ORIGINAL ARTICLE

AESTHETIC EVALUATION OF THE LOWER THIRD OF THE FACE COMPARING CEPHALOMETRIC AND PHOTOGRAPHIC ANALYSIS CONSIDERING NASOLABIAL AND LABIOMENTAL ANGLES IN YOUNG ADULT PAKISTANI POPULATION

Nofil Ahmad[1], Khalid Saeed Mirza[2], Faiza Ijaz[3], Rabia Mushtaq[2], Zuhaa Mushtaq[3], Amna Khalid[2], Husnain Abbas[4]

[1]Department of Orthodontics, Frontier College of Dentistry, Abbottabad, [2]Department of Periodontology, Akhtar Saeed Medical and Dental College, Lahore, [3]Department of Oral biology, Abbottabad International Dental College, Abbottabad-Pakistan
[4]Dugoni school of dentistry, University of Pacific-United States of America

Background: Although the results derived from orthodontic treatment are focused at attaining an aesthetically pleasing soft tissue profile as directed by Angle's paradigm, however hard tissue including bone and tooth dimensions also play a pivotal role in attaining the set goal. This study was focused on evaluating the comparison of photographs and cephalometric radiographic images to dictate the differences that might occur when the same aesthetic evaluation technique is applied. A cross sectional comparative study was carried out at Frontier college of dentistry, Abbottabad and Sharif Medical and Dental College, Lahore from June to November 2020. **Methods:** In this cross-sectional study, 60 subjects were incorporated as part of the study amongst which lateral cephalometric radiographic images and photographs, other diagnostic records such as dental casts were procured. The same analysis was applied to assess the lower third of the face in both the photographs and the radiographs with focus on the Labiomental and nasolabial angles for comparison. **Results:** The normal value of Nasolabial angle 102.10°±3.126° (NLA2) indicates the relationship of nose and upper lip which is within the normal range for the age group selected. No significant difference was found between the nasolabial angles measured by two separate methods (*p*-value is 0.67). Mean labiomental angle was found to be 120.70°±6.46°(LNA1) and 121.60°±5.386 degrees °(LMA2) respectively, which was within the normal range for the age group selected. **Conclusion:** There is no significant difference in the assessment of lower facial height and aesthetics between lateral cephalometric radiographic images and photographs taken from the camera.

Keywords: Facial Aesthetics; Nasolabial; Labiomental; Photographic and cephalometry

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INTRODUCTION

Accurate diagnosis is the most important tool for treatment, planning and successful treatment outcomes in orthodontics. Diagnostic tools guide us for appropriate diagnosis. An extensive data base of patients' information is required for diagnosis.[1–3] Appropriate case history, compendious clinical examination and diagnostic aids such as radiographs, study casts and photographs are required for collection of extensive data. In these days, the treatment planning and diagnosis place considerable emphasis on evaluation of the function of soft tissues and their role in functional aesthetics, however cephalogram has manifested questionable reliability and validity in the evaluations of soft tissues. Soft tissue analysis of the facial profile was a matter of perturb for the pioneers of orthodontics such as Case and Angle at the end of 19th and the start of 20th century. For more than a century, anthropologists have measured the human skull and face.[4] Korbitz in the past has designed devices similar to anthropometric tools to generate a diagnostic image manifesting the association of teeth in occlusion to the face.[4–7] Gnathometer was designed by Ruppe and gnathostatic casts by Van Loon. Simon in 1922 based on photographs devised the gnathostatic image and cephalometric-like tracing were formed by projecting the portions of gnathostatic casts.[8] Gnatho-physiognomical photographs that were a composite of photographs of the head and study models were developed by Andersen. Roentgenographic cephalometrics were introduced in 1931 by Hofrath and Broadbent which integrated radiography and craniometrics. Soon after the radiographic techniques were standardized the significance of the soft tissue facial analysis got undermined and dentoskeletal relationships became the key factor in diagnosis and treatment planning.[9,10] After the introduction of cephalometrics in 1931 by Broadbent, a major improvement in diagnostic information and the relationship between dental and skeletal structures can be appreciated.[11] However, cephalometry being an indispensable diagnostic aid for treatment planning of any orthodontic case has two basic disadvantages: 1) Radiation exposure to the patient, 2) Requirement of a

cephalostat and a radiation source which is not easily available everywhere.

