

SKELETAL FEATURES OF ANTERIOR OPEN BITE: A CROSS SECTIONAL STUDY

¹MUHAMMAD BURHAN HAYAT

²MUHAMMAD AZEEM

³ARSHAD MEHMOOD

⁴WAHEED UL HAMID

ABSTRACT

The objective of this study was to find out the skeletal features of Anterior Open Bite (AOB) by cephalometric analysis. This cross sectional study was conducted at Department of Orthodontics, de, Montmorency College of Dentistry, Lahore in which records of fifty untreated AOB patient with age range of 15 to 25 (23 Males, 27 Females) were included and patients were considered as having skeletal AOB when SN-MP angle was ≥ 32.5 degree. The results showed significantly increased values of linear and angular measurements. It was concluded that open bite malocclusion is largely due to the changes in the skeletal pattern.

Key Words: Anterior open bite; Skeletal; SN-MP.

INTRODUCTION

Anterior open bite (AOB) is an absence of vertical overlapping between upper and lower anterior teeth when the teeth are in centric occlusion.¹ There are various causes of this malocclusion, including thumb sucking, tongue thrusting, temporal joint involvement, and amelogenesis imperfecta.^{2,3} Link between cervical vertebral column morphology and craniofacial posture in cause of AOB is already proven.⁴ Different treatment methods to correct AOB have been reported.⁵⁻¹⁰

Another term used in describing AOB is apertognathia.¹¹ Open Bite malocclusion is classified as dental or skeletal, anterior or posterior and unilateral or bilateral. It may classify as simple or complex.¹² The implication of an AOB irrespective of its cause include aesthetic issues, speech and phonetic issues, lingual interposition during deglutition and difficulty in biting from front teeth.^{13,14} Severity grades of AOB are: Mod-

erate (0-2 mm), Severe (3-4 mm) and Extreme (more than 4 mm).¹⁵

The craniofacial morphology of orthodontic patients with skeletal AOB is characterized by vertical disproportions in vertical plane caused by imbalance between anterior and posterior facial heights (AFH/ PFH) and between upper and lower anterior facial heights (UAFH/ LAFH). A decreased size of ramus, increased mandibular plane, large LAFH and a steep gonial angle are key features of high vertical skeletal pattern.

Cephalometric standards are available for different AOB samples.¹⁶⁻²⁰ Very few reported attempts have so far been made to study skeletal characteristics of AOB individuals in Pakistani population; therefore objective of this study was to evaluate the morphologic characteristics of skeletal open bite in Pakistani orthodontic patients and to establish population norms of facial patterns for AOB sample.

METHODOLOGY

This study was conducted after taking informed consent from patients and institutional approval at the Department of Orthodontics, de, Montmorency College of Dentistry, Lahore. Fifty Cephalometric radiographs of untreated AOB patients (23 males, 27 females) who visited department of Orthodontics, during May 2016 to May 2017 were included.

Inclusion Criteria: All teeth present except wisdoms, patients with AOB as evident on clinical examination (Fig 1). Good quality Pre-treatment records. Age Range: 15- 25 years.

¹ Muhammad Burhan Hayat, BDS, Postgraduate Trainee Orthodontics, de, Montmorency College of Dentistry, Lahore, Pakistan. Email: burhanhayat@hotmail.com Cell: +92-3454741578

² Muhammad Azeem, BDS, FCPS, Assistant Professor Orthodontics, Health Department Government of Punjab, Lahore Email: dental.concepts@hotmail.com Cell: +92-3458409007

For Correspondence: Dental Concepts, 25-E-2, Main Road, Wapda Town, Lahore. Email: dental.concepts@hotmail.com Cell: +92-345-8409007

³ Arshad Mehmood, BDS, Resident Orthodontics, de, Montmorency College of Dentistry, Lahore Email: kidcooo@gmail.com

⁴ Waheed ul Hamid, MS, MOrtho, MCPS, BDS, Principal & Head of Orthodontics, de, Montmorency College of Dentistry, Lahore Email: de_montmorency@hotmail.com

Received for Publication: July 3, 2017

Revised: July 15, 2017

Approved: July 15, 2017

Exclusion Criteria: Craniofacial syndromes, history of trauma and any systemic or metabolic disease.

