

CEPHALOMETRIC DETERMINATION OF LIP POSITION IN PATIENTS PRESENTING IN A TERTIARY CARE HOSPITAL

¹ASIM RIAZ, ²USMAN ZAHEER, ³NAUMAN ZAHEER, ⁴NASEER AHMED CHAUDHRY, ⁵IMRAN RAHBAR, ⁶MALIHA NAUMAN

ABSTRACT

The most desired and prioritized goal of an orthodontist is to achieve or maintain the facial attractiveness of patients. In modern orthodontics, the objectives of treatment planning have shifted from hard tissue to soft tissue paradigm. However, the facial and aesthetic features vary among different ethnic groups. Many orthodontists used different cephalometric analysis to find out horizontal position of both lips along with their relation to facial profile. The mean values formulated by different authors may not be proper to serve as references for other racial groups. Therefore, each population should be treated according to specific characteristics of its own. The objective of this study was to determine mean cephalometric values and angles for horizontal lip position in Pakistani adults

85 subjects including outpatient department of Fatima Memorial Hospital and students of Fatima Memorial college of dentistry were selected. Collected data was entered and analyzed in computer program SPSS version 17. Stratification was done with regard to age and gender to control confounders and "t" test was applied. P-value of 0.05 or less was considered as statistically significant. Results of the study show significant difference between the two sexes for the Z angle, which was acute in females than males. All other parameters showed insignificant difference. Merrifield's Z angle in this study is found to be less than Caucasians whereas H angle in this study is found to be greater than Caucasian norms. Results of this study suggest that gender specific mean values for horizontal lip position should be applied in planning and treating orthodontic cases for Pakistani population.

KEY WORDS: *Soft tissue facial profile, Nasal profile, Horizontal lip position*

INTRODUCTION

The word Orthodontics is derived from Greek word 'orthos', which means normal or correct and 'dontos' which stands for teeth¹. Malocclusions have high prevalence and the results are less than ideal physically and socially.² These consequences can affect the quality of life of an individual and impair appearance and functions.² Orthodontics is the study of correcting jaw discrepancies and malocclusions associated with them.¹ Orthodontists are not only concerned with the position of teeth but they are equally keen to take a look at the skeletal and soft tissue condition of the patient while diagnosing and making a comprehensive plan for their case accordingly.³ Radiology has been an excellent tool to aid in diagnosis and treatment planning of orthodontic cases.⁴ There are many uses of cephalometry in orthodontics which includes ana-

lyzing treatment progress, studying physical growth of an individual, predicting rate of growth, position of teeth within the bone and many other in orthodontic research.⁴ Cephalometric radiography has been used vastly in the field of orthodontics to develop the mean values for teeth, skeletal apparatus and soft tissue positions.⁴ These mean values have been derived for specific populations in different studies done in the past.

Most patients opting orthodontic treatment have certain level of expectations in the outcome of the treatment which requires careful evaluation of soft tissue position i.e. lips in relation to teeth and skeletal bases. For this reason, objectives of treatment planning have shifted from hard tissue to soft tissue paradigm.⁵ Orthodontists have focused on different soft tissue measurements and facial aesthetics to fulfill expectations of patients regarding the outcome of treatment.⁶ For longer periods, horizontal lip position has been considered one of the basic features to determine the beauty of a patient's face.⁶ Many orthodontists used different cephalometric analysis to find out horizontal position of lips along with their relation to facial profile.⁶⁻⁷ Ricketts, Steiner and many others like Burstone,

¹ Asim Riaz, Assistant Professor, Orthodontics FMH

² Usman Zaheer, Assistant Professor, LMD Lahore

³ Nauman Zaheer, Assistant Professor, Institute of Dentistry

⁴ Naseer Ahmed Chaudhry, Professor, Orthodontics FMH Lahore

⁵ Imran Rahbar, Professor, Orthodontics FMH Lahore

⁶ Maliha Nauman, Senior Lecturer, Oral Biology Rashid Latif Medical College

Received for Publication: Dec 12, 2018

Approved: Dec 26, 2018

Holdaway, Merrifield have used different reference lines and measurements for an ideal and well balanced soft tissue profile.⁶⁻⁷

