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Comparison of Angular and Linear Measurements of Soft Tissue Profile between Cephalogram and Photograph in Subjects with Class I and Class II Malocclusion

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Abstract: The reliability of hard and soft tissue landmarks on lateral cephalometric radiographs has been well documented. However; there is limited evidence about the reliability of facial soft tissue landmarks on photographs. Thus the aim of the present study was to compare angular and linear measurements of soft tissue profile between cephalogram and photograph in subjects with class I and class II malocclusion using Nemoceph software. Samples consist of digital lateral cephalogram and profile photograph of 30 subjects (15 Class I and 15 Class II) between age ranges of 18 to 35 years (mean22 ± 2.32). All records were taken in natural head position, centric occlusion and lips in relaxed position. 7 angular and 14 linear parameters were measured for soft tissue analysis on both lateral ceph and photograph using Nemoceph software. Student's t-test was done for making adequate comparison. There was no statistically significant difference in the angular and linear parameters measured for soft tissue on cephalogram and photographs. Though cephalometric remains the method of choice for evaluation of dentoskeletal and soft tissue structure of patients, it can be summarized from the results of this study that photographs might be used as an alternative for large-scale epidemiologic studies, especially when there is a need for a low-cost, noninvasive method that can be used in diverse clinical and field settings.

Keywords: Soft tissue profile, cephalogram, photograph.

INTRODUCTION

Facial attractiveness plays a key role in social interaction and is responsible for psychological wellbeing and the self-esteem of an individual. However the perception of a pleasing face is subjective to many factors like ethnic background, culture, personality, generation, age, etc. Several medical specialties like Orthodontics, plastic surgery, and prosthodontics have the ability to change facial features[1] Improvement of facial esthetics is a main motivating factor for many patients and parents seeking orthodontic treatment, including up to 80% of adult patients [2]. Hence there is a need for clinicians working in the dentofacial area to know the esthetic standards of a face that guide the esthetic soft tissue goals in their patients [1].

The validity of any measurement obtained from cephalometric radiographs is dependent on the reliability of the landmarks identified. This concept emphasizes the importance of reliable landmarks for cephalometric facial analysis and should be considered for angular and linear soft tissue measurements on facial photographs. The reliability of skeletal landmarks on lateral cephalometric radiographs has been well documented [2]. However; there is limited evidence about the reliability of facial soft tissue landmarks on photographs. Therefore better evidence about the reliability of photogrammetric soft tissue landmarks is needed before a reliable facial analysis can be constructed [3, 7].

In previous studies facial profile has been compared between photographic and cephalometric measurements, to assess the diagnostic accuracy of

photograph as an alternative low cost, low radiation method for assessing soft tissue profile of the patients [4-6,8,9]. Another study compared only angular photogrammetric measurements of soft tissue profile of north Indian males and females using Nemoceph NX software. The advantage of various cephalometric softwares like Dolphin, Nemoceph, Vistadent, Quick Ceph, Dr Ceph and FACAD are that they provide rapid, precise and customized method of measurements and allow simulating and predicting multiple treatment options. In the present study we have taken more number of linear and angular parameters than the previous studies to cover the full assessment of soft tissue facial profile.

Since only few studies have been done to compare cephalometric measurements with photogrammetric measurements, hence it was decided to conduct this study to compare various parameters between lateral cephalogram and photograph in class I and class II malocclusion using Nemoceph software.

MATERIALS & METHODS

The samples for this study consisted of pretreatment digital lateral cephalograms and right profile photographs of 30 patients (15 class I and 15 class II) in the age range from 18 to 35 years (mean age 22 ± 2.34). All subjects were selected from the patients visiting the Department of Orthodontics and Dentofacial Orthopedics BBDCODS Lucknow for Orthodontic treatment.

