ORIGINAL ARTICLE

Cephalometric measurments of a Pakistani adult sample according to Jarabak's analysis

Taskeen Khan, Imtiaz Ahmed, Gul-e-Erum

Abstract

Objective: To establish cephalometric norms of Pakistani adults according to Jarabak's analysis and to evaluate whether a significant difference exists between Pakistani measurements and Jarabak's norms.

Methods: A prospective cross-sectional study, was carried out at the Department of Orthodontics Dr. Ishratul Ebad Institute Of Oral Health Sciences/Sindh Dental Hospital, Karachi from July to September 2012. Standardized lateral cephalometric radiographs were taken of 50 selected Pakistanis within age range 18-23 years having normal occlusion. The database was developed in SPSS 12.0 for Windows.

Result: A descriptive analysis and independent Student's test was used. A comparison of the angular and linear measurements according to the Jarabak's analysis in the Pakistani and Caucasian population describe that the Pakistani males had all of their angular as well as linear measurements significantly different then the Caucasian namely the saddle angle, gonial angle, articular angle, upper gonial angle and lower gonial angle ($p<0.0001$) and the anterior cranial base, posterior cranial base, ramus height, anterior facial height, posterior facial height and mandibular corpus ($p<0.05$).

Conclusion: Pakistani males and females demonstrated a significant difference in saddle angle, gonial angle, articular angle, upper gonial angle and lower gonial angle ($p<0.0001$) as compared to the Caucasian norms. Pakistani females also had a difference in the upper gonial angle and lower gonial angle ($p<0.0001$) and the anterior cranial base, posterior cranial base, ramus height, anterior facial height, posterior facial height and mandibular corpus measurements.

Keywords: Pakistani adults, Jarabak's analysis. (JPMA 63: 1345; 2013)

Introduction

The treatment of skeletal disharmonies presents better results when performed during the growth period. In order to identify such disharmonies and, hence, concentrate on clinical actions during treatment and influence facial growth. Cephalometrics appear as a useful diagnostic tool for identifying facial growth patterns or growth direction. Orthodontists and surgeons have widely used cephalometric radiography as a diagnostic tool since its introduction by Broadbent[1] in 1931. It is a vital tool for skeletal, dental assessments and soft tissue relationships as well as individual patterns resulting from particular ethnic and racial backgrounds. There have been various cephalometric analyses carried out using different landmarks and planes.[2-9]

Different racial and ethnic groups vary within their facial characteristics that warrant the establishment of cephalometric norms for each group. The variety of craniofacial characteristics present in different racial and ethnic groups has been investigated in several studies,[10-19] and also been compared for their similarities and differences. For example, a study showed that Brazilian subjects have craniofacial characteristics that are distinct from those of other races, especially Caucasians.[20] Similarly, Pakistani population also has distinct facial and dental features when compared with European and American populations.[21,22] As the cephalometric analysis routinely used for diagnosis and treatment planning in orthodontics is generally based on Caucasian cephalometric standards, there has been concern on elaborating a cephalometric analysis more specific to young Pakistani patients.

Jarabak cephalometric analysis considers the skeletal pattern in the anteroposterior and vertical dimension. Hence, it is one of the tools used for the cephalometric analysis of orthodontic patients and aids in various aspects of treatment planning. It too is based on cephalometric values that were initially developed from a Caucasian population. Hence, a modification of these normal values to better suit a particular racial group can provide better results and well-designed treatment plans. The purpose of this study was to determine mean values of Jarabak's cephalometric analysis for Pakistani adults

Department of Orthodontics, Ishrat-ul-Ebad Institute of Oral Health Sciences, Karachi.

Correspondence: Taskeen Khan. Email: aazmeer@gmail.com

with clinically excellent occlusion in order to establish the Jarabak's analysis norms for the Pakistani population and comparing it with the Caucasian population.

Materials and Methods

The prospective cross-sectional study was conductd at the Dr Ishratul Ebad Institute of Oral Health Sciences, Karachi from July to September 2012. It comprised 50 lateral cephalometric radiographs which were taken in the standardised manner, as verified by the researchers, by the same technician. The samples were selected according to the following criteria: pleasing and harmonious face; angle class I molar and canine relationship; normal overjet (1-4mm); normal overbite (35-50%); average skeletal relationship (ANB = 1-4); no history of trauma or jaw fracture; no craniofacial malformation and syndromes; no previous orthodontic treatment.

