CEPHALOMETRIC GENDER DIFFERENCE IN THE YOUTH OF KHYBER PAKHTUNKHWA

[1]TALLAT FIRDOS
[2]NIDA MURAD
[3]SHAHAB ADIL
[4]TAYYAB KHALILY

ABSTRACT

The objective of this study was to determine the gender difference in the craniofacial relationship of skeletal, dental and soft tissue components in the youth of Khyber Pakhtunkhwa. The population of the study consisted of students of Khyber College of Dentistry (KCD) Khyber Pakhtunkhwa (KP). The study sample consisted of 50 lateral cephalometric x-rays of KCD students having age range 18-25 years. The lateral cephalograms of 25 males and 25 females were analyzed by two assessors using independent t sample test in SPSS version 19. The results showed gender differences in some variables. When assessed for length of maxilla, mandible and cranial base, females were observed to have smaller linear measurement in comparison to males. In male group, increased posterior facial height and decreased gonial angle values were observed which point out towards the solid and broader mandible in comparison to slender one in females. Concluding the gender difference in this study, the males were found to have greater linear (sagittal and vertical) values as compared to females, with slightly more prominent upper lip in female population.

Key Words: *Cephalometry, Linear Measurement, Angular Measurement, Soft tissue analysis, Gender differences.*

INTRODUCTION

The cephalometric radiograph has important role in orthodontic diagnosis and planning since its introduction by Broadbent (1931).[1,2] It is extensively used to study the facial morphology that support orthodontic diagnosis and treatment planning. Correct cephalometric analysis needs reference values obtained from same ethnic, gender and age population of orthodontic patients.[3] This study also correlates with the above statement to determine the useful cephalometric values for both genders of same age and population.

Apart from orthodontic diagnosis it is ideal view for COGS analysis prior to orthognathic surgery, sex and stature determination for forensic and anthropological studies, as it provides all anatomic landmarks on single radiograph.[4] The most challenging task in orthognathic surgery is to establish the normality in surgically altered bone and soft tissues.[4] Orthognathic surgery utilizes the cephalometric norms to achieve ideal results for both genders.[5] Cephalometric norms are determined for both genders via COGS analysis which is readily transformed to study case for mock surgery.[6] It is considered most reliable, given their objectivity, reproducibility and statistical value.[7]

Recognition and identification of gender from anthropological and forensic point is important aspect of cephalometry.[8] Apart from pelvis, skull exhibits higher sexual dimorphism in human body.[9] Sexual dimorphism becomes apparent by the age of 14 years in most of skeletal but not dental aspects.[10] Other study narrated that most of skeletal maturity is achieved by the age of 25 years. An average of 5-9% larger measurements has been recorded in craniofacial complex of males than females using standard lateral cepahalometry.[11] The equipment required for lateral cephalometric radiograph is easily available and technique is cost effective, easy to perform with effective results. It can also be implemented in any special training for examination.[12]

Current concepts in orthodontic diagnosis and treatment planning focus on the harmony of various facial features.[13] Treatment goals are geared towards the achievement of an overall facial balance.[14]

[1] Tallat Firdos, BDS, MCPS, Professor of Orthodontics, Peshawar Dental College (KP), Riphah International University
[2] Nida Murad, BDS, FCPS, Assistant Professor of Oral and Maxillofacial Surgery
[3] Shahab Adil, BDS, FCPS, Assistant Professor of Orthodontic
[4] Tayyab Khalily, BDS, Senior Lecturer Orthodontic, Khyber College of Dentistry (KP) **Correspondence:** Prof Dr Tallat Firdos, Principal, Dean Peshawar Dental College, Warsak Road, Peshawar, Khyber Pakhtunkhwa Email: tallatfirdos@gmail.com Cell: 0321-902-9630, 091-5202264,

Received for Publication: May 19, 2016
Revised: June 13, 2016
Accepted: June 14, 2016

Looking to the above benefits of lateral Cephalometry, the present study was undertaken to evaluate the role of cephalometric radiograph in identification of standard values relating craniofacial complex of both genders at Khyber College of Dentistry, Khyber Pakhtunkhwa. This study is not only useful for orthodontic purpose but also important from Forensic, Anthropological and Orthognathic surgery point of view.

