

McNamara Cephalometric Analysis of Newars of Kathmandu

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ABSTRACT

Introduction: Standardized cephalogram is used for the orthodontic diagnosis and treatment planning and the measured values of the craniofacial structures are compared with the peer group having similar age, gender and ethnicity. However, this standardized comparison has not been possible so far for Newar ethnic group.

Objective: To determine cephalometric norms of Newar adults of Kathmandu using McNamara analysis and to assess gender difference within the group.

Materials & Method: Newar Indo-Aryan descendants aged 18-27 years were screened based on inclusion criteria. Lateral cephalometric radiographs of 62 untreated Newar adults (20 males and 42 females) were used. Manual tracing of the lateral cephalograms were performed and descriptive statistics were obtained. Comparative test was conducted within Newars to evaluate gender diversity at the significance level $p \leq 0.05$.

Result: Craniofacial structures of male and female Newars were significantly different. Parameters showing these differences were Effective Mid Face Length, Effective Mandibular Length, Lower Anterior Facial Height.

Conclusion: Standardized comparison with the peer group separately for male and female should be done when analysing cephalometry for any ethnic group.

Key-words: Cephalometric analysis, McNamara, Newar

INTRODUCTION

Discovery of radiograph in the year 1895 A.D. revolutionized medical fraternity. Its use in orthodontics became popular nearly thirty six years after the introduction of standardized lateral cephalogram by Broadbent and Hofrath in 1931.¹ Later Downs,² Tweed,³ Steiner,⁴ McNamara⁵ came up with various analysis systems to analyze craniofacial structure of the Caucasians. Subsequently craniofacial studies of other ethnic groups^{6,7} were done using various analyses and were compared with Caucasians.

Different from other analyses, McNamara analysis involves parameters that provides visual picture of facial skeletal profile making it easily communicable.⁵ This analysis system was used on other ethnic groups such as Japanese,⁸ Turkish,⁹ Saudis,¹⁰ and Chinese.¹¹

Nepal's capital city Kathmandu is resided by various ethnic groups with the largest and indigenous group being Newar.¹² Cephalometric study of Nepali populations has been performed earlier.¹³ Newars are easily distinguishable from other ethnic groups by their typical long and slender facial features.¹⁴ The present study was conducted with the primary objective to determine the norms for Newar adults of Kathmandu using McNamara analysis.

MATERIALS AND METHOD

Ethical clearance was obtained from Institutional Review Board to conduct this study. Convenient sampling comprising of 62 subjects including 20 males and 42 females were screened for Newar Indo-Aryan descendants aged 18-27 years. Inclusion criteria were Angle's Class I molar and canine relation, normal overjet and overbite, symmetric face and acceptable facial profile. Subjects were excluded having craniofacial abnormalities, history of orthodontic or surgical treatment and having proximal caries or prosthesis. Informed and signed consent was taken from all participants.

The lateral cephalometric radiographs were taken in natural head position¹⁵ with right side facing the cassette. Sordex Cranex Excel Ceph 71 Kvp 6 mA was exposed for 1.2 seconds by the operator standing behind the lead door. The distance from the source to the mid sagittal plane was 134 cm and the distance from mid sagittal plane to x-ray film was 18 cm. Linear measurements had 13% enlargement. The qualities of the radiographs were checked before printing. Landmark localization and manual tracing of the lateral cephalograms were performed by the principal researcher. Intra-observer