All lateral cephalometric radiographs were obtained in centric occlusion with the head in the natural position and lips in the rest position. Skeletal structures were traced on acetate paper using 4H pencils, an illuminator, transparent ruler to the nearest 0.5mm, protractor to the nearest 0.1º, and adhesive tape. All tracings were done in a darkened room by the same investigator. The cranial and facial structures were first outlined and then the investigator traced the lines and planes to compose Jarabak's cephalometric analysis .The information obtained from the readings were transferred onto the designed Proforma.As the patients in this study were selected to undergo orthodontic treatment, their cepholometric radiograph was a routine standard procedure for all patients undergoing ortho treatment. As such, there were no ethical consideration in the way. However the study was approved by the institution's ethical Review Committee and informed consent was obtained from the included patients.

Results

Of the total 50 samples, 25(50%) belonged to male subjects. The overall mean age of the study population was 23±1 years. The result of Jarabak's analysis of the male population of Pakistani sample (Table-1) and that of the female population (Table-2) were done separately. The values were also compared with Jarabak's analysis of both the genders with the Caucasian standards (Figure-1 and 2).

A comparison of the angular and linear measurements according to the Jarabak's analysis in the Pakistani and Caucasian population showed that the Pakistani males had all of their angular as well as linear measurements significantly different than the Caucasians including the saddle angle, gonial angle, articular angle, upper gonial angle and lower gonial angle, (p<0.0001) and the anterior

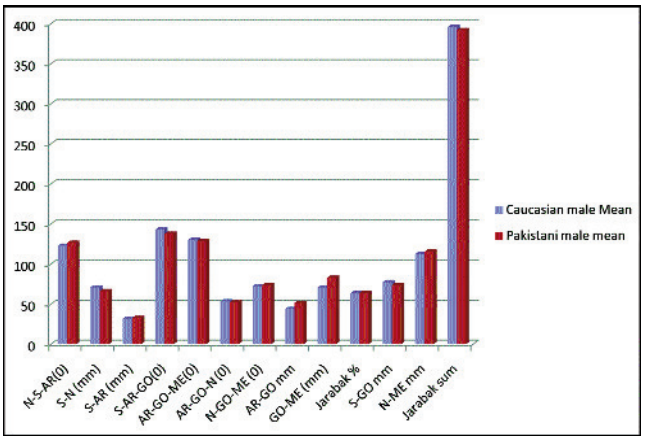

Figure-1: Comparison between the Jarabak's analysis of Caucasian and Pakistani males.

Table-1: Difference between the mean values of Caucasian and Pakistani males.

Measurments	Caucasian male		Pakistani male		Difference	
	Mean	SD	Mean	SD	t-test	P-value
N-S-AR(0)	123	6	126.48	2.1817	1.5	<0.001
S-N (mm)	71	3	66.4	2.3094	1.02	<0.001
S-AR (mm)	32	3	32.56	1.2936	5.8	<0.001
S-AR-GO(0)	143	5	137.84	2.9535	9.1	<0.001
AR-GO-ME(0)	130	7	128.48	3.0293	1.9	<0.001
AR-GO-N (0)	53.5	1.5	52.08	1.03763	1.4	<0.001
N-GO-ME (0)	72.5	2.5	74	3.6056	1.0	<0.002
AR-GO mm	44	5	51.56	2.3108	6.8	<0.001
GO-ME (mm)	71	5	82.88	2.0273	9.4	<0.001
Jarabak %	63.5	1.5	63.88	.6000	1.11	<0.001
S-GO mm	77.5	7.5	74.04	1.3379	7.0	<0.009
N-ME mm	112.5	7.5	115.32	2.2679	8.7	<0.001
Jarabak sum	396	6	392.12	2.3861	1.62	<0.001

Table-2: Difference between the mean values of Caucasian and Pakistani females.

Measurments	Caucasian female		Pakistani females		Difference	
	Mean	SD	Mean	SD	t-test	P-value
N-S-AR(0)	123	6	126.92	3.2061	7.29	<0.001
S-N (mm)	71	3	68.26	3.3795	-0.293	<0.771
S-AR (mm)	32	3	34.2	2.8067	6.47	<0.001
S-AR-GO(0)	143	5	136.24	5.6227	-9.401	<0.001
AR-GO-ME(0)	130	7	127.76	3.1594	12.44	<0.001
AR-GO-N (0)	53.5	1.5	52.82	1.62493	9.66	<0.001
N-GO-ME (0)	72.5	2.5	73.28	3.6029	3.37	<0.001
AR-GO mm	44	5	48.8	3.9331	7.91	<0.001
GO-ME (mm)	71	5	77.38	6.3628	4.64	<0.001
Jarabak %	63.5	1.5	63.7	1.9614	-11.16	<0.001
S-GO mm	77.5	7.5	74.88	3.8632	0.146	0.886
N-ME mm	112.5	7.5	116.66	4.9882	6.067	<0.001
Jarabak sum	396	6	390.1837	5.5139	7.48	<0.001

