Original Article

Cephalometric Norms for Population of Khyber Pakhtunkhwa Province - A Pilot Study

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ABSTRACT

Objective: This study was carried out to determine normal cephalometric values for the population i.e., Pathan descent presented at dental colleges of Peshawar, Pakistan.

Study Design: Prospective / cross-sectional study

Place and Duration of Study: This study was conducted at the carried out at dental colleges of Peshawar, Pakistan from Feb 2018 to Feb 2019.

Materials and Methods: Consecutive non-probability sampling technique was used foe selection of subject. Assessment of cephalometric parameters on standardized lateral cephalograms was done in 53 subjects (fulfilling inclusion criteria) aged 18-25 years with class I molars, canines and incisors relationship, straight profile, mild crowding and native Pashtuns. Data was analyzed using SPSS version 20.

Results: Twelve out of 16 (75%) parameters for subject population was significantly different from that of Caucasians'. A statistically significant increase was noticed in point A-Nasion-Point B angle, Witt's Appraisal, Y-axis, posterior facial height/total anterior facial height percentage, Upper incisor-sella nasion angle and lower incisors-mandibular plane angle whereas statistically considerate decrease was noticed in thegonial angle, lower anterior facial height/total anterior facial height percentage, inter incisal angle, upper lip-e line distance, naso-labial angle and lower lip-e line distance.

Conclusion: Cephalometric normal values determined for the population presented at Dental Colleges of Peshawar had 75% of parameters significantly different from that of Caucasians'. This behooves an orthodontist to consider cephalometric norms specific to the Pashtun race when deciding between extraction and non-extractions therapies with/without orthogenetic surgery.

Key Words: Cephalometry; Orthodontics; Dental occlusion; Jaw; Face.

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INTRODUCTION

The cephalometric analysis of the dent facial features was first introduced to dentistry in 1931 by Broadbent in the USA, which carries paramount importance in diagnosing and devising a plan for an orthodontic patient, supports the clinical examination and helps to identify the source of the problems in skeletal and/or dental relationships. [1]

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Thereafter, many cephalometric analyses became popular for planning orthodontic treatment. [2] to establish a sound diagnosis and treatment plan in orthodontics, measuring facial and cephalometric characteristics for assessing the differences in morphologic features is crucial. These morphologic differences proving abnormal for some while normal for other races warrant specified cephalometric norms determination. [3-4]

Cephalometric standards have been determined for Greek,[5] Caucasians,[6] African-Americans,[7-9] Japanese,[10] and Chinese[11] populations. Significant differences in the facial convexities of Saudi Arabians,[12] Kuwaitis,[13] Nepalese,[14] Afro-Caucasian.

Brazilians,[15] Chinese,[16] Japanese, Moroccans,[17] and Indians[18] to Native Americans were found earlier. Likewise, facial convexity was found in Asians particularly in lower third of the face. Previously researchers compared Jordanian, Saudi Arabian population features with Eastman standards and found cephalometic features to be significantly different.[19] Researchers compared Pakistani and Caucasian Norms

and found significant difference in skeletal, dental and soft tissue parameters, revealing the Pakistani population to have lesser vertical and hypo divergent growth pattern in the mandible and a tendency towards bimaxillary dental protrusion.[20]

This study was therefore; conducted to determine normal cephalometric values for the population presented at Dental Colleges of Peshawar, Khyber Pakhtunkhwa, Pakistan with Pathan descent and to compare them with accepted Caucasians' norms. Cephalometric norms developed as a result of this study will help in optimizing treatment plan according to the local population's facial features**.**

MATERIALS AND METHODS

This study was conducted at the carried out at dental colleges of Peshawar, Pakistan from Feb 2018 to Feb 2019.In this consecutive non-probability study, a total of 53 students (22 males and 31 females) from both genders aged from 8-25 years, from dental colleges of Peshawar city Khyber Pakhtunkhwa, Pakistan were included in the study. The study commenced after ethical approval (Ref: Prime/IRB/2017-18-0089) was obtained from the institutional review board.

Students who had no history of orthodontic treatment, fulfilling the following inclusion criteria and volunteered were included in the study

1. straight facial profiles,
2. mild crowding,
3. not more than 1-2mm of overbite and 2-3mm normal over jet,
4. Class I molars, canines and incisors relationships,
5. no history of any trauma or any related surgery
6. Offspring to parents and grandparents belonging to Khyber Pakhtunkhwa.

Those who had history of trauma, abnormal jaws, syndrome, and disease of the jaws and had history of orthodontic treatment were excluded With teeth in maximum interdegitation, relaxed lips posture and head in its natural position, all cephalograms belonging to the subjects were obtained using the same X-ray unit (Planmeca 2000, USA). The distances between the focus and film and from the mid-sagittal plane of subject's head to the film for each subject was 165 cm and 20.5 cm, respectively. Therefore, adjustments were made in linear measurements to calibrate to the inevitable 8% magnification. Tracing of all head films were carried out according to established procedures.