METHODOLOGY

The study was conducted at department of Orthodontics, KCD under supervision of two orthodontists from the faculty. The study sample consisted of fifty selected and thoroughly evaluated cephalometric radiographs (25 male/25 female). The chosen age range was 18-25 years. The study sample consisted of Pakistani citizens belonging to students of KCD Khyber Pakhtunkhwa. The present study was carried out to find out craniofacial differences in male and female adults of KP.

Inclusion criteria for selection

- Healthy and attractive appearance with good to excellent smile.
- Normal occlusion, with Full complement of teeth, inter digitating in class one occlusion.
- No previous orthodontic treatment.
- No skeletal and dental abnormalities.
- Normal to/mild crowding of both dental arches.

The exclusion criteria for selection;

- History of trauma.
- History of Surgery.
- Syndromes (e.g. Down syndrome, Treacher Collin syndrome etc.)

This study was conducted after the approval from the institutional ethical committee. The written informed consent was obtained from the concerned participants. Lateral cephalograms were obtained for all the subjects with teeth in centric occlusion, lips relaxed, cephalostat support and ear rods positioned. All films were traced for relevant landmarks by two assessors. Linear and angular parameters for skeletal, dental and soft tissues were recorded for both genders. Skeletal, dental and soft tissue variables were used to compare gender difference as explained in Table 1, Table 2 and Fig 1.

Data collected was analyzed using SPSS version 19.0 (IBM SPSS). Student's T test was applied to independent (Gender) and dependent (other than Genders) variables to calculate mean and SD with 95% confidence.

TABLE 1: LINEAR AND ANGULAR CEPHALOMETRIC VARIABLES

Points / Landmark		Description
S	Sella	Center of Sella Turcica
N	Nasion	Anterior limit of naso-frontal suture
Ba	Basion	Posterior inferior point of occipital bone
ANS	Anterior nasal spine	Apex of ANS
PNS	Posterior nasal spine	Apex of PNS
A point	Subspinale	Deepest point on the concave border of maxillary alveolar process
B point	Supramentale	Deepest point on the outer contour of mandibular alveolar process
Pog	Pogonion	Most anterior point on symphysis
Me	Menton	Most Inferior point on symphysis
Go	Gonion	Most posterior and lower point on angle of mandible
Ar	Articulare	Point of intersection of external contour of mandibular condyle of the temporal bone to the base of skull
Gn	Gnathion	The most anterior inferior point on bony chin
a p max		Anterior most point of maxilla
a p mand		Anterior most point of mandible
Planes		
SN plane	Sella Nasion plane	A plane joining Nasion to Sella
SeN plane	Sella entrance to Nasion plane	A plane joining Nasion to Sella entrance
MP	Mandibular plane	A tangent joining Me to lower border of mandible
PP	Palatal plane	A plane joining ANS and PNS
FOP	Functional occlusal plane	A plane passing through intercuspation of molars and premolars
Y- Axis		A plane joining Sella and Gnathion
E-plane		Soft tissue line joining tip of the nose to chin