The cephalometric mean values reported are specific to an ethnic group that should be applied on the same groups as one normal measurement may look attractive in one population but may not look attractive in another.⁶⁻¹² Therefore each population should be treated according to specific characteristics of its own.⁶ Literature reported varying results in determination of lip position in different racial groups when comparing with norms based on Caucasian samples of European-American ancestry.⁶⁻⁷ There is significant difference among different ethnic groups when these cephalometric measurements are taken into consideration in orthodontics diagnosing and planning.^{6-7,13}

Therefore, the aim of this study is to evaluate mean values and angles for horizontal lip position in Pakistani adult population helping to diagnose and planning of orthodontic cases with more esthetic and stable results.

METHODOLOGY

This cross-sectional study was carried out in Orthodontics department, Fatima Memorial Hospital College of Medicine and Dentistry Lahore. The duration of study was six months and sample size was estimated as 85 cases using 95% confidence level, $d = 0.35$ with an expected mean \pm SD of upper lip to E-line i.e. 3.21 ± 2.69 a linear measurement in horizontal lip position. Lateral cephalograms of all participants were taken in natural head position. Institutional Review Board of FMH College of Medicine & Dentistry approved the study. Informed consent was taken once the sample was selected & their demographic profile were recorded. The primary outcome variables was horizontal lip position. 85 subjects including outpatient department of Fatima Memorial Hospital and students of Fatima Memorial college of dentistry were selected. Non-probability consecutive sampling technique was used. Inclusion criteria was age 15 to 40 years, class I occlusion with minor or no crowding on clinical assessment, symmetrical face on clinical evaluation, normal overjet and overbite, Competent lips and interlabial gap 0-4mm. Exclusion criteria was standardized as significant medical history that could affect growth e.g. Growth hormone deficiency etc., previous orthodontic or prosthodontic treatment and craniofacial deformities or trauma. Cephalograms were drawn manually. Cephalometric variables were recorded in a specifically designed proforma. Outcome variable in terms of various types of horizontal lip position i.e. normal, protrusive and retrusive were noted as per operational definition. No harm was done to the participants. Participants who exhibited protrusive or retrusive lips were made aware about their soft tissue

facial profile.

Collected data was entered and analyzed in computer program SPSS version 21. Quantitative variables like age, upper lip to E-line, lower lip to E-line, upper lip to S-line, lower lip to S-line, upper lip to B-line, lower lip to B-line, lower lip to H-line, soft tissue facial angle, Z angle and H angle were presented in the form of mean and standard deviation. Qualitative data like gender were presented in the form of frequency and percentages. Stratification was done with regard to age and gender to control confounders and "t" test was applied. P-value of 0.05 or less was considered as statistically significant.

RESULTS

A total of 85 skeletal Class I cases were included in this study. The mean age of the patients was noted as 21.53 ± 1.93 years with minimum and maximum ages of 17 & 30 years respectively. Age distribution of the subjects was done and in Table # 1. Out of a sample of 85, 46 (54%) were females and 39 (46%) were males. Figure#1

When linear parameters of horizontal lip position were measured, the results of the study indicated that the mean value of Upper lip to E line of the patients was -3.28 ± 2.14 mm with minimum and maximum value of -8 mm and +1 mm respectively. The mean value of Lower lip to E line of the patients was -1.76 ± 1.86 mm with minimum and maximum value of -6 mm and +2 mm respectively. The mean value of Upper lip to S line of the patients was 0.51 ± 2.23 mm with minimum and maximum value of -3 mm and +5 mm respectively. The mean value of Lower lip to S line of the patients was 1.12 ± 1.69 mm with minimum and maximum value of -3 mm and +4 mm respectively. The mean value of Upper lip to B line of the patients was 3.33 ± 1.52 mm with minimum and maximum value of 0 mm and +6 mm respectively. The mean value of Lower lip to B line

