(8)            | 4.92| .156    | NS   |
| N.S.Ar                      | 123.09                | 5.04| 122.58(8)            | 4.66| .204    | NS   |
| Maxilla                     |                       |    |                      |    |         |      |
| SNA                         | 82.74                 | 3.55| 83.81(8)             | 3.21| .012    | S    |
| ANS-PNS                     | 55.03                 | 3.99| 56.4(44)             | 2.7 | .013    | S    |
| PP/SN                       | 7.89                  | 2.96| 6.61(8)              | 2.99| .002    | S    |
| Mandible                    |                       |    |                      |    |         |      |
| SNB                         | 79.46                 | 3.31| 81.64(8)             | 2.7 | .000    | S    |
| Ar-Go                       | 52.21                 | 4.93| 57.58(8)             | 3.99| .000    | S    |
| Go-Me                       | 76.49                 | 5.1 | 80.3(46)             | 3.5 | .004    | S    |
| Ar.Go.Me                    | 124.36                | 5.38| 124.9(44)            | 5.2 | .610    | NS   |
| MP-SN                       | 32.07                 | 5.89| 28.54(8)             | 4.76| .000    | S    |
| S.N.Pog                     | 80.46                 | 4   | 82.83(8)             | 2.78| .005    | S    |
| Intermaxilla                |                       |    |                      |    |         |      |
| ANB                         | 2.69                  | 1   | 2.23(8)              | 1.75| .008    | S    |
| MP/PP                       | 25.56                 | 5.73| 21.93(8)             | 4.89| .006    | S    |
| Facial height               |                       |    |                      |    |         |      |
| N-ANS                       | 54.71                 | 3.81| 57.98(8)             | 3.47| .001    | S    |
| ANS-Me                      | 71.29                 | 5.43| 74.54(8)             | 5.41| .016    | S    |
| N-Me                        | 126.55                | 7.24| 130.98(8)            | 6.46| .009    | S    |
| S-Go                        | 85.37                 | 6.65| 91.28(8)             | 6.19| .000    | S    |
| Growth Axis                |                       |    |                      |    |         |      |
| N.S.Gn                      | 68.07                 | 3.97| 64.4(8)              | 3.3 | .001    | S    |
| Dentition                   |                       |    |                      |    |         |      |
| UI/PP                       | 112.7                 | 5.12| 110.8(44)            | 5.3 | .047    | S    |
| LI/MP                       | 93.8                  | 5.34| 94.3(44)             | 6   | .513    | NS   |
| UI/LI                       | 129.4                 | 7.37| 135.1(44)            | 8.3 | .006    | S    |
| LI/A-Pog                    | 4                     | 1.52| 1.32(8)              | 2.29| .008    | S    |
| Soft tissues                |                       |    |                      |    |         |      |
| Nasolabial angle            | 100.96                | 10.78| 111.4(44)            | 11.7| .000    | S    |
| Mentolabial angle          | 122.06                | 10.77| 122(44)              | 10.1| .989    | NS   |
| G-Sn-Pog                   | 13.39                 | 4.97| 10.8(44)             | 4.2 | .041    | S    |
| Z-angle                     | 74.98                 | 3.98| 75.5(45)             | 8.3 | .792    | NS   |
| Sn-Sto                     | 21.43                 | 2.44| 23.9(44)             | 2.5 | .004    | S    |
| Sto-sm                     | 19.55                 | 2.9 | 19.3(44)             | 2.6 | .370    | NS   |
| U-lip thickness            | 14.21                 | 2.04| 14.8(46)             | 1.4 | .105    | NS   |
| L-lip thickness            | 14.82                 | 1.5 | 15.1(46)             | 1.2 | .298    | NS   |
From Figure 1: (1) N.S.Ar; (2) NS.Ba; (3) NS.Gn; (4) SNA; (5) SNB; (6) S.N.Pog; (7) PP/SN; (8) MP/PP; (9) Ar.Go.Me; (10) UI/PP; (11) UI/LI; (12) LI/MP; Figure 2: (1) distance from N to S; (2) distance from S to Ar; (3) distance from S to Ba; (4) distance from N to B; (5) maxillary length distance from ANS to PNS; (6) ramus height, distance from Ar to Go; (7) mandibular body length, distance from Go to Me; (8) upper anterior facial height, distance from N to ANS; (9) lower anterior facial height, distance from ANS to Me; (10) total anterior facial height, distance from N to Me; (11) posterior facial height, distance from S to Go; also in Figure 3 as shown details: (1) nasolabial angle; (2) Mentolabial angle; (3) Z-angle; (4) upper lip length; (5) lower lip length; (6) upper lip thickness; (7) lower lip thickness.

The data were analyzed using the SPSS program version 21.0. Shapiro-Wilk test is used to detect the normal distribution of data. All the measurements showed the normality; therefore, parametric statistical analyses were used. Means and standard deviation of all the measurements were extracted. Independent t-test was applied to check out any significant difference between Iraqi population males and females. A one-sample t-test was utilized to assess the racial differences at P=0.05 significance level between the Caucasian and Iraqi population.

