

## Hard tissue Cephalometric Norms in Iranian adolescents

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### Abstract

**Aim:** Accurate information about the normal dentofacial pattern of the patients' ethnic group is of critical importance for diagnosis and treatment planning. The aim of this study was to determine hard tissue cephalometric norms for Iranian adolescents.

**Materials and Methods:** Cephalometric radiographs of 60 Iranian adolescents (38 girls and 22 boys) were analyzed regarding 4 common cephalometric analyses. Mean values and standard deviations were compared with those of original analyses.

**Results:** Average Iranian adolescents revealed more protrusive maxillary and mandibular incisors, flatter mandibular plane with a tendency to deep bite and more acute gonial angle. SNA and SNB were less in Iranian sample. In addition, posterior to anterior facial height ratio was higher in Iranians.

**Conclusion:** Some hard tissue cephalometric norms are specific for racial groups. More protrusive incisors in Iranians might indicate more possibility of non-extraction treatment planning for this population.

It is well-known that lateral cephalometric analysis is still an important diagnostic record for orthodontic patients. However, the key point is that cephalometric measurements of each patient should be compared with normal values which belong to identical age, gender and ethnic group. Therefore, it is important to determine the normal cephalometric values of each ethnic group.<sup>1-4</sup>

Unfortunately, most of published normal cephalometric values belong to European or American whites and therefore may not be appropriate for patients of different ethnic groups.<sup>5-13</sup> Therefore, several investigations have been performed to establish cephalometric norms for special ethnic groups.<sup>4, 14-20</sup>

Although hard tissue cephalometric norms for Iranians have been evaluated in some studies previously, most of these researches were performed on children and have evaluated limited cephalometric analyses.<sup>21-22</sup> The purpose of this study was to determine the normal hard tissue cephalometric values for Iranian adolescents and compare differences between normal values for girls and boys using several analyses.

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### Materials and Methods

180 Iranian adolescents (14-18 years old) were selected from a group of 8000 Iranian students. At first students were asked to select the most beautiful faces from their classmates. Then intraoral and extra oral examinations were performed for the selected students. They entered the study by meeting following criteria: proportionate and symmetric face, conventional convexity of face, normal occlusion, no signs or symptoms of TMD and no previous orthodontic treatment.

Lateral cephalograms were taken from 90 of the sample who tended to enter the study. 30 samples ruled out because of problems in quality of cephalograms or impossibility in accurate determination of some cephalometric landmarks. Finally 60 cephalograms (from 38 girls and 22 boys) were traced by hand on 0.003 matte acetate sheets using negatoscope in standard situation. Tracing measurements were performed for 4 common cephalometric analyses (Downs, Steiner, Bjork, and Tweed). Tracings were reviewed by another investigator to make sure about accuracy landmark determination. Mean, SD, range and mode were determined for total sample, males, and females. T-test was used for comparison of mean Iranian values with original values and evaluation of sexual dimorphism.  $P \leq 0.05$  was considered as statistically significant.

### Results

#### Steiner analysis:

Iranian adolescents revealed more protrusive incisors in both jaws than the American samples. SNA and SNB angles were less in Iranians.

#### Bjork analysis:

Iranian adolescents revealed less sum of posterior angles which was the result of a more acute gonial angles in comparison to American group. In addition, Iranians have longer posterior and anterior cranial bases, rami and mandibular bodies. Posterior to anterior facial height ratio seems to be more in Iranians

#### Tweed analysis:

Flatter mandibular plan angle and more protrusive mandibular incisors were found in Iranians.

#### Downs analysis:

Higher value of facial angle in Iranians indicated chin protrusion in them. Significant gender difference were noted in some skeletal measurements as boys had significantly larger anterior and posterior cranial bases and longer lower anterior and posterior facial heights. No significant difference in dental and dentoalveolar measurements was found between boys and girls.

Normal hard tissue cephalometric values for Iranian adolescents and in detail comparison of these values with original values are presented in Tables 1-4.

