ORIGINAL ARTICLE

Normal standards of McNamara analysis in Iranian adult population

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Background and aim: The form of the facial skeleton and dental relationship is race specific, and estimating the cephalometric standards in each race is important. The purpose of this study was to determine the McNamara's Analysis standards in Iranian population and to compare them in Iranian men and women.

Materials and Methods: In this Cross Sectional study cephalograms of 75 Iranian adults (18-35yrs) including 36 males and 39 females that represented Class I skeletal relationship, normal vertical pattern and space deficiency less than 3 mm were selected Eleven indexes of McNamara Analysis were manually traced and analyzed. Mann-Whitney and Independent t-tests were used to compare values between males and females.

Results: It was shown that there is significant difference in effective length of mid face, mandibular length and lower one-third height between men and women ($p<0.05$).Our study findings was very similar to McNamara`s norms

Conclusion: Despite the larger jaw dimensions in Caucasian compared to Iranian ethnic group. McNamara analysis can be applied for Iranian population.

Keywords: McNamara analysis, Iranian population, cephalometric standards

Received 10February 2014; accepted 4March 2014;Published 7 June 2014
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Introduction

Since morphologic features of different races and ethnic groups are randomly distributed, knowledge of normal dentofacial pattern of each ethnic group is important. Variations in dentofacial structure of different ethnic groups have been noticed by many investigators.[1-7] McNamara in 1983 invented a new cephalometric analysis,[8-10] in which the reference line was not dependent on tooth and bone positions.[11-13]

Jacobson studies on blacks with normal occlusion showed significant differences in cephalometric standards between African blacks and whites,[14] therefore the standards for an ethnic group is no longer valid for another race or ethnic group. [15]

This finding motivated many researchers to estimate cephalometric standards of different races in various countries such as America, Europe, Africa, Japan and China.[16] So far studies to achieve these standards in Iranian have been presented by Nouri [17]and Padisar [18] because appropriate application of cephalometric analysis, depends on normal standards. Considering the fact that today's orthodontic patients are widely dispersed among diiferent age groups from juvenile to adults, accessing to a wide range of reliable standards is ideal.[19]The skeletal pattern is determined at the end of growth; therefore selecting adults to access a standard is of utmost priority. The aim of this study is to investigate normal standards of McNamara analysis in Iranian adult population and compare them between men and women.

Material &Methods

In this Cross Sectional study ,cephalograms of 75 Iranian adults (36 males and 39 females) with an age range of 18-25 years old that represented class I skeletal , molar and canine relationship , normal vertical pattern, ANB 2-4 degrees, space deficiency of less than 3 mm and without facial anomalies were investigated. Each participant underwent one standard lateral cephalogram with the teeth in centric occlusion and the head in normal head position (NHP) in one specific center. Lateral cephalograms of all samples were traced manually and 11 indexes of McNamara analysis (including 8 linear and 3 angular) were determined to evaluate normal indexes (Figure 1). All of the parameters were analyzed again after 2 weeks by the same person, and the reliability of the results were surveyed by one way ANOVA and t-test. The data distribution in each group was investigated by using Kolmogorov Smirnov test. Data of nine Indexes followed a normal distribution and the data related to MD-P and Li - APog did not. The equality of variance in the three groups were determined by using Leven test besides, t-test and Mann - Whitney test were used to compare indexes of McNamara analysis between two genders.

Results

The results indicated that: (Table 1)

The indexes showing maxillary relationship to the skull base including :A to NP (P=0.40>0.05) and SNA (P =0.83>0.05) did not differ significantly between men and women.

Among the indexes that were indicative of maxilla mandibular relationship, Co-Gn(P=0), Co-A(P= 0.02) , ANS-Me(P=0.01)., MD-P(P=0.04) ,FA-A (P=0.01) showed statistically significant difference between men and women(P<0.05) but MxMD - Dif was not statistically significant between the two genders (P = 0.19>0.05).

Pog - NP that shows mandibular relationship to skull base did not show significant difference between two genders (P= 0.73).

The distance of upper in cisor to point A(U1 to A) in Iranian women was significantly (P = 0) more than Iranian men while Li - APog did not show a statistically significant difference between two genders. (P = 0.52<0.01)

Table 1. comparison of the genders in Mc-Namara Analysis indexes

Variables	numbers	mean ± SD	P-Value	Sig
A to NP male Female	36 39	4.49 mm± 1.20 3.25 mm ±0.45	0.40	NS
SNA male female	36 39	3.46° ± 80.61 2.88°± 80.77	0.83	NS
Co-Gn male female	36 39	12.32 mm ± 119 17.97mm ± 96.36	0	*
Co – A male female	36 39	6.51 mm± 94.72 6.35 mm± 91.12	0.02	*
Mx – MD.Dif male Female	36 39	5.25 m m±27.28 5.45 mm ± 25.63	0.19	NS
ANS – Me male female	36 39	6.86 mm± 74.37 5.23 mm± 70.73	0.01	*
FA – A male Female	36 39	5.51° ± 0.39 5.05°± -3.18	0.01	*
Pog – NP male female	36 39	13.59 mm±4.22 5.53 mm ±5.04	0.73	*
Ui – A male female	36 39	1.62 mm±4.90 1.83 mm± 6.27	0.00	*
Li – APog male Female	36 39	3.63 mm 3.95 mm	0.52	NS
MD.P male Female	36 39	28.68° 27.53°	0.04	*

Discussion

The importance of these parameters in diagnosis and treatment of patients according to their race is clear. Attempts have been made to obtain standards for Iranian by different researchers. The results of this study indicated that the distance from point A to NP is not statistically significant between men and women. (P > 0.05) This finding is similar to findings from other researches and the numbers are very close to the study of McNamara.[10] The amounts of SNA angle were similar with the results of Nouri[17], McNamara [7]and Nahidh[24]. Effective length of mandible (Co - Gn) (P = 0) and mid face (Co - A) (P = 0.02) differences were stati significanly greater in men than women and these findings were in accordance with the results of other studies [8, 13,14,18,24] but inconsistent with Nouri's study[17] .The cause of this difference can be attributed to age differences between the samples of the two studies. In the present study subjects were adults (18-25 years old) while study samples of Nouri's study had an age range of 9-11 years old who had still growth to happen.