TABLE 2: LINEAR AND ANGULAR MEASUREMENTS

I. Skeletal Analysis	Land Marks	Description
Sagittal analysis		
CBA	Ba S N	Cranial base angle
SNA	S N A	Angle between SN plane and N A plane
SNB	S N B	Angle between SN plane to N B plane
ANB	A N B	(Difference of angle SNA and SNB)
Vertical analysis		
Inclination angle	N' ⊥PP	⊥ from Sella entrance nasion line at N` to palatal plane
Gonial angle	Ar Go Me	Angle between Articulare, Gonion and Menton
Y axis	N S Gn	Angle from N to Y axis
Ratio for facial heights		
PFH to TAFH	S- Go N -Me	Posterior facial height to total anterior facial height
LAFH to TAFH	ANS- Me N - Me	Lower anterior facial height to total anterior facial height
Linear measurements		
AO-BO distance(Witt's value)	A⊥FOP B⊥FOP	Perpendicular dropped from A and B points on functional Occlusal plane and distance measured Distance from Se to N (mm)
Anterior cranial base length	Se-N	Distance from a p mandible to Go (mm)
Mandibular length	a p mandible	Distance from apmaxilla to Posterior nasal spine (mm)
Maxillary length	apmaxilla	
Dental analysis		
UI-SN line	Upper incisor to SN line	Long axis of Upper incisor to Sella Nasion angle
IMPA	Lower Incisor to mand. plane	Long axis of lower incisor to mandibular plane angle (Go-Me)
IIA	Upper and lower incisors	Angle between the long axis of upper and lower teeth
Soft tissue analysis		
UL-Eline	Upper lip to Esthetic line	Soft tissue nose –chin line called Esthetic (E-line)
LL-Eline	Lower lip to esthetic line	Distance of upper and lower lip from E line
NL angle	Naso labial angle	Base of the nose to most prominent point on the upper lip

RESULTS

The statistical difference for cephalometric skeletal (angular and linear), dental and soft tissue analysis for gender was expressed in mean and standard deviation with 95% confidence level.

Angular measurements for both genders

It was found that maxillary and mandibular protrusion relative to anterior cranial base (SNA and SNB) for males was 82°±3.81° and 79°±3.76° and for females was 81°±3.85° and 78°±3.24° respectively. Maxillo-mandibular relation (ANB) in males and females was recorded as 2.20°±1.57° and 2.80°±1.32° respectively. Vertical analysis via inclination angle was (85.68°±1.012°), gonial angle (119.20°±3.61°) and Y axis (67.36°±3.38°) in males, while in female it was (82.75°±1.001°), (121.2°± 4.40°)and (67.88°± 3.96°)respectively. (Table 3)

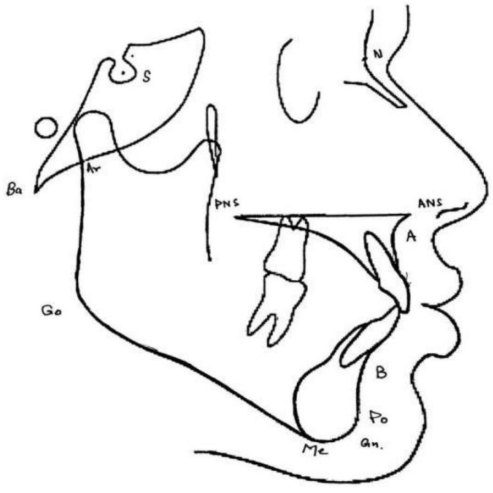

Fig 1: Cephalometric variables

TABLE 3: ANGULAR MEASUREMENTS FOR BOTH GENDERS

	Gender	N	Mean	Std. Deviation
Cranial base angle	Male	25	129.32°	5.097°
	Female	25	131.36°	4.803°
SNA	Male	25	81.84°	3.815°
	Female	25	81.28°	3.285°
SNVB	Male	25	79.20°	3.764°
	Female	25	78.00°	3.240°
ANB	Male	25	2.20°	1.5745°
	Female	25	2.80°	1.3235°
Inclination angle	Male	25	85.68°	1.012°
	Female	25	82.75°	1.001°
Gonial Angle	Male	25	119.20°	4.546°
	Female	25	121.28°	4.402°
Y Axis	Male	25	67.36°	3.377°
	Female	25	67.88	3.961°