Table 1. Comparison of Steiner's original norms with Iranian norms.

STEINER ANALYSIS	Steiner Study		This Study N=60			
	Mean	SD	Mean	SD	t	P value
SNA						
SNB	82	-	80.6	3.5	-0.9	0.004
ANB	80	-	78.2	3.2	-4.1	0
I TO NA (MM)	2	-	2.4	1.5	1.8	0.07
$\bar{I}$ TO NA	4	-	5.9	2.2	6.6	0
$\bar{I}$ TO NB (MM)	22	-	23.3	6.2	1.6	0.09
$\bar{I}$ TO NB	4	-	5.7	2.3	5.6	0
OCCL TO SN	25	-	26.2	5.9	1.5	0.1
GOGN TO SN	14	-	17	4	5.8	0
$\bar{I}$ TO I	32	-	31.2	5.2	-1.1	0.2
	131	-	130.1	10.2	-0.6	0.5

Table 2. Comparison of Down's original norms with Iranian norms.

DOWNS ANALYSIS	Downs N=20	Study	Iranians N=60		t	P value	Iranian Female N=38		Iranian male N=22	
	Mean	SD	Mean	SD			Mean	SD	Mean	SD
FACIAL ANGLE	87.8	3.6	90.1	2.5	7	0	90.2	2.8	89.9	1.8
ANGLE OF CONVEXITY	0	5.1	2.5	4.3	4.5	0	2.7	4.3	2.3	4.6
A-B PLANE ANGLE	-4.6	3.7	-4.5	3	0.2	0.8	-4.5	3.4	-4.3	2.3
MPA	21.9	3.2	21.1	4.7	-1.2	0.2	20.6	4.9	22	4.2
Y AXIS	59.4	3.8	57.6	2.9	-4.6	0	57.1	3.1	58.3	2.6
CANT OF OCCLUSAL	9.3	3.8	7.2	3.2	-4.9	0	7.4	3.5	6.8	2.7
$\bar{I}$ TO $\bar{1}$	135.4	5.8	130.1	10.2	-3.9	0	130.6	11.9	129.2	6.7
$\bar{I}$ TO MP	91.4	1.4	96.6	6.2	7.5	0	96.9	7	96.1	4.7
$\bar{I}$ TO OCC.PLANE	14.8	3.5	20.5	6	7.6	0	20	6.3	21.3	5.6
$\bar{1}$ TO A-P PLANE (MM)	2.7	1.8	6.3	2.3	11.8	0	6.1	2.5	6.6	2.1

Table 3. Comparison of Tweed's original norms with Iranian norms.

TWEED ANALYSIS	Tweed Study N=150		Iranians N=60				Iranian Female N=38			Iranian Male N=22		
	Mean	SD	Mean	SD	t	P value		Mean	SD		Mean	SD
FMIA	68.2	-	62.8	6.6	-6.3	0	62.9	7.2		62.5	5.6	
FMA	24.6	-	21.1	4.7	-5.6	0	20.6	4.9		22	4.2	
IMPA	86.9	-	96.6	6.2	12	0	96.9	7		96.1	4.7	

