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Determination of Facial Height Dimensions in Iranian Kurdish Population

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ABSTRACT

Much cephalometric analyses have been introduced to assist in the orthodontic treatment plans. The aim of this study was to determine facial height dimension in Iranian Kurdish population by lateral cephalometric radiographs, and to assess sexual dimorphism if present, and to compare these standards with Caucasians population. 100 lateral cephalograms of Iranian Kurdish people with normal occlusion were analyzed. Linear measurements were done based on Wylie-Johnson, Siriwat-Jarabak, Gebeck, Merrifield and Horn analysis, and the angles of SN.MP, MMA, MA, SN.GoGn, R-angle, and Y-axis used for angular measurements. There was a statistically significant difference between men and women for LAFH, UAFH, TAFH, LPFH, UPFH, TPFH, LAFH/TAFH, and PFH (P<0.05), so that the mean of these variables in men was less than women. The variables of UAFH/TAFH and SN.MP (P<0.05) in men were significantly more than women. The statistically significant difference was seen between Iranian Kurdish population and Caucasians for TPFH, LAFH, UAFH, TAFH, SN.MP, LPFH, UPFH, and R-angle (P<0/05), so that the mean of these variables in Iranian Kurdish population was more than Caucasians, and The variables of LPFH/TPFH, LAFH/TAFH, and Y-axis (P<0.05) in Caucasians population were significantly more than Iranian Kurdish population. In this study, there was a significant difference between men and women in facial height dimension, so that it seems that vertical growth pattern in women is more than men. Furthermore, Iranian Kurdish population have more facial height dimensions than Caucasians, however, LAFH/TAFH in Caucasians was more than Iranian Kurdish population.

Key words: Facial Vertical Dimension, Lateral Cephalometry, Kurds Ethnic Group

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INTRODUCTION

The desire to improve facial expressions is the most common reason for the demand for orthodontic or surgery treatments [1]. The vertical pattern of the face affects the harmony of the face and smile attractiveness [2,3] and it can play an important role in facial beauty [4]. On the other hand, the height of the face is an important factor in the balance of the face and its changes affect the position and rotation of the mandible and so it is involved in the development of the Deep Bite or Open Bite. Orthodontic treatments can cause changes in the vertical dimension. Facial beauty standards around the world have begun to change. Also, in populations around the world, the likelihood of differences in cephalometric patterns in the various ethnic groups is high [5]. The cephalometric standards of different ethnic and racial populations should be assessed separately [2]. As a result, clinicians should have accurate information in this area to make desirable changes and reduce unavoidable adverse effects in orthodontic treatments [2]. The excessive growth

in the facial vertical dimension may cause a gummy smile, inappropriate lips and the pattern of the long face. In contrast, the decreased vertical dimension may result in the inadequate display of upper incisors, over-closure of the lips and the pattern of the short face [6]. Cephalometric analysis is helpful in the evaluation of orthodontic patients [7] that determines the relationships between bone structures, dental tissue, and soft tissue, and thereby facilitates a complete assessment of malocclusion in various spatial dimensions [2]. Using only one standard for cephalometric analysis is not suitable for all ethnic groups, and precise information from the special standard measure is required to determine the degree of difference from the normal in each particular ethnic group [8]. Few studies have been conducted to determine the Iranian cephalometric norms and determine whether there is any difference between Iranians and the population of Caucasians in these norms. Therefore, we decided to examine the vertical cephalometric dimensions of the face in the Iranian Kurdish population to achieve the norms of values of this ethnic group that allows orthodontist for the evaluation and treatment of the patients in this population.

MATERIALS AND METHODS

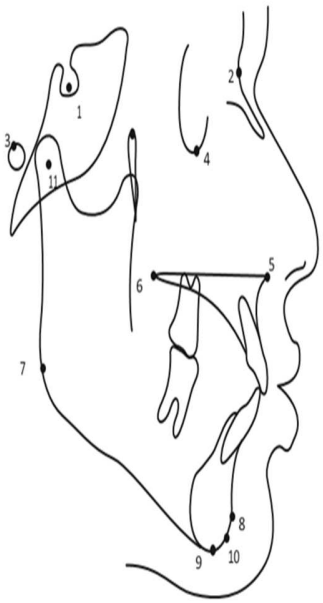
This cross-sectional study initiated in February 2017 as dentistry thesis in the orthodontic department, dental school, Kermanshah University of Medical Sciences. This study was approved by the Ethics Committee of this university.