Extra oral and Intra oral photography has also been also been considered another vital diagnostic tool that has been historically one of the basic parts of both pre-treatment and post-treatment orthodontic records.[12]Normally in a general population it has been observed that aesthetically pleasing faces also reveal fine skeletal patterns. But a reverse is not always true. The three most common constituents in a treated orthodontic case with negative and non-ideal treatment outcomes are: 1) Treatment planning based on occlusion 2) lack of facial diagnosis, and 3) absence of treatment plan linked with soft tissue paradigm. Therefore, we need our treatment plans based on giving importance to the soft tissue paradigm in order to ensure a more effective, practical and pleasing overall treatment result. Study models-based cast analysis, photographic analysis and cephalometric analysis together should provide the base leading for successful diagnosis and treatment plan.[13,14] Photographs have long been used in the past as an aid in anthropometric research as well as in orthodontics clinical practice. However, with modernization leading to the development of the cephalostat, development and standardization of the radiographic technique, facial photography has become a secondary tool for orthodontic record for several years. As cephalometric analysis makes the baseline for diagnosing the craniofacial morphology in routine clinical practice, the chance of evaluating and calculating cephalometric values with the help of photographs can be relevant and a non-invasive tool for diagnosis, specifically in the field of epidemiologic research. The goal of this study was to establish relationship between extra oral photographs and cephlometrics by getting some reference values for two soft tissue variables in a sample of adult Pakistani male and female subjects with class I malocclusion for the future orthodontic diagnosis required for treatment planning.

MATERIAL AND METHODS

A cross sectional study was carried out at Frontier College of dentistry, Abbottabad and Sharif Medical and Dental College, Lahore from June 2020 to November 2020. The sample size was calculated by

WHO sample size calculator $N=\frac{z^2 \times p(1-p)}{n^2}$ in which Sample Size (N) is equal to (Distribution of 50%) / ((Margin of Error% /Confidence Level Score) Squared and the level of significance (α) was kept 5% and the Power of test (1-β) was taken as 90%. Using this sample size calculator, the total sample size (N) was calculated. 60 individuals between the ages of 20 and 25, males and females who had a Pakistani ancestry parents and grandparents from different ethnic groups were selected and they all had given their informed consent for inclusion in the study. Inclusion criteria involved subjects with normal values of maxillary and mandibular cephalometric positions ANB: 2±2, normal vertical SN-MP: 32±5, dental class I malocclusion and complete eruption of permanent dentition with the exception of third molar. Any patient who was suffering from craniofacial syndrome with the history of trauma or pathology that had led to a facial deformity or any patient who was undergoing orthodontic therapy was excluded from the study sample collection. Purposive sampling was used to ensure that selection criteria are met for all subjects included in the study. Diagnostic records used for evaluation included study casts, OPG and lateral cephalometric radiographic images in natural head position along with photographs of the facial profile. The nasolabial angle and the labiomental angles were the photographic variables that were used for the comparative analysis. All the radiographs were taken by single operator in the department of radiology in Frontier college of dentistry, Abbottabad using Soredex radiographic equipment with the same standardized radiographic technique being applied to all subjects. The position of the subjects were kept in a natural head position by instructor to look into their own eyes in a looking mirror on opposing wall to record the radiograph. The head position was secured with ear rods in the cephalostat to avoid movement during exposure. The lips were relaxed and closed while the teeth were in centric occlusion.