TABLE 4: LINEAR MEASUREMENTS FOR BOTH GENDERS

	Gender	N	Mean	Std. Deviation
WITTS value	Male	25	1.00 mm	1.3454 mm
	Female	25	-0.06 mm	1.2172 mm
SN length	Male	25	69.40 mm	3.041 mm
	Female	25	65.12 mm	2.603 mm
Mandibular length	Male	25	74.96 mm	4.587 mm
	Female	25	69.80 mm	4.272 mm
Maxillary length	Male	25	51.12 mm	3.219 mm
	Female	25	47.12 mm	1.900 mm
Height of Ramus	Male	25	58.84 mm	4.269 mm
	Female	25	50.40 mm	5.212 mm
Posterior facial height ratio	Male	25	72.12 mm	4.952 mm
	Female	25	68.36 mm	4.462 mm
Lower facial height ration	Male	25	56.92	3.378
	Female	25	55.00	2.041

TABLE 5: DENTAL ANALYSIS FOR BOTH GENDERS

	Gender	N	Mean	Std. Deviation
Upper Incisal	Male	25	107.48°	5.092°
	Female	25	108.04°	4.420°
IMPA	Male	25	99.64°	5.567°
	Female	25	102.52°	5.672°
IIA	Male	25	119.60°	5.041°
	Female	25	122.88°	5.659°

TABLE 6: SOFT TISSUE ANALYSIS FOR BOTH GENDERS

	Gender	N	Mean	Std. Deviation
Upper lip E line	Male	25	4.60 mm	1.756 mm
	Female	25	3.60 mm	1.528 mm
Lower lip E line	Male	25	3.96 mm	1.925 mm
	Female	25	3.16 mm	1.463 mm
Nasolabial angle	Male	25	97.64°	9.456°
	Female	25	93.80°	6.311°

Linear measurement for both genders:

In males the mandibular and maxillary base lengths were 74.96±4.58mmand 51.12±3.12mm respectively while in female group it was recorded as 69.80±4.27mm and 47.14mm respectively. Anterior cranial base length in males was 69.40±3.04mm and in female group was 65.12±2.63mm.

Witt's value for males was 1±1.34mm and females -0.06±1.21mm. Facial heights were also recorded for both genders and it was found that PFH ratio to TAFH for male and female was 72.12±4.95 and 68.36±4.46 respectively. Ratio of Lower facial height to TAFH for males and females was recorded as 59.92±3.37 and 55.00±2.04. (Table 4)

Dental analysis for both genders

Upper and lower incisor proclination with respect to maxillary and mandibular bases in males were 107°±5.09° and 99.64°±5.56° respectively, while those in females were 108.14°±4.20° and 102°±5.67°. Interincisal angle in males was 119°±5.04° and in females were recorded as 122°±5.65°. (Table 5)

Soft tissue analysis for both genders

The upper and lower lip prominence with respect to esthetic line (E line) in males were 4.60±1.75mm and 3.96±1.92mm, while in female it was 3.60±1.52mm and 3.16±1.43mm. Nasolabial angle in male and female group was found to be 97.64°±9.45° and 93.80°±6.31° respectively. (Table 6)

Gender differences:

Males and females presented with straight profiles having non-significant maxillary and mandibular dysplasia. In general anterior cranial base (Se-Na), maxillary (a p maxilla-PNS), and mandibular (a p man-Go) dimensions in male group were found larger than female group. Facial heights (PFH, TAFH, and LAFH) were also apparently larger in males than female group. The dental analysis of both groups showed proclination of upper and lower incisors. Inter incisal angle was statistically reduced in both groups showing proclination of teeth relative to their bases. Naso labial angle in males showed straight upper lip while in females mild prominence was present in upper lip.