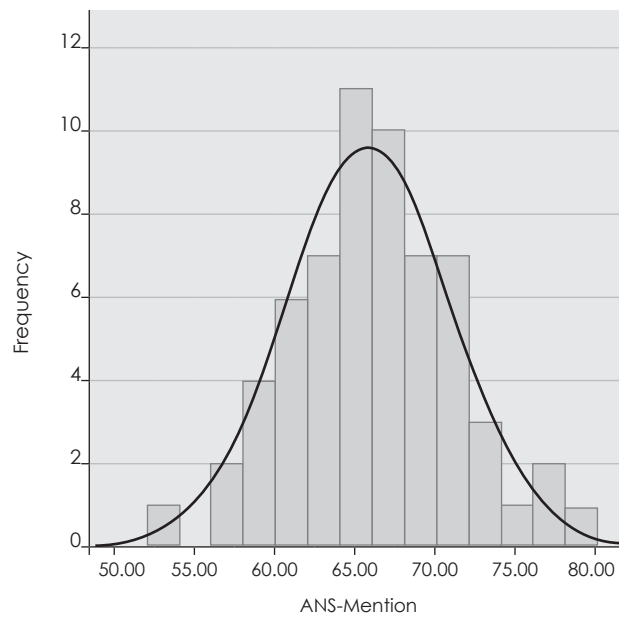


Figure 1. Histogram showing normal distribution

variation in identifying and locating the anatomical landmarks during tracing and measurements was assessed using paired t-test.

Quantitative data were analyzed using SPSS program Version 20. Data were presented in tables with descriptive statistical measures at significance level $p \leq 0.05$. Quantitative data of eleven variables of the craniofacial structures of Newars showed single peak with symmetric distribution of the data following normal distribution in frequency distribution graph. Figure 1 shows histogram of one of the variable ANS-Mention. In this study, most of the distribution of variables were slightly skewed positively or negatively, however median values of the variables were very close to mean, which permitted parametric 't' test.

RESULT

Table 1 shows sample size and age distribution of Newar subjects. The mean age of males was 20 years 7 months and females was 19 years 6 months.

Descriptive statistics of the maxillary, mandibular, vertical components of craniofacial region and dentoalveolar

parameters of the samples were expressed as mean, range and standard deviation. The descriptive data showed biological variability of two series of data between the gender groups. Wide range of data was reflected by minimum and maximum values of Pogonion to Nasion Perpendicular. Spread out of the data of this parameter was also reflected by standard deviation 6.96 and 5.33 in male and female respectively.

Comparison of the Maxillary, Mandibular, and Vertical Components of craniofacial region and dentoalveolar parameters of Newar male and female adults are presented in Table 2. There was significant gender difference regarding the craniofacial structures. Male subjects had significantly larger craniofacial parameters than females in: Effective Midface Length, Effective Mandibular Length, Maxillomandibular Differential and Lower Anterior Facial Height. Mandibular Plane Angle was significantly steeper in Newar females compared to males. Dentoalveolar positions were not significantly different between the gender groups.

Table 1. Demographic data of Newar sample

Sample	Number	Age (in years)				
		Minimum	Maximum	Mean	Median	SD
Male	20	18	27	20.70	20.00	2.93975
Female	42	18	25	19.67	19.00	2.02022

*Significant at $p < 0.01$

Table 2. McNamara cephalometric findings of Newar male and female adults

Parameter		Minimum		Maximum		Mean		SD		p-value
		Male	Female	Male	Female	Male	Female	Male	Female	
Maxillary Skeletal Position	SNA	75.00	74.00	90.00	88.00	82.25	81.64	3.58	3.27	0.525
	Co-point A	84.11	74.55	95.58	89.84	87.64	82.21	3.36	3.70	0.000***
	Point A to Na-P	-6.69	-2.87	8.60	7.65	0.38	1.84	3.50	2.77	0.112
Mandibular Skeletal Position	Pog to Na-P	-14.34	-12.42	14.34	11.47	0.14	0.38	6.96	5.33	0.896
	Co-Gn	108.96	100.35	126.16	120.42	115.79	107.20	3.76	4.53	0.000***
Inter Maxillary	MXMD-DF	21.03	17.20	33.45	33.45	28.15	25.00	3.49	3.50	0.002**
Vertical Skeletal Components	FA-A	-9.00	-11.00	8.00	6.00	-0.55	-2.05	4.17	4.13	0.1930
	ANS-Menton	57.35	50.65	75.50	68.81	66.19	61.21	4.86	4.13	0.000***
	Md-P	17.00	18.00	32.00	33.00	21.30	24.05	4.70	4.48	0.0360*
Maxillary Dentoalveolar Position	UI-A	3.82	2.87	11.47	8.60	7.02	6.04	2.09	1.60	0.0720
Mandibular Dentoalveolar Position	Li-A Pog	0.00	-3.82	7.65	8.60	3.78	3.28	2.53	2.14	0.4520