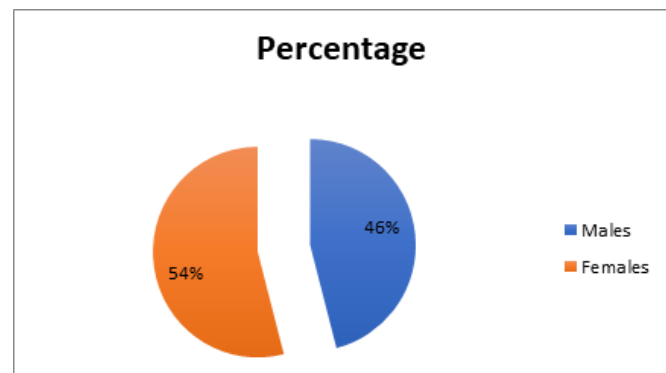


Fig 1: Frequency distribution of Gender of patients

TABLE 1: FREQUENCY AND PERCENTAGE OF DIFFERENT AGES OF TOTAL SUBJECTS

		Frequency	Percent
Age	≤20	19	22.4
	21 - 25	44	51.8
	≥25	22	25.8
	Total	85	100.0

TABLE 2: DESCRIPTIVE STATISTICS OF LINEAR MEASUREMENTS IN HORIZONTAL LIP POSITION

Measurements	Mean	Standard Deviation	Maximum	Minimum
Upper lip to E line	-3.28	2.14	-8	1
Lower lip to E line	-1.76	1.86	-6	2
Upper lip to S line	0.51	2.23	-3	5
Lower lip to S line	1.12	1.69	-3	4
Upper lip to B line	3.33	1.52	0	6
Lower lip to B line	2.74	1.47	0	6
Lower lip to H line	0.58	1.55	-3	3

TABLE 3: DESCRIPTIVE STATISTICS OF ANGULAR MEASUREMENTS IN HORIZONTAL LIP POSITION

Measurements	Mean	Standard Deviation	Maximum	Minimum
Soft tissue facial angle	92.54	3.86	81	98
Z angle	77.89	5.03	66	86
H angle	16.56	4.06	10	24

TABLE 4: DESCRIPTIVE STATISTICS OF HORIZONTAL LIP POSITION IN MALES AND FEMALES

Measurements	Males		Females		t value	P-value	Confidence Interval	
	Mean	Standard Deviation	Mean	Standard Deviation			Lower	Upper
Upper lip to E line	-3.23	2.31	-3.33	2.02	0.203	0.839	-0.837	1.028
Lower lip to E line	-1.69	1.86	-1.83	1.86	0.329	0.743	-0.674	0.948
Upper lip to S line	0.46	2.24	0.54	2.23	-0.168	0.867	-1.052	0.889
Lower lip to S line	1.28	1.76	0.88	1.62	0.826	0.411	-0.428	1.035
Upper lip to B line	3.26	1.65	3.39	1.42	-0.405	0.687	0.797	0.528
Lower lip to B line	2.67	1.57	2.80	1.39	-0.427	0.670	-0.779	0.503
Lower lip to H line	0.56	1.50	0.59	1.61	-0.067	0.947	-0.699	0.654
Soft tissue facial angle	92.87	4.26	92.26	3.49	0.726	0.470	-1.063	2.285
Z angle	79.18	4.72	76.80	5.07	2.218	0.029	0.245	4.505
H angle	16.26	4.10	16.83	4.05	-0.642	0.522	-2.334	1.194

TABLE 5: DESCRIPTIVE STATISTICS OF COMPARISON OF PAKISTANI NORMS WITH ESTABLISHED SOFT TISSUE NORMS FOR CAUCASIAN POPULATION