DISCUSSION

This is first cephalometric study conducted at Peshawar KP for gender differences. The results describe the craniofacial differences of esthetically pleasing faces with normal occlusion, between male and female groups using independent student's t sample test. Most of the angular measurements showed no significant gender difference and it is consistent with the findings of Yoeng[10] and John[13] which shows the same results. Although the study on Afro-Caucasians adults showed that males had greater maxillary and mandibular protrusion when compared to females.[11]

The study conducted in Indian females exhibited greater mandibular protrusion and retrusive chin.[7] One of the study conducted in Pakistani population by Attiya and colleagues[15] showed bimaxillary protrusion with prominent chin in males which is contradicting the findings in this study. No statistically significant difference was found among Chinese males and females for skull base, SNA and SNB and it correlates well with our study.[16]

In the present study the linear measurements in females were smaller than in males (cranial base, mandibular corpus, and maxillary base lengths). Facial height ratio was also reduced in female group (PFH, LAFH and TAFH). The study conducted by Budai and his colleagues[14] also had similar findings. The results of Attiya and Alvi[15] also revealed greater linear measurements in males. It is to be expected since males are in general larger than females.[11]

The study of Uysal and Basciftci[17] has showed no significant difference between both genders. Abilasha and colleagues[12] had shown different results and they claim that central Indian females had greater upper facial heights, anterior facial height, and posterior facial heights and greater ramal and mandibular corpus length. But the study of Sisman[18] had different findings which is coherent to this study. He has shown that PFH, TAFH and maxilla-mandibular base lengths were significantly larger in males.

Dental analysis in current study showed proclined incisors relative to maxillary and mandibular bases which is further confirmed with reduced inter-incisal angle in both genders. The findings of Uysal and Colleagues[19] and the results of Basciftci[20] and Wu Ju[21] also agree to this current study. The Yoeng[10] also showed that lower incisor was less protrusive in males relative to mandibular plane.

Results of Thilander,[22] Rogers,[23] and Franklin,[24] have consistent findings regarding soft tissue analysis in both genders. In the present study there was straighter upper lip in males while females had mild procumbency. This also correlates well with the study of Yoeng.[10] however the study of Fouad and colleagues[25] found no statistically significant sexual dimorphism in dental and soft tissue analysis. Results of Sahar[26] showed bimaxiliary lip protrusion which is supporting this study.

The data provides useful information regarding male and female craniofacial morphology. It also provides the relevant cephalometric values for both genders which is important for orthodontic treatment planning and taking decision for proceeding with camouflage or orthognathic surgical procedures. The data information can also be utilized to identify a mutilated body for its gender.

ACKNOWLEDGMENTS

We are thankful to Western International and Panoroma Diagnostic Center for their support in obtaining and synthesizing data for the present study. The co-operation of the staff of KCD is also appreciated.

Ethetical consent

Informed consent was obtained from each subject, after approval of institutional ethical committee.

REFERENCES

1 Al-Jasser NM. Cephalometric evaluation of craniofacial variations in normal Saudi population according to Steiner analysis. Saudi Med J, 2000; 21: 746-50.

2 Alam MK, Basri R, Purmal K, Sikder MA, Saifuddin M, Iida. Cephalometric evaluation for Bangladeshi adult by Steiner analysis. International Medical Journal. 2012; 19: 262-65.

3 Arlia E, Adi H, Koesoemahardja D. Differences of lateral cephalometry values between Austrlo-Melanesian and Deutro-malay races. Indonesia Dent J 2013; 20: 9-14.

4 Trivedi K, Singh S, Patel B. Analysis of cephalometry for orthognathic surgery to determine norms applaid to Rajistani population. Nati J Of Max Fax Surg 2010; 1: 102-7.

5 Alam M, Basrin R, Enadul M. Cephalometric analysis for orthognathic surgery (COGS) for Bangladeshi population. Int Med J 2013; 2: 345-48.

6 Sreedhara S, Sashi GM, Naik P. Hard tissue cephalometric norms for Orthognathic surgery in Karnataka population 2015; 7: 143-47.