Measurement of ANS - Me (P = 0.01) proved that the lower one-third height of men are greater than women and this finding was consistent with other studies.[8, 11,14,15,24] while, Nouri's study[17] is inconsistent with these results and that can be attributed to lack of growth in Nouri`s samples.

ANS-Me in the present study is very similar to the Mc-Namara's analysis[10]. (Table 2)

The present study indicated that the angle between mandibular plane to Frankfurt plane in Iranian men is significantly more than women (p = 0.04) that is consistent with other studies [8,14,17] and inconsistent with McNamara's [10], Nahidh's [24]and Miyajima.[15] These differences can be attributed to racial differences. FA-A parameter is significantly greater in women (P = 0.01) and shows a tendency of horizontal growth in women compared to men. This finding is consistent with Al – Barakati's [7]and Nouri's study [17], but inconsistent with McNamara's study. The difference between present study and McNamara's can confirm that American people grow more vertically than Iranians.

Pogonion is far more protrusive compared to N in Iranian but it did not show significant difference between men and women (P = 0.73).These results are similar with the results of Al – Barakati's[14] and Wu's[8] investigations. Upper teeth in comparison with the perpendicular line to A point is positioned significantly more protrusive women compared to men (P = 0.00) which is similar with Mc Namara's[10], Wu's[8] and Miyajima's[15] study, however it is not in agreement with Nouri's [17] findings

Li-Apog does not show statistically significant difference between men and women (P = 0.52) that is similar to Nahidh's [24], Mc Namara's[10], Miyajima's[15]and Nouri's [17] study ·According to the findings above, the cause of differences between men and women can be attributed to facial dimensions and facial proportions that is greater in men and it is originated from skeletal relation .conclusively it can be inferred that the findings of this study in many cases, including Li-Apog, LAFH, Co-A, A to NP is similar to McNamara's analysis. Thus,

applying of McNamara's analysis standards in most of the parameters for Iranian can be valid.

It can be concluded that Iranian population and American population are similar in all of the indexes except for Pog - NP that implicates more prominent chin in Iranian. Besides, Americans' jaws are larger than Iranian ethnic group .This finding is similar with Nouri's study .[17]According to similarities of 4 indexes (A to NP, Co-A, LAFH, L1-Apog), McNamara analysis can equally be applied for Iranian (Table 2).

Table2.Mean parameters of McNamara in present study and other countries

Author	McNamara		Miyajima et al.		Wu et al.		Al- barakati and Talic		Mohammed Nahidh.		Present study	
Year	1984		1996		2007		2007		2010		2013	
Age	Adults		Adults		12years		Adults		Adults		Adults	
Country	USA		Japan		China		Arabia Saudi		Iraq		Iran	
Sex	male	female	Male	female	Male	female	male	female	Male	female	male	female
Number	38	73	26	28	200	205	36	29	33	42	36	39
A TO NP (mm)	1.1	0.4	2.5	2.3	-0.75	-0.53	-2	-0.2	1.6	0.67	1.2	0.45
SNA (degree)	83.9	82.4	82.2	82.1	81.78	81.97	-	-	83.75	81.8	80.61	80.77
Co – Gn (mm)	134.3	120.2	125.5	118.8	113.95	113.32	133.4	124.9	121.37	111	119	96.36
Co – A (mm)	99.8	91	91.4	86.3	87.90	85.93	101.7	98.2	93.22	85.5	94.72	91.12
MM dif (mm)	34.5	29.2	34.1	32.5	26.06	27.39	31.8	26.8	28.15	25.7	27.28	25.63
LAFH (mm)	74.6	66.7	75.1	72.7	66.14	64.39	76.1	68.9	68.75	63.4	74.37	70.73
FMA (degree)	21.3	22.7	22.3	26.1	27.81	26.10	24.9	25	21.69	23.9	28.68	27.53
FAA (degree)	0.5	0.2	-4.2	-3.5	-5.51	-3.83	2.8	2.9	-0.61	-0.19	0.39	-3.18
Pog – NP (mm)	-0.3	-1.8	0.3	-1.7	-7.45	-4.88	-6.1	-5.9	-0.09	-1.44	4.22	5.04
U1-PNP (mm)	5.3	5.4	5.7	6	7.34	7.86	6.2	4.3	6.44	5.91	4.90	6.27
L1-APog (mm)	2.3	2.7	4	4.9	6.35	6.26	4.4	3.6	3.99	4.01	3.63	3.95

Conclusion:

1 - Since this study was conducted in subjects with normal occlusion and normal vertical dimension, measurements in this study can be used as normal standards in lateral cephalometric studies

2 - The results of the research can be classified in four groups:

A- Maxilla to cranial base relationship: These indexes were not statistically significant between men and women

B-Maxilla to mandible relationship: Effective length of mid face and mandible are significantly larger in men than

3- Mandible to cranial base relationship: The dimensional variations of Pog - NP was not statistically significant between men and women.

4- Dental analysis: Central incisors of maxilla and mandible in men are significantly more protrusive than women.

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