* $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$ NS – Not Significant

Table 3. Comparison of McNamara cephalometric values between Nepali (Newar) and Turkish¹⁶

Parameter		Newar (M:20, F:42)				Turkish (M:33, F:83)			
		Mean		SD		Mean		SD	
		Male	Female	Male	Female	Male	Female	Male	Female
Maxillary Skeletal Position	SNA	82.25	81.64	3.58	3.27	-	-	-	-
	Co-point A	87.64	82.21	3.36	3.7	91.39	88.65	4.73	4.13
	Point A to Na-P	0.38	1.84	3.5	2.77	0.18	-0.44	2.36	2.52
Mandibular Skeletal Position	Pog to Na-P	0.14	0.38	6.96	5.33	-3.92	-4.79	4.29	4.55
	Co-Gn	115.79	107.2	3.76	4.53	117.36	113.65	6.24	5.64
Inter Maxillary	MXMD-DF	28.15	25	3.49	3.5	25.97	24.86	3.87	3.39
Vertical Skeletal Components	FA-A	-0.55	-2.05	4.17	4.13	-2.34	-1.93	3.38	3.89
	ANS-Menton	66.19	61.21	4.86	4.13	69.43	66.66	4.84	4.16
	Md-P	21.3	24.05	4.7	4.48	25.02	25.01	3.22	3.65
Maxillary Dentoalveolar Position	UI-A	7.02	6.04	2.09	1.6	4.19	3.15	2.22	2.15
Mandibular Dentoalveolar Position	Li-A Pog	3.78	3.28	2.53	2.14	2.48	1.67	1.92	2.28

Radiographic magnification in present study changed from 13 to 8% and 8.7% in Turkish study.

DISCUSSION

Broader view of craniofacial structure is possible with McNamara analysis. Unlike angular parameters used in earlier analysis, McNamara analysis system uses mostly linear parameters of the craniofacial structure.⁵

Significant gender differences were observed within the Newar ethnic group indicates gender dimorphism. Gender dimorphism was also observed in previous studies on Chinese,¹⁷ Mexican American¹⁸ and Nepali Brahmin.¹⁹

Newar females presented with smaller craniofacial dimension compared to males. In spite of smaller Effective Maxillary Length in female subjects (82.21 mm females, 87.64 mm males); maxilla was more anteriorly positioned

compared to male subjects as expressed by the parameter Point A to Nasion Perpendicular (1.84 mm females, 0.38 mm males) indicating more prognathic maxilla in Newar females than in males.

Steeper Mandibular Plane Angle in Newar females (24.05° females, 21.30° males) would contribute to Lower Anterior Facial Height. Mandibular Ramal Height would require as a confirmatory measure, since shorter ramal height would also result in steep Mandibular Plane.²⁰ Negative Facial Axis Angle in Newar females (-2.05° females, -0.55° males) indicated narrower anteroposterior dimension of the face compared to male subjects²¹ Negative Facial Axis angle would also contribute to vertical development of face.⁵

Newar females compared to males presented with smaller sized but anteriorly positioned maxilla; similar prominence of chin (0.38 mm females, 0.14 mm males) inspite of differences in mandibular lengths (107.20 mm females, 115.79 mm males). Furthermore, Newar females also presented with narrower anterior posterior dimension of face with steeper Mandibular Plane and lesser prominence⁸ of anterior dentition compared to Newar males.

Comparison of the craniofacial variables among the Asian population (Table 3) revealed greater Effective Maxillary Length, Effective Mandibular Length and Lower Facial Height of the Turkish population than Newars of Kathmandu. These parameters were compared separately for male and female as the Turkish population also showed gender diversity. Downs analysis of the Nepalese population¹³ showed no significant differences

in craniofacial structure between male and female. Whereas parameters of McNamara analysis of Newars revealed significant differences in male and female. These differences can also be seen in Turkish population. When the position of Maxilla and Mandible was compared in reference to Nasion Perpendicular, both Maxilla and Mandible of the Newars was found to be positioned more anteriorly than the Turkish.

CONCLUSION

Ethnic and gender diversity of the craniofacial structures of Newars of Kathmandu have been observed. Hence for diagnosis and treatment planning of Newar individuals, standardized comparison separately for male and female will be justifiable.



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