boys). The reason of selecting this age spectrum

**Table 4. Comparison of Bjork's original norms with Iranian norms**

Bjork ANALYSIS	Bjork Study N=150		Iranians N=60				Iranian females N=38		Iranian males N=22	
	Mean	SD	Mean	SD	t	P value	Mean	SD	Mean	SD
SADDLE ANGLE										
ARTICULAR A.										
GONIAL A.						0				
SUM	123	5	125.3	4.1	4.4		125.5	3.3	125	5.3
U. GONIAL A.	143	6	145.2	5	3.4	0.001	145.5	5.3	144.8	4.6
L. GONIAL A.	130	7	119.9	6.4	-12.1		119	6.2	121.4	6.7
ANT.CRANIAL BASE	396	-	390.7	5.5	-7.4	0	390.1	5.4	391	5.6
L.	53.5	1.5	48.8	3.3	-11.8	0	48.6	3.3	49.2	2.9
POST.CRANIAL BASE	72.5	2.5	71	4.7	-2.3	0	70.3	4.6	72.1	4.9
L.	71	3	76.7	3.5	12.4	0.0	75.5	3	78.8	3.5
RAMOUS HEIGHT	32	3	37.4	3.7	11.2	0	36.3	3.5	39.4	3.4
BODY LENGTE	44	5	54.1	5	15.3	0	53.4	5	55.2	5
MAND.BODY TO ANT	71	5	78	4.9	11	0	77.4	4.1	79	5.9
.	100	-	101.8	7.1	1.9	0	102.5	5.7	100.5	9.1
CRANIAL BASE						0.05				
RATIO	-	-	129	6.4	-		126.6	4.8	133.3	6.5
ANT . FACIAL	-	-	87.6	5.9	-	-	86.1	5.2	90.1	6.3
HEIGHT	63.5	1.5	67.7	4.9	6.5	-	67.7	5.1	67.6	4.7
POST.FACIAL H.	5	2	7	3.2	4.7	0	6.7	3.3	7.3	3.1
POST .-ANT FACE						0				
RATIO										
1 TO FACIAL										
PLANE(MM)										

Table 4. Comparison of Bjork's original norms with Iranian norms.

### Discussion

The samples of this study were indeed selected from 8000 14 to 18 year old students. This large population size possibly has directed us to a really normal sample. The mean age of total sample was 16 yr and 3 months (16yr and 7 months for girls and 15yr and 3 months for

- 1-The majority of orthodontic patients meet this age range this age is after spurt for most girls?
- 2- Growth spurt in lower ages makes the values of those age ranges somewhat unstable and unreliable for treatment planning
- 3- Second molars are erupted and can include treatment

#### 4- Lack of cephalometric norms for Iranian adolescents

Our data for SNA, SNB and ANB in Steiner analysis were close to values of Hajighadimi 22 for Iranian children. In addition, normal upper and lower incisor values in all three studies revealed more protruded incisors in Iranian samples than American whites.

In Bjork analysis, anterior cranial base length, AFH and PFH were significantly larger in boys. However; Jarabak index was similar in both sexes which is because of coordinated increase in anterior and posterior facial heights. Gonial angle and sum of posterior angles of our samples were significantly lower than Bjork's norms. Since saddle and articular angles of both studies are similar, this reduction in sum of angles is caused by more acute gonial angles. This difference might be arisen from ethnical differences or age differences between two groups.

Hajighadidmi et al investigated 67 Iranian children based on tweed analysis and resulted values of 28.3° FMA, 56.3° FMIA, 98 °IMPA for boys and 27.5° FMA, 58.5° FMIA and 94.2° IMPA for girls. These values for IMPA are consistent with our results. Since mean age of our samples was greater, reduced amount of FMA in our study might be attributed to growth related reduction of FMA caused by mandibular rotation.

Amounts of FMA, FMIA and IMPA in our study were significantly different from the original values of Tweed and mandibular plan seemed to be flatter in Iranian norms. However MPA and IMPA are similar to Downs' values. This finding is not surprising regarding difference between samples of Downs and Tweed and considering their different definition of mandibular plan.

In Steiner analysis, although Iranians have less SNA nad SNB, amount of ANB in Iranians is similar to American whites. This finding indicates identical acceptable differences in jaw discrepancy in both races.

The interesting point is that Chinese, Japanese and Kuwaitis 4, 19, 20 norms reveal more protrusive incisors than white Americans and are closer to our data. Therefore it seems that in

Eastern countries people prefer more protrusive profiles.

#### Conclusion

Many hard tissue cephalometric norms are specific for ethnic groups which indicate specification of cephalometric norms for different groups. More protrusive incisors in Iranian population might indicate more possibility of non-extraction treatment planning for this population. Designing and fabrication of cephalometric templates based on data of this study would be helpful for orthodontists and general practitioners.

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