The cephalometric radiographs of the study sample were traced on .003 inches thick and 8 by 10 inch acetate paper with 4h lead pencil. Cephalometric landmarks used were identified and reference planes were drawn on tracing of lateral cephalogram. Linear and angular measurements were recorded for individual patients. The amount of AOB was confirmed by measuring interincisal distance with standardized digital vernier callipers on plaster models. Dental history sheets were used to rule out any systemic disease and history of dental trauma.

Following skeletal linear measurements/Angular measurements were taken (Fig 2).

Posterior face height: Sella to gonion.

Anterior face height: Nasion to menton.

Upper face height: Nasion to Anterior nasal spine.

Lower face height: Anterior nasal spine to menton.

SN-MP: Angle formed by the sella nasion line and mandibular plane.

Gonial Angle: Angle formed by the posterior border of ramus of mandible (Ramal plane) and the mandibular plane.

SN-PP: Angle formed by the sella nasion line and palatal plane.

PP-MP: The angle formed by the palatal plane and the mandibular plane.

Statistical Analysis

The data were analyzed in Statistical Package for the Social Sciences software package (SPSS) 19. The descriptive statistics for cephalometric measurements included arithmetic means, mode, minimum, maximum,

standard deviation and range for all the quantitative measurements. Males and female values were also compared by using the independent Student's t-test.

RESULTS

The mean measurement of anterior open-bite in the sample was 2.71 mm with the range of 1.5 to 7 mm. It was found that the males in general had similar mean linear and skeletal cephalometric values as compared to females in the study sample.

Mean value of SN-MP was 45.45 of SN-PP was 8.80, PP-MP was 34.60 and gonial angle was 133.30, PFH was 82.50 and AFH was 130.00. (Table 1 & 2)

(Anterior face height: Nasion (N) to menton (Me), **Upper face height:** Nasion to Anterior nasal spine (ANS), **Lower face height:** Anterior nasal spine to menton.)

DISCUSSION

Without a population cephalometric norm, the use of cephalometric analysis to diagnose and manage orthodontic cases with dentofacial issues is limited, as these norms are required to determine the normality, abnormality, site and extensions of dentofacial deformity for that particular population group. There have been many studies of different population group showing that skeletal and dental patterns can, and do, vary.

Richardson²¹ concluded that there was significant greater lower facial height (LFH) and increased mandibular plane angle in AOB patients. He found that the etiology of AOB from seven to ten years of age is slow vertical development of upper facial part and increased LFH, combined with lack of development of dento-alveolus. He believed that, with catch up growth of face will self correct itself but that vertical develop-

TABLE 1: SKELETAL MORPHOLOGIC STRUCTURE OF AOB (LINEAR MEASUREMENTS)

Cephalometric Norm	Minimum	Maximum	Mean ± SD	Mode	Median
PFH	71.01	95.40	82.50±5.50	75.40	81.00
AFH	116.0	141.0	130.0±6.06	141	129.50
UFH	51.03	66.06	57.33±5.22	54.40	54.50
LFH	54.00	81.00	73.80±4.50	67.56	72.20
PFH/AFH ratio	55.66	68.99	63.33±3.60	64.40	64.50
UFH/LFH ratio	65.66	89.90	77.76±5.77	81.50	77.00

TABLE 2: SKELETAL MORPHOLOGIC STRUCTURE OF AOB (ANGULAR MEASUREMENTS)

Cephalometric Norm	Minimum	Maximum	Mean ± SD	Mode	Median
Gonial Angle	122.00	145.00	133.30±6.06	133.0	133.0
SN-PP	6.00	15.00	8.8±2.20	9.0	9.0
PP-MP	27.00	31.00	34.60±5.30	33.0	33.0
SN-MP	35.00	55.00	45.50±5.57	44.0	44.0



Fig 1: Patient with AOB.