Samples

100 lateral cephalometric radiographs were prepared from patients who received these radiographs for therapeutic purposes. The data were collected with a checklist which is attached at the end of this article. Determination of landmarks and cephalometric analysis for all specimens was done by two trained observers independently. For determination of the Intra-class correlation, two weeks later, about 30% of the samples was examined again by both observers independently. The inclusion criteria of this study were the participants with proportional and harmonic faces, class I occlusion, normal overjet and overbite, and age range of 15 to 22 years old. The exclusion criteria were a history of previous orthodontic treatment, surgical treatment, and having dental prostheses.

Variables

The lateral cephalometric radiographs were prepared by Planmeca (Panmeca ProSensor®, Finland) with exposure conditions of 68 kVp, 10 mA, and 15.3s. For this study, all radiographs were traced by using orthodontic tracing paper (Dentaurum, Germany) and identified the following points (fig 1).



Sella(S).1
Nasion(N).2
Porion(Po).3
Orbital (Or).4
Anterior nasal spine(ANS).5
Posterior nasal spine(PNS).6
Gonion(Go).7
Pogonion(Pog).8
Menton(Me).9
Gnathion(Gn).10
Condylion(Co).11

Figure 1: Traced points on radiograph

Since the purpose of this study was to determine the normal cephalometric values of the vertical dimensions of the face, based on Wylie-Johnson, Siriwat-Jarabak, Gebeck, Merrifield, and Horn analyzes, the vertical distance between the points mentioned above was determined. The measuring unit was millimeter (mm). These values are included (fig2):

1. Total anterior facial height (TAFH): Linear distance between Nasion (N) and Menton (Me)
2. Upper Anterior Facial Height (UAFH): Linear distance between Nasion (N) and Anterior nasal spine (ANS)
3. Lower anterior facial height (LAFH): Linear distance between anterior nasal spine (ANS) and Menton (Me)
4. Upper anterior facial height to total anterior facial height ratio (UAFH/TAFH)
5. Lower anterior facial height to total anterior facial height ratio (LAFH/TAFH)
6. Total posterior facial height (TPFH): Linear distance between Sella (S) and Gonion (Go)

7. Upper posterior facial height (UPFH): Linear distance between Sella (S) and Articulare (Ar), which is measured on the S-Go line
8. Lower posterior facial height (LPFH): Linear distance between Articulare (Ar) and Gonion (Go) which is measured in the S-Go line
9. Upper posterior facial height to total posterior facial height ratio (UPFH/TPFH)
10. Lower posterior facial height to total posterior facial height ratio (LPFH/TPFH)
11. Anterior facial height (AFH): Perpendicular linear distance between Palatal Plane and Me, measured on Me-PP line
12. Posterior Facial Height (PFH): A Line drawn from Ar point to the Mandibular Plane (Go-Me), tangent to the mandibular ramus.
13. Facial Height Index (FHI): PFH to AFH ratio, multiplied by 100 (FHI = PFH/AFH x 100)