RESULTS

The results were arranged simply in three tables. Table 1 shows the descriptive statistics (mean, standard deviation) and gender difference for all
the selected cephalometric craniofacial variables in Iraqi Arab adult individuals population. Results found a significant difference in the shape and dimensions of the cranial base in the Iraqi adult gender. Yet, likewise, maxilla appears more prognathic and has a larger dimension in males than females. Females show a retrusive mandible when evaluated by SNB angle, and lesser ramus and corpus dimensions than males. Sexual dimorphism was also apparent in facial heights so that the anterior and posterior heights were significantly greater in males. In regarding the soft tissues, fewer differences were present between comparisons, lesser nasolabial angle with more exceptional lip thickness was shown in males. No gender difference was present in Iraqi adult individuals in dentoalveolar relationships and growth axis.

Table 2 show the ethnic difference between adult Iraqi females and Caucasian females. Generally, there was no ethnic difference in cranial base shape, but, the Iraqi females exhibited smaller dimensions of the cranial base than Caucasians. Even though the Iraqi females had slightly retrusive maxilla and mandible positions when compared with Caucasian females, they still have a more convex profile because of larger ANB value. The jaws dimensions appeared smaller, with a significantly steeper mandibular plane in Iraqi females. Relatively, the upper anterior facial height and posterior facial height had substantially higher values in Caucasian females. Iraqi females showed more downward facial growth axis than Caucasians females. The dentoalveolar segment in Iraqi females had specific characteristics such as proclined upper incisors, retroclined and protruded lower incisors when compared to Caucasians. Seemingly, soft tissues, facial envelop exhibited many ethnic differences between the comparisons, so that in Iraqi females, nasolabial angle appeared smaller, facial convexity and Z- the angle was larger, besides the upper lip was shorter. The lip thickness was lesser in Iraqi than Caucasian females.

Table 3 demonstrates the comparison of Iraqi males with Caucasian males. Like the Iraqi females, the cranial base shape showed a non-significant ethnic difference, while the dimensions appeared smaller in Iraqi males. Significant ethnic differences in anteroposterior skeletal jaws pattern with a mean value of SNA 82.740, SNB 79.460 which were lesser in Iraqi males. Both ANB with 2.230 mean and S-N-Pog with 82.830 mean demonstrated a straighter skeletal profile in Caucasian males when compared to Iraqi males. The hyper-divergent facial pattern was significantly apparent in Iraqi males by greater MP-SN and MP-PP angles. On the other hands, more downward backward facial growth axis was shown in Iraqi males. Lower incisors appeared in more protrusive position in Iraqi males when compared to Caucasians. Soft tissue parameters demonstrated that the Iraqi males had a less obtuse nasolabial angle, with more soft tissue convexity and shorter upper lip than Caucasians.

DISCUSSION

The feminine and masculine characteristics are highly evident in soft tissues and hard tissues of the craniofacial region. This could be noted in the presence of difference in the mean values of many cephalometric parameters between males and females (Scheideman et al., 1980). For this, gender is considered as one of the factors which have a considerable impact on facial hard and soft tissue characteristics of an individual. Depending on this, and several cephalometric studies have gone on to describe gender specified means values to be depended in cephalometric assessment (Arnett et al., 1999). The finding results in this study support this concept, so, statistically, significant differences in much of cephalometric parameters were found between Iraqi males and females. The dimensions of the cranial base, maxilla, mandible, vertical facial heights show a significant difference between the genders, with larger means values in Iraqi males than females. These results come parallel to that found in other studies for the Iraqi population (Al-Mashhadany and Nmj, 2012) and other ethnic population (Aurizanti et al., 2017). All these studies agreed on one concept that regardless of the race, males have more significant dimensions of the craniofacial region than females statistically. This can be attributed to the later maturity which let for a more extended growth period in males, allowing more growth, and in turn, larger craniofacial dimensions have attained (Proffit et al., 2013).

The cranial base shape, represented by saddle angle, is significantly affected by gender, as it is more obtuse in females than male, which goes with other study findings (Yassir and Yassir, 2009). The configuration of the cranial base has an impact of facial prognathism in individuals with normal occlusion so that the inversely proportional relationship was noted between them (Järvinen, 1982). This could be explaining why the Iraqi males have more SNA than females statistically. Otherwise, the backward position of females’ mandible, so they have less SNB, S. N., the Pog angles, could be attributed to possession of the females a significantly higher saddle angle.

Posterior jaw rotation is predominant in Iraqi females, represented by a significant increase in the
maxillary and mandibular plane angles. This could be related to that the females have a reduced posterior facial height relative to the anterior (explained in less PFH/AFH ratio in females compared to males).

Iraqi males show more obtuse nasolabial angle than females. Gender difference in upper lip thickness can be blamed for this, males have the thicker upper lip, which accounts for their possession of less nasolabial angle value. Despite the difference was not significant; the Iraqi females showed a more convex facial profile when compared to males. Similar findings were reported for Iraqis population (Al-Khawaja et al., 2015), and Saudis population (Hashim and Albarakati, 2003).