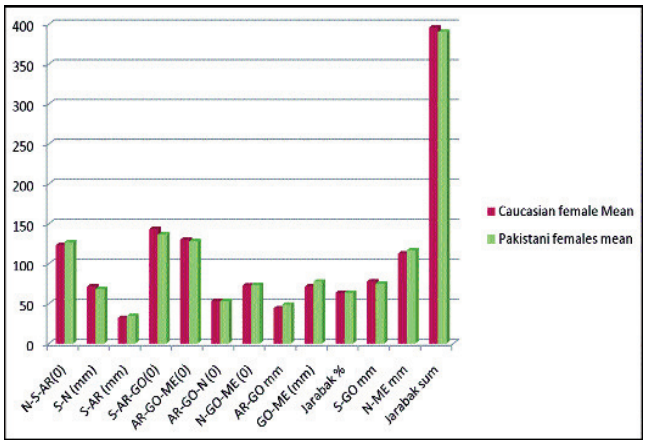

Figure-2: Comparison between Jarabak's analysis of Caucasian and Pakistani females.

cranial base, posterior cranial base, ramus height, anterior facial height, posterior facial height and mandibular corpus ($p<0.05$).

Similarly, the comparison between the Caucasian and Pakistani females revealed a statistically significant difference ($p<0.05$) in all parameters except the anterior cranial base (S-N) measurements and the posterior facial height measurements (S-GO) which showed no statistically significant difference between the two populations.

Of the significant values, the Pakistani mean for the measurement of articular angle, gonial angle and upper gonial angle were slightly larger compared to the Caucasian population. Those for the saddle angle, lower gonial angle, ramus height, posterior cranial base, anterior facial height, and mandibular corpus were slightly smaller than the values for the Caucasian population.

Discussion

The element of cephalometry for the dentist is of utmost importance and it forms an integral part of the diagnostic procedure that is followed by an orthodontist in treatment planning. When assessing these cephalometric radiographs, it has been found that not all human beings are alike and, in fact, differences exist between the facial characteristics of various racial groups.[20,22-24] This very clearly explains why the measurements that can be considered normal in one race cannot be applied to other racial groups as normal. Hence, it depends on each of the different ethnic groups to find out and establish their own norms in order to achieve the best possible treatment plan, leading to excellent results after treatment.

Most of the cephalometric analyses used in orthodontics are established within the Caucacian population. However, attempts have been made towards achieving norms in various ethnic groups like Americans,[25] Arabs,[26] Greeks,[27] Chinese,[28] Japanese[29] and others. There have been few studies to establish cephalometric norms of Pakistani population.[30-33] However, these studies do not include the Jarabak's analysis.

The results of the current study provide the norms for the Jarabak's analysis in Pakistani population. Since it is the first research to be conducted in evaluating the Jarabak's analysis, it cannot be compared with any of the previous researches. However, when comparing the results of the present study with international studies it can be seen that the measurements of the Pakistani population are unique and quite significantly different than the other races like the Caucasians,[24] Saudis[34] and Brazilians.[35]

The Pakistani population has been shown to exhibit significantly greater articular angle, gonial angle and

upper gonial angle compared to the Caucasians which is entirely opposite to the results of the Saudi population[34] where these three variables are significantly lower than the norms of the Caucasians. The Pakistani population has also been shown to have a slightly smaller saddle angle, lower gonial angle, ramus height, posterior cranial base, anterior facial height, and mandibular corpus compared to the Caucasian norms which is also different from the values obtained from the Saudi[34] and Brazilian[35] populations.

In terms of limitations of the current study, the sample size was not calculated and convenient sampling was employed.

Conclusion

Pakistani males and females have distinct craniofacial features compared to Caucasians. These distinct features should be considered when orthodontists and orthognathic surgeons set their treatment objectives.