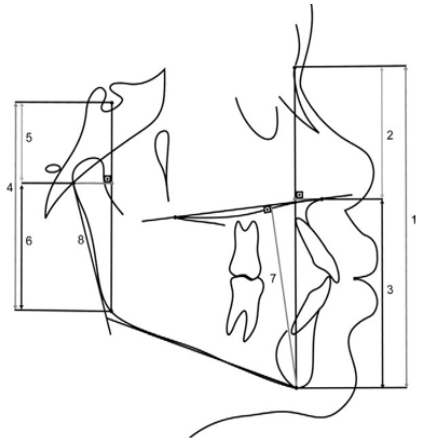


Figure 2: Measurements of various analyzes on radiograph

The angles which were measured on radiographs (fig 3):
1. Y-axis: Angle between S-Gn and Posterior nasal spine (PNS)
2. Sella-Nasion to the mandibular plane angle (SN.MP): Angle between S-N line and Down's Mandibular Plane
3. Maxillary/Mandibular planes angel (MMA): Angle between the maxillary plane (PNS-ANS) and mandibular plane
4. Sella-Nasion to Gonion-Gnathion plane angle (SN-GoGn): Angle between S-N plane and the Steiner's mandibular plane
5. Frankfort mandibular plane angle (FMA): Angle between FH plane and Down's Mandibular Plane
6. R-angle: The angle between N, Co, and Me

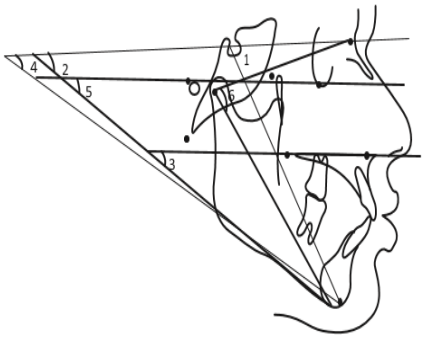


Figure 3: Measurements of angles on radiograph

Statistical analysis

All the measurements obtained were filled in the form of a checklist. The data of the present study were analyzed using descriptive and inferential statistics. In the descriptive statistics section, centrality and dispersion criteria along with charts were reported. Kolmogorov-Smirnov test used to test the normality of the data. If the data was normal, an *independent t-test* was used. If the data was not normal, the Mann-Whitney U test was used. The ICC index was carried out to verify the reliability. SPSS version 18 (Inc., Chicago, II, USA) was employed to analyze the data. The significance level in this study was considered to be less than 0.05.

RESULTS

In the present study, lateral cephalometric radigraphs of 100 patients (36 men and 64 women) were examined.

ICC index was in the excellent state for all variables, Except for the Y-axis that ICC was in the good state [9]. The mean and standard deviation of vertical dimensions of the face in men and women in the Iranian Kurdish population are presented in Table 2. There was a significant difference for TAFH, UAFH, LAFH, LAFH / TAFH, TPFH, UPFH, LPFH and PFH between men and women, so that mean of these variables was higher in women than in men. The variables of UAFH/TAFH and SN.MP ($P<0.05$) in men were significantly higher than women.

The mean and standard deviation of the vertical dimensions of the face by sex in the Iranian Kurdish population and the Caucasian population are presented in Table 3. There was a significant difference for TAFH, UAFH, LAFH, TPFH, UPFH,

LPFH, SN.MP, and R-Angle variables between the Iranian Kurdish and Caucasian populations, so that the mean of these variables in the Iranian Kurdish race was higher than that of the Caucasian. The variables of LPFH/TPFH, LAFH/TAFH, and Y-axis (P<0.05) were in the Caucasians population more than Iranian Kurdish population, significantly.

Table 1: Reliability test results of intra-examiner and inter-examiner by the ICC* index

Variable	ICC (inter-examiner)	P-value	ICC (intra-examiner)	P-value
TAFH	0.997	<0.001	0.998	<0.001
UAFH	0.987	<0.001	0.992	<0.001
LAFH	0.987	<0.001	0.996	<0.001
UAFH/TAFH	0.810	<0.001	0.811	<0.001
LAFH/TAFH	0.915	<0.001	0.955	<0.001
TPFH	0.994	<0.001	0.995	<0.001
UPFH	0.983	<0.001	0.975	<0.001
LPFH	0.980	<0.001	0.978	<0.001
UPFH/TPFH	0.939	<0.001	0.919	<0.001
LPFH/TPFH	0.941	<0.001	0.913	<0.001
AFH	0.997	<0.001	0.997	<0.001
PFH	0.988	<0.001	0.986	<0.001
FHI	0.931	<0.001	0.936	<0.001
SN.GoGn	0.901	<0.001	0.896	<0.001
FMA	0.919	<0.001	0.937	<0.001
MMA	0.986	<0.001	0.985	<0.001
Y-Axis	0.735	<0.001	0.841	<0.001
SN.MP	0.959	<0.001	0.953	<0.001
R-Angle	0.928	<0.001	0.936	<0.001