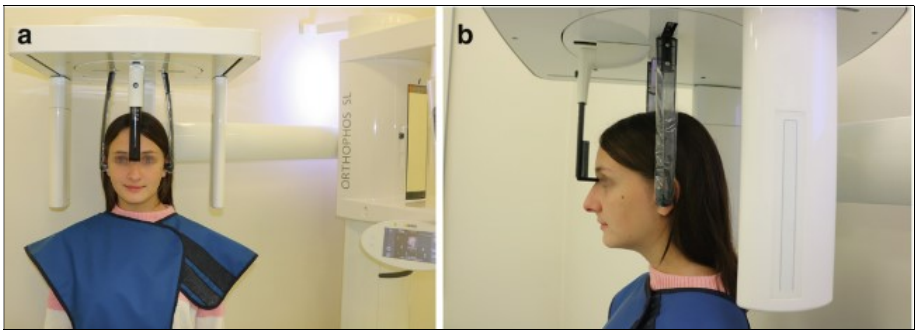

Figure-1: Image showing patient while exposure by the cephlostat machine

Exposure was made at 80–86 kvp and 32 mA. Each subject was exposed for 1.2 seconds for each radiograph. Lateral cephalograms were traced manually on 0.003 inch thick and 8×10-inch size acetate paper with 4 H lead pencil. Standardized extra oral photographs (lateral profile) were taken with each patient in natural head position, relaxed lip posture and centric relation. Subjects were advised to look into a mirror 5 feet away from them with their right side towards the photographer.

All the photographs were captured with a Nikon COOLPIX S200 camera, which was levelled with the optical axis of the lens horizontally and the film plane vertical and mounted on a tripod.

Figure-2: Image showing Nikon COOLPIX S200 Camera

The subjects stood 1.7 meters away from the camera with a metric scale right infront of them to provide both a real metric scale and a vertical reference line (true vertical line TVL) during image measurement. Photographic analysis was done on full page photo print. Specific analysis for lower third face were then applied on both the lateral cephalograms and photographs of 60 selected subjects between the two methods under study.

SPSS for windows version 20.0 was used for the statistical analysis. There were two angular measurements of both cephalograms and photographs; hence the variables were four in all. The data was numerical and for each measurement the standard deviation, arithmetic mean, and standard error mean was calculated. Test was applied to find out any significant statistical difference between the two methods under study. A *p*-value of ≤.05 was considered as significant.

RESULTS

A total of 60 subjects were included in this study. All had class I dental and skeletal relationships. The mean age of the sample was 22.31±1.64 years, with a range of 20-25 years almost evenly distributed in 6 groups. Soft tissue parameters of the subjects were computed with data given in Table 1. The Table gives the statistical differences between Nasolabial and Labiomental angles measured by lateral cephalograms and photographs respectively. The mean value of Nasolabial angle indicated the relationship of nose and upper lip were 102.10°±3.126° (NLA2) respectively, which were within the normal range for the age group selected. No significant difference was found between the Nasolabial angles measured by two separate methods (*p*-value is 0.67). Labiomental angle was found to be 120.70°±6.46° (LNA1) and 121.60°±5.386 degrees °(LMA2) respectively, which was within the normal range for the age group selected. No significant difference was found between the Labiomental angles measured by two separate methods (*p*-value 0.56). No notable and significant difference was found between the Nasolabial and Labiomental angles measured by two separate methods.

Table-1: Comparison of Angular measurements between Cephalometric and Photographic Methods. (n=60)
(In degrees)

Parameter	Mean	SD	Class interval	Df	*p*-value
Cephalometric Nasolabial Angle 1	102.10	2.975	0.543	58	0.67
Photographic Nasolabial Angle 2	102.43	3.126	0.571		
Cephalometric Labiomental Angle 1	120.70	6.460	1.179	58	0.56
Photographic Labiomental Angle 2	121.60	5.386	0.983		