RESULTS

Table No.1: Different linear and angular measurement used

Variables	Description
SNA(Sella Nasion Point A Angle)	Maxillary apical base relationship to anterior cranial base
SNB(Sella Nasion Point B Angle)	Mandibular apical base relationship to anterior cranial base
ANB(A Nasion Point B angle)	Difference between Maxillary apical base - Mandibular apical base
Witt's Appraisal	Perpendicular drawn from point A and point B on functional occlusal plane (distance in mm between AO and BO)
Cranial base Angle	Angle between Basion - Sella and Nasion
Inclination Angle	Sen. extended to $N^{'}$ Perpendicular drawn at $N^{'}$ joining Palatal plane
Gonial Angle	Relation of the posterior border of Ramus to lower border of the Mandible (Ar-Go-Me)
Y- axis	Angle between N – S – Gn
PFH– TAFH	Percentage of posterior face height to total anterior face height (S-Go / Na –Me) x 100
LAFH–TAFH	Percentage of lower anterior face height to total anterior face height (ANS –Me / Na – Me) x 100
UI – SN	Inclination of maxillary incisors to Sella Nasion plane
IMPA	Inclination of mandibular incisors to mandibular plane
IIA	Inter incisal angle
UL– E Line	Upper lip to E- line
LL- Eline	Lower lip to E- Line
NLA	Nasio Labial angle

The standard deviation along with mean value and the range for each variable were calculated through SPSS version 20. Independent t-test was performed for comparison of measured cephalometric values with Caucasians' norms. Parameters (table I) with the probability value of 0.05 or lesser (P value) were considered statistically significant. Quantitative variables such as age and cephalometric values were calculated as Mean ±SD. Qualitative variable like genders were calculated as frequencies and percentages.

Table No.2: Comparison between KPK population and Caucasians norms

Variables	KPK Population Norms (Mean± SD)	Caucasian's Norms (Mean± SD)	P-Value
Sella Nasion Point An Angle	82.0º± 3.92º	82.0º± 2.0º	0.944
Sella Nasion Point B Angle	79.4º± 3.75º	80.0º±2.0º	0.262
A Nasion Point B angle	2.6º± 1.91º	2.1º±2.0º	0.022*
Witt's Appraisal	0.5 mm±1.85mm	0 mm±2.0 mm	0.000*
Cranial base angle	130.5º±4.85º	130º±5.0º	0.40
Inclination Angle	84.3º±4.19º	84.0º±4.0º	0.231
Gonial Angle	121.2º±4.73 º	128.0º±3.0º	0.000*
Y- axis	67.5º±3.80º	66.0º±3.0º	0.000*
PFH/TAFH** (%)	68.1%±4.99%	65.0%±4%	0.000*
LAFH/TAFH*** (%)	52.5%±2.61%	54.0%±4 %	0.000*
UI- SN****	106.7º± 6.32º	102.0º±5.0º	0.000*
IMPA*****	99.7º±6.12º	90.0º±5º	0.000*
Inter incisal angle	122.2º±7.99º	130.0º±5.0º	0.000*
Upper lip to E- line	-5.3 mm±1.98 mm	0mm±2.0mm	0.000*
Lower lip to E- Line	-2.2mm±3.27mm	2mm±2mm	0.000*
Nasio Labial angle	96.3º±9.83º	102º±5.0º	0.000*

Statistically significant parameter; Percentage of posterior face height to total anterior face height; Percentage of lower anterior face height to total anterior face height, Inclination of maxillary incisors to Sella Nasion plane; Inclination of mandibular incisors to mandibular plane.

Table 2 compares mean cephalometric norms of KP population with Caucasians. 12 out of 16 (75 percent) variables of KP population are significantly different from the Caucasians'. An increase in cephalometric values for KP population was noticed for sella-nasion-point A angle (SNA), point A-Nasion-Point B angle (ANB) , Witt's Appraisal, cranial base angle (CBA),Y-axis, posterior facial height/total anterior facial height percentage (PFH/TAFH%) , upper incisor-sella nasion line angle (UI-SN) and lower incisors- mandibular plane angle (IMPA).

Cephalometric values Lesser than that of Caucasians' include sella-nasion-point B (SNB), Gonial angle, lower anterior facial height/total anterior facial height percentage (LAFH/TAFH %) , inter incisal angle (IIA), upper lip-E line distance (UL-E line), lower lip-E line distance (LL-E line) and naso-labial angle (NLA) while amongst the aforementioned parameters of lesser values, only the difference in value for SNB was found statistically insignificant**.**

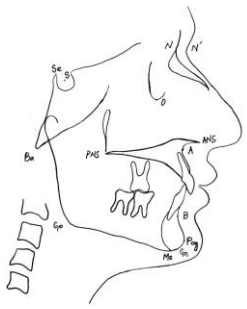

Figure No.1: Points and landmarks used in the present study.

Key:(Se) Sella entry, (S) Sella , (N) Nasion, (N') Soft tissue nasions, (O) Orbitale, (ANS) Anterior Nasal Spine, (PNS) Posterior Nasal Spine, (Ba) Basion (A) Point A, (B) Point B, (Go) Gonion, (Me) Menton, (Gn) Gnathion, (Pog) Pogonion.