**ICC: Intra-class correlation coefficient (n = 30)*

Table 2: Mean and standard deviation of vertical dimensions of the face based on gender in Iranian Kurdish population

Variable	Male (n = 36)		Female (n = 64)		P-value [a]
	Mean	SD*	Mean	SD*	
TAFH	113.406	10.090	122.500	15.380	0.002
UAFH	50.789	5.502	54.806	8.953	0.007
LAFH	62.242	6.328	69.083	9.961	0.000
UAFH/TAFH	0.446	0.028	0.434	0.026	0.043
LAFH/TAFH	0.545	0.028	0.558	0.025	0.021
TPFH	71.051	11.632	81.806	12.324	<0.001
UPFH	31.172	3.978	34.417	4.711	<0.001
LPFH	41.023	5.388	47.389	8.299	<0.001
UPFH/TPFH	0.429	0.038	0.418	0.027	0.078
LPFH/TPFH	0.563	0.037	0.573	0.027	0.135
AFH	61.156	6.335	65.937	14.835	0.073
PFH	42.313	5.896	49.056	8.718	<0.001
FHI	68.835	8.795	68.557	15.781	0.910
SN.GoGn	36.844	37.994	30.556	7.072	0.329
FMA	28.141	25.318	25.542	5.981	0.546
MMA	25.680	5.374	24.986	5.540	0.541
Y-Axis	69.008	4.759	67.736	4.047	0.180
SN.MP	35.484	5.152	33.042	5.741	0.031
R-Angle	74.180	4.124	73.500	4.087	0.429

**SD: Standard Deviation. [a] Independent Samples T-test*

Table 3: The comparison of vertical dimensions of the face by gender in two populations

Variable	Kurdish (N 100)		Caucasian			
	Mean	SD	Mean	SD	n	P
TAFH	116.680	12.948	111.93	5.30	74	0.001[a]
UAFH	52.235	7.167	50.04	2.65	74	0.006[a]
LAFH	64.705	8.453	61.89	4.34	74	0.005[a]
UAFH/TAFH	44.140	2.793	44.74	2.07	74	0.121[a]
LAFH/TAFH	54.965	2.747	55.25	2.07	74	0.001[a]
TPFH	74.922	12.912	70.83	4.82	74	0.004[a]
UPFH	32.340	4.513	29.74	3.14	74	<0.001[a]
LPFH	43.315	7.229	41.09	3.56	74	0.008[a]
UPFH/TPFH	42.520	3.471	41.98	3.31	74	0.299[a]
LPFH/TPFH	56.650	3.430	58.02	3.31	74	0.009[a]
AFH	62.877	10.424	61.76	4.17	74	0.296[a]
PFH	44.740	7.718	43.99	3.76	74	0.399[a]
FHI	68.735	11.717	71.36	5.59	74	0.052[a]
SN.Go Gn	34.580	30.749	34.51	5.18	85	0.982[a]
FMA	27.205	20.546	27.86	4.8	55	0.762[a]
MMA	25.430	5.417	25	-	-	0.429[b]
Y-Axis	68.550	4.536	70.21	-	-	<0.001[b]
SN.MP	34.605	5.471	31.84	4.56	55	0.001[a]
R-Angle	73.935	4.103	72.5	1.84	80	0.002[a]

[a] Independent Samples T-test. [b] One-Sample T-test

DISCUSSION

This study was designed and implemented as a descriptive cross-sectional study to determine cephalometric facial norms of vertical dimensions in the Iranian Kurdish population. The difference in cephalometric values of facial vertical dimensions in men and women was statistically significant.

It is important to consider the cephalometric norms of facial dimensions for each particular ethnic group separately [10, 11]. The difference in facial height dimensions between different populations and the Caucasian was previously investigated [5, 8, 10, 12, 13].