Measurements	Pakistani Norms		Caucasian Norms	
	Mean	Standard Deviation	Mean	Standard Deviation
Upper lip to E line	-3.28	2.14	-4.0	2.00
Lower lip to E line	-1.76	1.86	-2.0	2.00
Upper lip to S line	0.51	2.23	2.0	2.00
Lower lip to S line	1.12	1.69	1.5	2.00
Upper lip to B line	3.33	1.52	3.5	1.40
Lower lip to B line	2.74	1.47	2.2	1.60
Lower lip to H line	0.58	1.55	0.00	1.00
Soft tissue facial angle	92.54	3.86	91.00	7.00
Z angle	77.89	5.03	80.00	5.00
H angle	16.56	4.06	10	4.00

of the patients was 2.74 ± 1.47 mm with minimum and maximum value of 0 mm and +6 mm respectively. The mean value of Lower lip to H line of the patients was 0.58 ± 1.55 mm with minimum and maximum value of -3 mm and +3 mm respectively. Table # 2

When angular parameters for horizontal lip position were measured, the results of the study indicated that the mean value of soft tissue facial angle of the patients was 92.54 ± 3.86 degrees with minimum and maximum value of 81 and 98 degrees respectively. The mean value of Z angle of the patients was 77.89 ± 5.03 degrees with minimum and maximum value of 66 and 86 degrees respectively. The mean value of H angle of the patients was 16.56 ± 4.06 degrees with minimum and maximum value of 10 and 24 degrees respectively.

Table # 3

Our findings show insignificant difference between the two sexes except for the Z angle, which was acute in females (79.18 ± 4.72) than males (76.80 ± 5.07). The values of lip which did not vary by sex were upper lip to E-line, lower lip to E-line, upper lip to S-line, lower lip to S-line, upper lip to B-line, lower lip to B-line, lower lip to H-line, soft tissue facial angle and H-angle.

Table # 4

When findings of this study were compared with Caucasian population, it was noted that two out of ten lip parameters studied showed significant difference, which included Z angle and H angle. Merrifield's Z angle (77.89 ± 3.86) was found to be less than Caucasians (91.00 ± 7.00) whereas H angle in this study (16.56 ± 4.06) was found to be greater than Caucasian norms (10.00 ± 4.00). The parameters which showed no significant difference in two populations were upper lip to E-line, lower lip to E-line, upper lip to S-line, lower lip to S-line, upper lip to B-line, lower lip to B-line, lower

lip to H-line and soft tissue facial angle. Table # 5

DISCUSSION

Soft tissue cephalometric mean values are one of the most important and effective aid in diagnosing and planning an orthodontic case. Previously different orthodontists around the globe evaluated and developed these mean values for different ethnicities including Holdaway, Legan and Burstone, Stark and Epkar soft tissue norms for Caucasian sample. These available norms cannot be applied to other races unless they are modified as one soft tissue value may look pleasing in one ethnic group and may not be aesthetic in another. This study was conducted to develop these cephalometric mean values for a particular sample presenting in a tertiary care hospital, which can serve as norms for this specific population. The sample selection was limited by the inclusion criteria of normal facial proportions, normal occlusion and esthetic profile along with the risk of radiation exposure.

Orthodontists and plastic surgeons use these values as standard to plan cases and predict end results of the surgery within the aesthetic limits. Measurements evaluated in this study were divided into linear and angular measurements. Sexual dimorphism was carried out for the same population and then results were compared with mean values available in literature for Caucasian population. Our findings show insignificant difference between the two sexes with males having equal values than females except for the Z angle, which was acute in females (79.18 ± 4.72) than males (76.80 ± 5.07). When findings of this study were compared with Caucasian population, it was noted that two out of ten lip parameters studied showed significant difference, which included Z angle and H angle. Merrifield's Z angle

(77.89 ± 3.86) was found to be less than Caucasians (91.00 ± 7.00) whereas H angle in this study (16.56 ± 4.06) was found to be greater than Caucasian norms (10.00 ± 4.00).