DISCUSSION

Cephalometric analysis carries key importance in treatment planning for patients seeking orthodontic treatment. It analyzes not only skeletal and dental parameters but also includes their relationship to each other and the soft tissues.

Cephalometric values for the Caucasians (European-Americans) have been globally accepted as cephalometric norms. Though the KP population has different ethnic background, nutrition, life style, and environment, yet the European-American norms are used for the said population. In our study, it was attempted to establish cephalometric norms for the said population through sample presented at different Dental College of Peshawar, Pakistan in order to device the best treatment plan and achieve optimum orthodontic treatment outcomes.

The subjects have 12 out of 16 (75%) of variables for a sample of 53 subjects of age range 18-25 years significantly different than Caucasians. Significant difference was observed in, ANB, Witt's Appraisal, Gonial Angle, y-axis, posterior face height to total facial height, lower anterior face height to total facial height, UI-SN, IMPA, IIA, UL-Eline , LL-Eline and NLA. A local study[21] supporting the results of our study also reported that 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[21]. These findings are consistent with previous studies.[12,13,19,22]

According to Table-2 SNB angle was of lesser value as compared to Caucasians'. Interestingly, the difference in ANB values was statistically significant. Hence it shows that the former population has class I skeletal sagittal relationship with a greater ANB. Our study further shows, that the gonial angle and lower anterior face height to total anterior face height were significantly smaller. Similar findings of a smaller lower anterior facial height was found in a Saudi population [12]of 18-28 years while in contrast the Kuwaiti[13] (36 individuals, aged 11-14 years) and central Indian[18] (76 individuals aged 18-28 years) population was found to have an increased lower anterior facial height.

Y-axis, posterior face height was considerably larger indicating towards a deeper bite. Other important significant variables were UI to SN plane and LI to Mandibular plane (IMPA) which indicate that the sample has more proclined maxillary and mandibular incisors (bimax proclination). Similar bimaxillary dental proclination was found in the Kuwaiti[20], Nepalese[14] (120 cephalograms of individuals aged 16-21 years), Brazilian (40 individuals with average age of 13.02 years)[15], Moroccan (102 university students at an average age 21.5±1.5 years)[17], Central Indian[18], and Saudi (87 individuals aged 21-27 years)[23] population while only LI to Mandibular plane angle was found obtuse in the Japanese[10] population (25 individuals at an average age of 25.1±2.7 years).

UI to SN plane and LI to Mandibular plane (IMPA) affect Inter Incisal Angle, Nasiolabial angle and Upper Lip to E line, which means that the sample has comparatively acute nasiolabial angle and recumbent upper lip due to a lesser upper lip to E line value whereas the Kuwaiti [13] and Japanese [10] Population had more procumbent lips on cephalometric values comparison to that of Caucasians'.

Hence in accordance with SNB, Witt's value, Gonial Angle, Y-Axis, Posterior facial height to total facial height percentage (PFH/TAFH %), Lower anterior facial height to total anterior facial height percentage (LAFH/TAFH%), Upper Incisor to SN line angle, lower incisors to mandibular plane angle, Interincisal angle, Upper and lower lips to E-line and Nasolabial angle one may misinterpret the sample to have skeletal class I sagital relationship with a greater ANB, bimaxillary protruding teeth in deep bite with recumbent lips due to a poky nose and a stronger chin when compared to cephalometric values of Caucasians.

This article falls short with regard to the fact that the sample size is small. The sample collected was only from the capital city (Peshawar) of the province and the study being a small study, therefore results cannot be extrapolated over the whole population of Khyber Pakhtunkhwa. To make the study applicable throughout the province, it demands the sample to be collected equally from every district. Although while acquiring the cephalograms the subjects were placed in natural head position, there was no standardized reference plane used during cephalometric analysis such as the Frankfurt's horizontal plane for better reliability of sella nasion plane. Therefore detailed studies should be conducted on a bigger scale in order to determine the percent population with normal occlusion, opening doors to more research with regard to cephalometry and orthodontics**.**

CONCLUSION

Cephalometric normal values determined for the population presented at Dental Hospitals of Peshawar had 75 % of parameters significantly different from that of Caucasians'. When compared to the Caucasians' cephalometric norms, one may misinterpret the normal dent facial characteristics of this population to be skeletal class I with a greater ANB, bimaxillary protruding teeth in deep bite and recumbent lips due to strong chin with a prominent nose. It is important to establish norms for regional population for accurate diagnosis, interpretation, deformity assessment and optimized treatment planning of orthodontic patients according to local population's facial features.

Author's Contribution:

Concept & Design of Study:	Tallat Firdos
Drafting:	Shahab Adil, Muhammad Tayyab Khalili
Data Analysis:	Syed Salman Shah, Saqib Ali

Revisiting Critically:	Tallat Firdos, Shahab Adil
Final Approval of version:	Tallat Firdos

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