In the present study, the mean of TAFH, UAFH, and LAFH, and LAFH / TAFH ratio of the Kurdish women was higher than men. Also, UAFH / TAFH ratio was higher in Kurdish men than women. This indicates a duality between the two sexes in the Kurdish population. The higher proportion of LAFH / TAFH in women than men and the greater proportion of UAFH / TAFH in men than women indicates a greater ratio of lower one- third of the face to total facial height in women than men. In addition, the mean of SN.MP angle was greater in men than women, which probably indicates the lower position of the S point or a higher position of N point in men than women. TAFH, UAFH, and

LAFH in the Kurdish population were greater than the Caucasian population, indicating the larger overall dimensions of the anterior face in the Kurdish people relative to the Caucasian. But, the ratio of LAFH / TAFH in the Kurdish population was less than that of the Caucasian population. This indicates that although the vertical dimensions of the anterior face in the Kurdish population are greater than the Caucasian population, the lower third of the face relative to the total face height in the Kurdish population was less than the Caucasian population. Also, the Y-axis in the Kurdish population was less than that of the Caucasian population. This finding consistent with other findings from this study, which is based on the shorter vertical growth pattern in the Kurdish population than the Caucasian population.

The mean of TPFH, UPFH, LPFH, and PFH in women were higher than in men in Kurdish ethnic group, indicating a greater development of the posterior face in Kurdish women than Kurdish men. Also, the mean dimensions of TPFH, LPFH, and UPFH were higher in this population than in the Caucasian. As a result, the posterior dimensions of the face in the Kurdish population are generally higher than the Caucasian population. The average ratio of LPFH / TPFH in Kurdish population was lower than that of the Caucasian population. This could be a marker for the further development of the lower one-third of the facial posterior dimensions in the Caucasian population. Also, these findings may indicate a difference in the developmental age in the two populations. Development in the Caucasian may occur faster and ends sooner.

Previous studies showed different results in posterior and anterior vertical dimensions of the face in men and women of different populations [5, 8, 10, 13, 14]. In addition, the present study and other studies that have been carried out showed significant differences between the Caucasian population to other populations [10, 15]. In the study of Azarbayejani and colleagues [15], a significant difference was found between an Iranian population and the Caucasian population in facial dimensions. Also, Viera *et al.,* [15] found significant differences in the facial norms in the Japanese-Brazilian population between men and women. These results indicate that dimorphism is present in other populations in the world.In the study of Basciftci *et al*., [16], significant differences were found between the facial norms of Anatolian Turkish population and that of other ethnic groups, which is consistent with the current study. Also, the study of Hassan in Western Saudi Arabia's population [17] calculated the specific norms of the population, and their result showed the cephalometric norms of each population are characteristic and it is very important for orthodontic treatment of that population. Behbehani *et al.,* [18] found significant differences in the facial dimensions of Kuwaiti and White people, which confirmed the differences between the norms of the different populations. Also, one Iranian research [19] showed that there is significant difference between soft tissue cephalometric norms of Kurdish populations and Caucasians.

The present study includes some limitations such as examined only two dimensions of the face in the lateral cephalometric radiographs and do not assess the use of clinical information and soft tissue dimensions of the population which can provide more favorable results. The Kurdish population has many ethnicities that are scattered throughout the different parts of the Kurdish region in the Middle East and there is a possibility of differences between different ethnicities of Kurds in relation to the factors examined in this study. Also, the study of other age groups can help the development of knowledge in relation to the vertical facial norms. In addition, the study of other facial dimensions in the Kurd population and other ethnic groups is recommended.

CONCLUSION

In this study, Kurdish women and men had differences in vertical dimensions of the face, so that the overall height of the face and the ratio of the lower anterior one third height of the face to total anterior facial height in women was higher than that of men, and it seems that the vertical pattern of facial growth in women are more than men. Facial vertical dimensions of the face in Iranian Kurdish population and Caucasian population were not coordinated with each other. In some cases, norm dimensions were more in the Kurdish population and in other cases were fewer. The Kurdish population generally has higher vertical dimensions than Caucasian population. However, the ratio of the height of the lower one-third of face to total facial height in the Kurdish population was lower than that of the Caucasian population.

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Conflict of interest
The authors declare no conflict of interest.

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