Janson et al in 2010 compared the soft tissue profile of Afro-Caucasian Brazilian subjects with Caucasian faces and found out that Afro-Caucasian possessed greater protrusion of lips as compared to Caucasians. This finding is contradictory to the results of this study, which shows no significant difference in lip protrusion as compared to Caucasians.

The results of the study conducted by Hamdan Ahmed in 2010 contradict with the results of this study. Hamdan demonstrated that sexual differences are present in Jordanian males and females for variables like H-angle, upper lip to E-line, lower lip to E-line, soft tissue facial angle as males exhibited more prominent lips as compared to females. The results of the current study indicate that lip protrusion does not change with sex difference and same mean values can be used for both genders. Furthermore, H angle in Jordanian population (5.4 degrees) was less than white Caucasians (10.00 ± 4.00 degrees), which also contradicts with this study in which H angle (16.56 ± 4.06) is greater than Caucasian adults H angle.

The results of this study agree on certain variables and disagree upon others with study of Albarakati et al in 2012. They found out that Saudi population exhibited more prominent upper and lower lips as compared to Holdaway's Caucasian norms whereas this study shows same profile of lips in both populations. However, both studies show similar results in case of holdaway's H angle that is increased in both studies (15.16 ± 3.22 degrees for Saudis and 16.56 ± 4.06 for this study) when compared with Caucasians sample (10.00 ± 4.00 degrees). There is also contradiction of the results in sexual difference as both males and females have insignificant difference in nose and lip prominence in this study where as Albarakati found out that Saudi males had more prominent upper lip as compared to Saudi females.

Uysal et al in 2011 found out in their study that Turkish population exhibited significantly different upper and lower lip protrusion, upper lip length as compared to European-American adults. These results do not coincide with this study, which shows that both upper and lower lips are present in normal position when compared with white norms and Caucasian norms for lip protrusion can be used for Pakistani population without any modification.

Erbay et al in 2002 evaluated in his study that Anatolian Turkish population had retrusive lips as compared to norms of Steiner and Ricketts where as this

study demonstrates that same norms can be applied to both populations. However results of both studies agree on the variables like H angle which is increased in both studies when compared with Holdaway's mean value, and Z angle which is less than Merrifield's mean value. Erbay et al also compared lip protrusion with sushner mean values and concluded that upper lip in Anatolian was more protrusive and lower lip was more retrusive.

In 2012, Sachan et al carried out sexual dimorphism in North indian population for soft tissue cephalometric mean values and concluded that males had greater soft tissue facial angle, more prominent nose, lesser H angle and greater upper lip thickenss than females. The results of this study do not agree to the results of the Sachan et al and shows that all the soft tissue variables for both lip and nose closely correlate in both genders except for the Z angle, which is more obtuse in males ($79.18 + 4.72$) than females ($76.80 + 5.07$).

The cephalometric errors measured in this study were within the normal range described by Frantz. Natural head position was made the horizontal reference plane to limit the errors that could have occurred white taking the lateral cephalograms. The inclusion criteria of skeletal class I patients eliminated the bias that could have made a difference in effect of dentoalveolar anatomy on soft tissue facial profile. The lower age limit was set to 17 years on the purpose that facial maturity is achieved in both the genders.

The sexual dimorphism in this study and differences with other populations infer that soft tissue cephalometric norms for both horizontal lip position and nasal profile should be used as baseline data only for this population. It is hoped that the results of this study will provide significant objective database helping in diagnosing and planning cases for improved post treatment and postoperative outcomes. However these mean values should not be taken as template but more of a guide in planning and treating an orthodontic, orthognathic or plastic surgery case. Every patient should be planned and treated according to desires of the individual.