References

1. Broadbent B. A new x-ray technique and its application to orthodontia. Angle Orthod 1931; 1: 45-86.
2. Riedel R. The relation of maxillary structures to cranium in malocclusion and normal occlusion. Angle Orthod 1952; 22: 142-5.
3. Steiner C. Cephalometrics for you and me. Am J Orthod 1953; 39: 729-55.
4. Steiner C. Cephalometrics in clinical practice. Angle Orthod 1959; 29: 8-29.
5. Tweed C. The FMPA in orthodontic diagnosis, classification, treatment, planning and prognosis. Am J Orthod Oral Surg 1946; 32: 175-230.
6. Tweed C. Evolutionary trends in orthodontics past, present and future. Am J Orthod 1953; 39: 81-108.
7. Ricketts R. The influence of orthodontic treatment on facial growth and development. Angle Orthod 1960; 30: 103-33.
8. Jacobson A. The wits appraisal of jaw disharmony. Am J Orthod 1975; 67: 125-38.
9. McNamara J. A method of cephalometric evaluation. Am J Orthod 1984; 86: 449-69.
10. Connor AM, Moshiri F. Orthognathic surgery norms for American black patients. Am J Orthod 1985; 87: 119-34.
11. Cotton WN, Takano WS, Wong WM. The Downs analysis applied to three other ethnic groups. Angle Orthod 1951; 21: 213-20.
12. Kuramae M, Magnani MBBA, Nouer DF, Ambrosano GMB, Inoue RC. Analysis of Tweed's facial triangle in black Brazilian youngsters with normal occlusion. Braz J Oral Sci 2004; 8: 401-3.
13. Flynn TR, Ambrogio RI, Zeichner SJ. Cephalometric norms for orthognathic surgery in black American adults. J Oral Maxillofac Surg 1989; 47: 30-9.
14. Naidoo LC, Miles LP. An evaluation of the mean cephalometric values for orthognathic surgery for black South African adults. Part 1: Hard tissue. J Dent Assoc S Afr 1997; 52: 495-502.
15. Huang WJ, Taylor RW, Dasanayake AP. Determining cephalometric norms for Caucasians and African Americans in Birmingham. Angle Orthod 1998; 68: 503-51110.
16. Bailey KL, Taylor RW. Mesh diagram cephalometric norms for Americans of African descent. Am J Orthod Dentofacial Orthop 1998; 114: 218-23.
17. Anderson AA, Anderson AC, Hornbuckle AC. Biological derivation of a range of cephalometric norms for children of African American descent (after Steiner). Am J Orthod Dentofacial Orthop 2000; 118: 90-100.
18. Dandajena TC, Nanda RS. Bialveolar protrusion in a Zimbabwean sample. Am J Orthod Dentofacial Orthop 2003; 123: 133-7.
19. Utomi IL. A cephalometric study of antero-posterior skeletal jaw relationship in Nigerian Hausa-Fulani children. West Afr J Med 2004; 23: 119-222.
20. Ajayi EO. Cephalometric norms of Nigerian children. Am J Orthod Dentofacial Orthop 2005; 128: 653-6.
21. Sheikh AJ, Alvi AR. Comparison of cephalometric norms of esthetically pleasing faces. J Coll Physicians Surg Pak 2009; 19: 754-8.
22. Kuramae M, Magnani MBBA, Boeck EM, Lucato AS. Jarabak 's cephalometric analysis of Brazilian black patients. Braz Dent J 2007; 18: 258-62. doi: 10.1590/S0103-64402007000300016.
23. Ahmad F, Naeem S, Asad S. Soft tissue profile of a Pakistani sample with class I occlusion. Pak Oral Dental J 2010; 30: 104-7.
24. Jarabak J, Fizzel J. Technique and Treatment with Light Wire Edgewise Appliances. 2nd ed. St Louis: Mosby; 1972.
25. Drummond RA. A determination of cephalometric norms for the Negro race. Am J Orthod 1968; 52: 670-82.
26. Bishara SE , Abdalla EM , Hoppens BJ. Cephalometric comparisons of dentofacial parameters between Egyptian and North American adolescents. Am J Orthod 1990; 97: 413-21.
27. Argyropoulos E, Sassouni V. Comparison of the dentofacial patterns for native Greek and American-Caucasian adolescents. Am J Orthod Dentofac Orthop 1989; 95: 238-49.
28. Cooke MS, Wei SHY. A comparative study of southern Chinese and British Caucasian cephalometric standards. Angle Orthodontist 1989; 59: 131-8.
29. Ioi H , Nakata S, Nakasima A, Counts A. Comparison of cephalometric norms between Japanese and Caucasian adults in antero-posterior and vertical dimension. Eur J Orthod 2007; 29 493-9.
30. Burki S, Faisal M. In search of normal facial profile. Pak Oral Dental J 2000; 20: 165-74.
31. Hamid W, Asad S. Prevalence of skeletal components of malocclusion using composite cephalometric analysis. Pak Oral Dental J 2003; 23: 137-44.
32. Hamid W, Asad S. Vertical reference plane: used to asses cephalometric features of a Pakistani sample. Pak Oral Dental J 2005; 25: 193-200.
33. Zaib F, Israr J, Ijaz A. Photographic angular analysis of adult soft tissue facial profile. Pakistan Orthod J 2009; 1: 34-9.
34. Talic NF, Al-Barakati SF. Cephalometric measurments of a Saudi adult sample according to Jarabak's analysis. Pak Oral Dental J 2009; 29: 281-6.
35. Kuramae M, Magnani MBBDA, Boeck EM, Lucato AS. Jarabak's Cephalometric Analysis of Brazilian Black Patients. Braz Dent J 2007; 18: 258-62.