DISCUSSION

Multiple cephalometric analyses were evolved with time which gave the field of orthodontics a firm base to evolve the concept of normal and abnormal skeletal pattern. However, concerns regarding radiation exposure led to the possibility of performing the quantitative analysis with the help of photographs, which may enhance its clinical effectiveness. This type of quantitative analysis can provide useful methods to study facial growth and to deal with the treatment of craniofacial disorders (syndromes) and to formulate ideal treatment plans and hence can get ideal surgical and orthodontic treatment results. So, it can be as effective as in several other medical fields as in the field of orthodontics.[1,4,5,15] Concrete relationships through lateral radiographs analysis between facial soft tissues and skeletal structures have been found.[6,16,17] However, relationships between photographic and cephalometric measurements have rarely been carried out and conflicting results have been seen.[7,18]

Cephalometric analysis is currently considered as the gold standard diagnostic tool for

diagnosing skeletal craniofacial morphology in orthodontics. However, photographic assessment being a cost effective and a diagnostic tool being free from radiation exposure can prove to be useful and potent for epidemiologic studies.[1] It has also been found out that the angular and linear measurements which are useful for formulation and characterization of facial morphology can be easily and reliably measured from extra oral facial photographs which is consistent with the results of the previous studies.[3–5,7,8,10,19–21] These results suggest that photography can be considered a practical and feasible option when radiography is considered too invasive or logistically impractical.[7, 20]

In a recent study, it has been suggested that factors such as gender, age, face type as well as racial origin leads and contributes to the facial variation.[22]

Upon analysing the literature, it is apparent that a lot of work has been done worldwide in determining the diagnostic value of soft tissue drape of lower third face. Cephalometric studies conducted worldwide gave an idea about the correlation between the hard and soft tissue components of the face. Photographic analysis followed as a non-invasive, inexpensive tool for facial analysis. More recent work is now cantered on a point where correlations are being tried to establish between these two important diagnostic tools.

Focus of this study is to describe the soft tissue pattern of Pakistani adult population and to obtain norms based on culture to aid in treatment planning.

Facial aesthetics is considered as one of the most important factors upon which opinion and perception of social ability and character is conceived.[22–27] Results obtained from multiple standardized lateral profile photographs were compared with standardized lateral cephalogram values in order to observe any significant difference between the two methods and found that under standardized conditions both methods can be used interchangeably for the parameters used in this study. The present study was carried out on lateral cephalograms and profile photographs of sixty subjects. Mean age of the sample was 22.31±1.64 years, with the range of 20–25 years. Nasolabial angle is one of the angles which show large variation due to ethnicity and genetic predisposition.

This angle is formed between the columella of nose and the upper lip and hence depending on the way the tangents to these two structures are drawn, we get a lot of variation in the measurement of this value.[28] In the literature the mean value of NLA varies from 80–120 degrees. The mean value of cephalometric NLA in this study was 102°± 2.975° and for photographic NLA is 102.43°±3.126° respectively, which were closer to the results of Yuen and Hiranaka in a study of southern Chinese population. McNamara *et al*[30] reported similar study on a lateral cephalograms of adult Caucasians with attractive facial aesthetics.[29,30] In another study mean value of cephalometric NLA was 102.6° and mean value of photographic NLA was 100.3°.[31] Labiomental angle is measured between the lower lip and chin. In this study, the value measured for the cephalometric labiomental angle was 120.70°±6.460° and for photographic LMA was 121.60°± 5.386°respectively, which is in close agreement with that of Hashim (120°±12°) and Lines *et al*[33] (130°).[32]

CONCLUSION

No significant difference was found between the cephalometric and photographic methods for aesthetic evaluation of lower third of the face using nasolabial and labiomental angle in young adult Pakistani population. Clinical examination still remains a decisive tool for treatment planning on everyday basis.

AUTHORS' CONTRIBUTION

NA: Literature search, study design, data collection, data analysis. KSM: Study design and concept, revising data with critical analysis. FI: Write up, investigation, Proof reading, editing. RM: Literature search, editing. ZM: Data collection, editing. AK: Data analysis and interpretation. HA: Critical revision and conceptualization.

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Address for Correspondence:

Faiza Ijaz, Department of Oral Biology, Abbottabad International Dental College, Abbottabad-Pakistan
Cell: +92 334 914 6265
Email: faizaijaz999@gmail.com