7 Lim JV. Steiners cephalometric analysis for Filipino students aged 16-25 years. Phil J Orthod 2000; 1: 23-34.

8 Kranioti EF, Iscan MY, Mischl M. Cephalometric analysis of the modern Cretan population. Forensic Sci Int 2008; 180-110-15.

9 Oleveiri F, Tinco R, Junoir D, Sayuri A, Silvi D, Paranhos R. Sexual dimorphism in brazilian human skulls: Discriminant Function Analysis. JFOS 2012; 30: 26-33.

10 Yoeng P, Huggare J. Morphology of Singapore Chinese males and females. Eur J Othod. 2004; 26: 605-12.

11 Guilharm J, Camila LQ, Arnaldo P, duardo J, Marcas. Craniofacial characteristics of Caucasians and afro-Caucasians Brazilians subjects with normal occlusion. J Appl Oral Sci 2011; 19: 118-24.

12 Abilasha O, Rajiv M, Kiran H, Abhay N. Cephalometric norms for central Indian population using burrstone and legan analysis. Ind J Dental Res 2011; 229: 28-33.

13 John YC, Ricky WK. Modified Bjork Analysis of lateral head radiograph of southern Chinese. Anthropology J 2009; 2: 40-47.

14 Budai M, Farkas LG, Tompson B, Katik M, Forrest CR. Realtion between anthropometric and cephalometric measurements and proportions of face of healthy white adult male and female. J Craniofac surg 2003; 14: 154-61.

15 Shaikh A, Alvi R. Comparison of cepahlometric norms of esthetically pleasant faces. J CPSP 2009; 19: 754-58.

16 Wu Ju, Hagg U, Rabie Ab. Chinese norms of Macnamara Analysis. Angle Orthod 2007; 77: 12-20.

17 Uysal T, Yaqci A, Bascifiti A. Comparison of soft tissue norms between Turkish and Europeon American adult. J Sci World 2013; 1: 1-6.

18 Sisman Y. Standards of soft tissue Arnett analysis for surgery planning in Turkish adults. Eu J of Orthod 2009; 31: 449-56.

19 Uysal T, Baysal A, Yaqci A, Sigler M. Macnamara analysis. Ethnic differences in soft tissue profile of Turkish and Europeon American young adults with normal occlusion and balanced face. J Of Orthod 2012; 34: 296-301.

20 Basciftci FA, Uysal T, Buyukerkman A. Craniofacial structure of Anatolian Turkish adults with normal occlusion and balanced face. Am J Orthod Dentofac Orthop. 2004; 125: 366-72.

21 Wu Ju, Hagg U, Pancherz H, Wong R, Colman M. Chinese and Caucasian norms of Pancherz cephalometric sagittal and vertical occlusal analysis. Am J Orthod Dentofac Orthop 2009; 22: 16-20.

22 Thilander B, Persson M, adolfsson U. Roentogen-Cephalometric standards for Swedish population. The longitudional study between ages of 5-31 years. Eur J Orthod 2005; 27: 370-89.

23 Rogers TL. Determination of sex of human through cranial morphology. J Forensic Sci 2005; 50: 493-500.

24 Franklin D, Freedman L, Malin N. Sexual dimorphism and discriminant function sexing in indigenous South African Crania Homo 2005; 55: 213-28.

25 Fouad A, Yehia M, Rizk A, Tannir ML, Farah A, Hamadeh G. Forensic norms of female and male Lebanese adults. J Forensic Odontol stomatol 2008; 27: 18-23.

26 Sahar F. Soft tissue facial profile of adult Saudis. Lateral cephalometric analysis. Saudi Med J 2011; 32: 836-42.

CONTRIBUTIONS BY AUTHORS

1 Tallat Firdos:	Conception and design of research, overall supervision of the article.
2 Nida Murad:	Data synthesis and article writing.
3 Shahab Adil:	Data collection, analysis and final results.
4 Tayyab Khalily:	Active participation in data collection.