CONCLUSION

This study established cephalometric soft tissue mean values for a Pakistani population presenting in a tertiary care hospital:

1. There is significant sexual dimorphism in Z angle with females exhibiting less value than males.
2. Z angle is less obtuse whereas H angle is greater for Pakistani population as compared to norms reported for Caucasians by Merrifield and Holdaway.

REFERENCES

- 1 Ikenna IG, Olatokunbo DO, Chukwudi IM. A Cephalometric investigation of horizontal lip position in adult Nigerians. *J Orthod.* 2012; 39: 160-169.
- 2 Asad S, Kazmi F, Muhammad M, Malik A, Baig RR. Assessment of antero-posterior position of lips: E-Line- S-Line. *PODJ.* 2011; 31: 84-87.
- 3 Sahar F, Naif A. Holdaway soft tissue cephalometric standards for Saudi adults. *KSU Journal of Dental Sciences.* 2012; 3: 27-32.
- 4 Sachan A, Srivastav A, Chaturvedi TP. Soft tissue Cephalometric norms in north Indian ethnic population. *J Orthod.* 2012; 1: 92-97.
- 5 Uysal T, Baysal A, Yagci A, McNamara JA Jr. Ethnic differences in the soft tissue profile of Turkish and European-American young adults with normal occlusion and well-balanced faces. *Eur J Orthod.* 2012; 34: 296-301.
- 6 El-hadidy M, El-din BA, El-bassioni L. Cephalometric Analysis for Evaluating the Profile Nasal Morphology in Egyptian adults. *Egypt, J. Plast. Reconstr. Surg.* 2007; 31: 243-249.
- 7 Hamdan AM. Soft tissue morphology of Jordanian adolescents. *Angle Orthod.* 2010; 80: 80-85.
- 8 Li KZ, Guo S, Sun Q, Jin SF, Zhang X, Xiao M, Wang CC, Sun X, Lv MZ. Anthropometric nasal analysis of Han Chinese young adults. *J Craniomaxillofac Surg.* 2013; 15: 99-100.
- 9 Al-Qattan MM, Alsaeed AA, Al-Madani OK, Al-Amri NA, Al-Dahian NA. Anthropometry of the Saudi Arabian nose. *J Craniofac Surg.* 2012; 23: 821-824.
- 10 Hassan AH, Amin HE. Association of orthodontic treatment needs and oral health related quality of life in young adults. *Am J Orthod Dentofacial Orthop* 2010; 137: 42-47.
- 11 Gu Y, McNamara JA Jr, Sigler LM, Baccetti T. Comparison of craniofacial characteristics of typical Chinese and Caucasian young adults. *Eur J Orthod.* 2011 Apr; 33(2): 205-11.
- 12 Taki AA, Oguz F, Abuhijleh E. Facial soft tissue values in Persian adults with normal occlusion and well-balanced faces. *Angle Orthod.* 2009; 79: 491-494.
- 13 Metgud R, Tiwari P, Ramesh G. Evaluation of soft tissue landmarks using Holdaway analysis among southern Rajasthan population in various skeletal malocclusions. *J Forensic Res.* 2015; 6: 1-4.
- 14 Rehan A, Iqbal R, Ayub A, Ahmed A. Soft tissue analysis in class I and class II skeletal malocclusions in patients reporting to department of orthodontics, Khyber college of dentistry, Peshawar. *Pakistan Oral and Dental Journal.* 2014; 34: 87-90.

CONTRIBUTIONS BY AUTHORS

- | | |
|---------------------------------|--|
| 1 Asim Riaz: | Conception and design of work, data collection, critical revision and final approval of the draft. |
| 2 Usman Zaheer: | Data collection, data interpretation and drafting the article. |
| 3 Nauman Zaheer: | Data collection, data analysis and drafting the article. |
| 4 Naseer Ahmed Chaudhry: | Data analysis and drafting the article. |
| 5 Imran Rahbar: | Data analysis and drafting the article. |
| 6 Maliha Nauman: | Data analysis and drafting the article. |