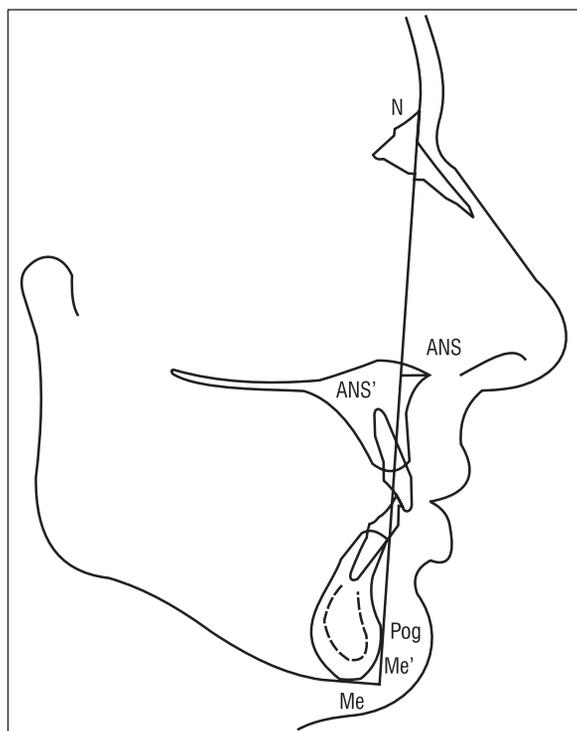


Fig 2: Cephalometric landmarks for facial height measurement.

ment of the dento-alveolus will never catch up. There it seems that anterior open bite may be attributed to both skeletal and dento-alveolus discrepancies.

Findings are difficult to compare and contrast; in part, because of different methodologies, age differences of sample, interexaminer variations, and the different sample sizes. The results of this study revealed that males in general had similar mean linear and skeletal cephalometric values as compared to females in the study sample; this is in contrast to the findings of certain studies, where gender differences were found.^{22,23} Mean values were SN-MP 45.45°, SN-PP 8.80°, PP-MP 34.60°, gonial angle 133.30°, PFH 82.50° and AFH 130.0°. Comparing the values of vertical analysis with international studies on Caucasian population we found higher values of all the skeletal linear measurements.

Ratios of PFH to AFH and UFH to LAFH also confirmed that LFH and TFH is more in our population than the Caucasian population. Comparing the values of vertical analysis with local study we found similar values of all the skeletal vertical measurements.²² The MPA, Gonial and PP-MP angle are larger in our AOB cases and these results are in accordance with Cangialosi²⁴ and Nahoum.²⁵

The limitation of this study is small sample size; further large scale studies are suggested. We did not investigate etiological causes of AOB. We will focus on these aspects in the future studies.

CONCLUSION

The results showed significantly increased values of linear and angular measurements in AOB patients. It was concluded that open bite malocclusion is largely due to the changes in the skeletal pattern.

REFERENCES

- 1 Ng CS, Wong WK, Hagg U. Orthodontic treatment of anterior open bite. *International Journal of Paediatric Dentistry*. 2008 Mar 1;18(2):78-83.
- 2 Huang GJ. Giving back to our specialty: Participate in the national anterior open-bite study. *American journal of orthodontics and dentofacial orthopedics: official publication of the American Association of Orthodontists, its constituent societies, and the American Board of Orthodontics*. 2016 Jan;149(1):4.
- 3 Ngan P, Fields HW. Open bite: a review of etiology and management. *Pediatric dentistry*. 1996 Dec;19(2):91-98.
- 4 Kim P, Sarauw MT, Sonnesen L. Cervical vertebral column morphology and head posture in preorthodontic patients with anterior open bite. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2014 Mar 31;145(3):359-66.
- 5 de Menezes LM, Ritter DE, Locks A. Combining traditional techniques to correct anterior open bite and posterior crossbite. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2013 Mar 31;143(3):412-20.
- 6 Woodside DG, Linder-Aronson S. Progressive increase in lower anterior face height and the use of posterior occlusal bite-block in its management. *Orthodontics: State of art, essence of the science ed*. St. Louis: Mosby Co. 1986:209.
- 7 Alcan T, Keles A, Erverdi N. The effects of a modified protraction headgear on maxilla. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2000 Jan 31;117(1):27-38.
- 8 Küçükkeles N, Acar A, Demirkaya AA, Evrenol B, Enacar A. Cephalometric evaluation of open bite treatment with NiTi arch wires and anterior elastics. *American journal of orthodontics and dentofacial orthopedics*. 1999 Nov 30;116(5):555-62.
- 9 Kim YH. Anterior openbite and its treatment with multiloop edgewise archwire. *The angle orthodontist*. 1987 Oct;57(4):290-321.
- 10 Park YC, Lee HA, Choi NC, Kim DH. Open bite correction by intrusion of posterior teeth with miniscrews. *The Angle Orthodontist*. 2008 Jul;78(4):699-710.
- 11 Ize-Iyamu IN, Isiekwe MC. Prevalence and factors associated with anterior open bite in 2 to 5 year old children in Benin city, Nigeria. *African health sciences*. 2012;12(4):446-51.
- 12 Ireland AJ, Mc Donald F. *Treatment and biomechanics oxford*, Great Britain: Oxford university press; 2003: 52.