Regarding the ethnic and racial characteristics, the Caucasians population have a distinctive craniofacial region, differ in many cephalometric parameters from the individuals who belong to other ethnic groups. Many studies have revealed this conclusion, Chinese, Mexican, Japanese and Indian populations (Gu et al., 2011; Gonzalez et al., 2013; Miyajima et al., 1996; Nanda and Nanda, 1969), they showed a difference either in relationship or morphology of one or more of functional units of the craniofacial region from that of Caucasians population. Jordanian and Saudis Arabic populations (Hamdan and Rock, 2001), showed a distinctive means value of several cephalometric parameters from the Caucasians population. In corresponding with above-mentioned previous studies, the results of this study explain that the Iraqi Arab population cephalometric norms differ significantly from that of Caucasians population. Such a broad comparison of the present study, involve many hard and soft tissue cephalometric parameters of Iraqi Arab adults, including both genders, to the corresponding Caucasians’ values were not done before.

In this study, Iraqi Arab population individuals appear to have significantly retrognathic maxilla in both genders, as compared to Caucasians counterparts. This disagrees the findings of other studies done on the Arabic population (Hamdan and Rock, 2001) which found a similar maxillary skeletal relationship to the Caucasians population. Moreover, the maxilla, in Iraqi individuals, appears smaller in the anteroposterior dimension as compared to Caucasians individuals.

Iraqi adult’s population Cephalometric norms of mandibular skeletal pattern, assessed by the SNB, have less mean value reflecting the retrognathic mandible position in Iraqi adults. Furthermore, both Remus and corpus have smaller sizes than Caucasians. Also, this study found that the Iraqis have a less prominent chin.

The significantly larger values of MP-SN, PP-SN, MP-PP angles indicate the clockwise jaws growth pattern in the Iraqi adults. Downward backward growth axis in addition to significantly lesser posterior facial height, which characterizes the Iraqis population. The facial profile of Iraqi adult individuals tends to be more convex than in Caucasians. It seems that the straight facial profile can be considered as a characterized trait for Caucasians, which looks obvious when they compared to other ethnic groups like, Chinese, Korean, Japanese, Iranian and Saudis population (Gu et al., 2011).

The inter-racial differences were apparent in the dentition. The lower incisors in Iraqis were significantly forward-positioned relative to A-Pog line than those of Caucasians. The same finding was reported in another study for Iraqis Nahidh (2010). This study also revealed that the inter-incisal angle is significantly reduced in Iraqi adults. This difference could be attributed to a significant increase of upper incisors or forwards inclination which seen in Iraqis when compared to that in Caucasians population.

The presence of considerable ethnic differences in hard tissue cephalometric parameters, the soft tissue parameters also exhibit the Iraqi-Caucasians ethnic disparities. The Iraqi ethnic group in this study showed specific features of soft tissues envelop differ significantly, particularly the females, from their counterparts of Caucasians. There is no doubt that the soft tissues closely related to underlying hard tissues. The findings of soft tissue analysis studies support the influence of upper incisor position on the nasolabial magnitude, and the change in the location of upper incisors go along with a shift in upper lip profile (Muslim and Kadhim, 2016). Iraqi population, males and females, have significantly less obtuse nasolabial angle, this could be attributed to possession of Iraqi a higher UI-PP angle. This finding was similar to that in Yemeni and Saudis Arab population Albarakati (2011), the current study reveals that Iraqis Arab population show an increased soft tissue convexity in comparison to Caucasians population.

The Z - angle is greatly influenced by lower face soft tissue thicknesses Merrifield (1966). Upper and lower lip show significant lesser thicknesses in Iraqi females compared to Caucasians females, which could lead to the variance in Z-angle values between two ethnic groups. This difference is not considerably appeared between Iraqi and Caucasian males, as the lips thicknesses showed nonsignificant ethnic variation. Furthermore, the Iraqi
individuals appear to have shorter upper lip as compared to Caucasians, which come in agreement with other Iraqi soft tissues study has found fewer norms than arnet standards (Kadhom and Mf, 2011).

CONCLUSIONS

This extensive analytic study, which involved much of Iraqi cephalometric studies

Demonstrated evident sexual dimorphism in many cephalometric parameters in the Iraqi Arab population. Clarified the considerable ethnic differences in much settings of cephalograms between widely used Caucasian norms and those of Iraqis. The current study establishes reliable standards to a large extent for many cephalometric parameters of the Iraqi Arab adult population. Thus, these standards could be applied, instead of Caucasians, in the evaluation of cephalograms and putting the objectives of treatment, for all individuals belong to Iraqi Arab race, who seek for orthodontic treatment or need an orthognathic surgery.

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Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Declaration of patient consent

Consent had obtained from librarian office (Baghdad university/college of dentistry) for using thesis in this study.

Conflict of interest

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