- 13 Maciel CT, Leite IC. Etiological aspects of anterior open bite and its implications to the oral functions. *Pro-Fono Revista de Atualizacao Cientifica*. 2005 Dec;17(3):293-302.
- 14 Chung CJ, Hwang S, Choi YJ, Kim KH. Treatment of skeletal open-bite malocclusion with lymphangioma of the tongue. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2012 May 31;141(5):627-40.
- 15 Mizrahi E. A review of anterior open bite. *Br J orthod* 1978; 5:21-27.
- 16 Congialosi TJ. Skeletal morphologic features of anterior open-bite. *Am J Orthod* 1984; 85(1): 28-36.
- 17 Sasso A, Nakane MA, Sasso MB. Cephalometric Evaluation of patients with anterior openbite. *Braz Dent J* 2000; 11(1): 35-40.
- 18 Kao CT, Chen FM, Lin TY, Peng CH, Huang TH. The morphologic structure of the open-bite in adult Taiwanese. *Angle Orthod*. 1996; 66(3): 199-206.
- 19 Isiekwe M. The measurements of anterior and posterior facial heights in a Nigerian population. *Afr Dent J* 1993; 8: 1-6.
- 20 Tsang WM, Cheung LK, Samman N. Cephalometric characteristics of anterior open bite in a southern Chinese population. *Am J Orthod Dentofac Orthop*. 1998; 113(2): 165-72.
- 21 Richardson A. Facial growth and the prognosis for anterior openbite: a longitudinal study. *Trans Eur Orthod Soc* 1971; 149-57.
- 22 Cheema JA, Hameed WU. The skeletal morphologic structure of openbite in adult Pakistani sample. *Pakistan Oral and Dental Journal*. 2014 Jun 30;34(2):304-09.
- 23 Tsang WM, Cheung LK, Samman N. Cephalometric characteristics of anterior open bite in a southern Chinese population. *Am J Orthod Dentofac Orthop*. 1998; 113(2): 165-72.
- 24 Congialosi TJ. Skeletal morphologic features of anterior open-bite. *Am J Orthod* 1984; 85(1): 28-36.
- 25 Nahoum HI. Vertical proportions and the palatal plane in anterior open-bite. *Am J Orthod* 1971; 59(3): 273-82.

CONTRIBUTIONS BY AUTHORS

- 1 Muhammad Burhan Hayat:** Title, abstract, & approved the final version.
- 2 Muhammad Azeem:** Corresponding author, conceiving and designing the study, data recording, analysis and interpretation of data
- 3 Arshad Mehmood:** Analysis and interpretation of data.
- 4 Waheed Ul Hamid:** Main supervisor, critically reviewed the manuscript & final editing

CORRIGENDUM

Reference article on "Oral Hygiene of Orthodontic patients (Vol. 37, June 2017) read:
 Page 279 Methodology 5th line males 35
 Page 282 author number 2, Rabia Awan