Criteria for Sample Selection

All subjects should have

- Age from 18 to 35 years
- Normal growth and development
- No facial asymmetry and Craniofacial Syndromes
- No significant medical history or history of trauma
- No previous history of Orthodontic treatment and maxillofacial or plastic surgery

Approval from ethical committee of college was taken before starting the study. The objectives were explained to the participants. Written consent was also taken from all the subjects before taking the radiograph and photograph. Table 1 shows distribution of samples

Table-1: Group Division

Groups	No. of Sample	Age(in years) (mean ±SD)
Group Ia (Right Profile Photograph) Of class I malocclusion	15	22 ± 2.32
Group Ib (Lateral Cephalogram) of class I malocclusion	15	22 ± 2.32
Group IIa (Right Profile Photograph) of class II malocclusion	15	22 ± 2.36
Group IIb (Lateral Cephalogram) Of class II malocclusion	15	22 ± 2.36

Method of taking Photographs

The photographs of the subjects were taken with digital camera (Kodak Easy Share C180 with 10.2 megapixels) (figure 1) in NHP, centric occlusion and lips in relaxed position using a calibration scale. All photographs were imported into a commercially available photograph editing software Adobe Photoshop 7. The selected and cropped profile photographs were transferred to Nemoceph digital imaging software (Version 6.0) for photographic evaluation.

Method of taking Radiograph

Planmeca Proline XC, (Finland) was used to take the digital lateral cephalograms of the subjects in NHP, centric occlusion and lips in relaxed position.

The digital lateral cephalograms were obtained in bitmap format in CD Rom from computer loaded with Planmeca software. These digital lateral cephalograms were then transferred to Nemocech digital imaging software (Version 6.0) for soft tissue analysis.

Method of Measurement

After transferring the lateral cephalogram and profile photographs to the computer loaded with Nemoceph digital imaging software images were calibrated to eliminate magnification error. The image enhancement features of the software were used for accurate identification of landmarks and adjustments of soft tissue structures. Cephalometric and photographic landmarks were identified and marked (figure 1). A total of 21 soft tissue parameters were measured of which 14 were linear and 7 were angular measurements. Then analysis was done with the help of Nemoceph

software. (Figure 2 and 3) The data obtained was subjected to appropriate statistical analysis.

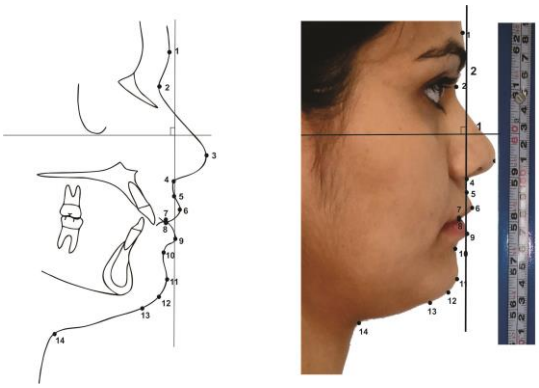

Fig-1 Landmarks: 1. Glabella (G'), 2. Soft tissue Nasion (N'), 3. Pronasal(P), 4. Subnasal (Sn), 5. Superior Labial Sulcus (SLS), 6. Labrale superoris(Ls), 7. Stomium superioris(stm s), 8. Stomium inferioris(stm i), 9. Labrale inferiorus(Li), 10. Inferior Labial Sulcus(ILS), 11. Soft tissue Pogonion(Pog'), 12. Soft tissue Gnathion (Gn'), 13. Soft tissue Menton(Me'), 14. Cervical point (C), 15. Frankfort Horizontal Plane (FH), 16. True Vertical Line (TVL)

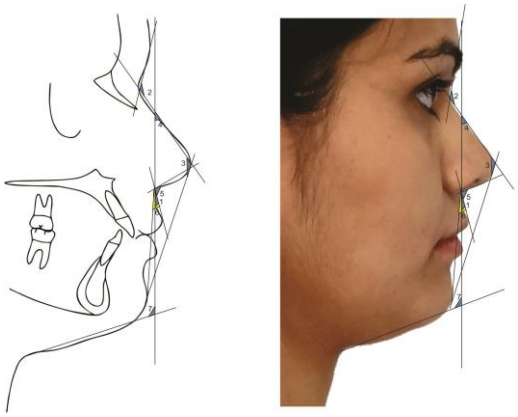

Fig-2: Angular Measurements: 1. Upper lip Angle, 2. Naso Frontal Angle, 3. Naso Mental Angle, 4. Naso Facial Angle, 5. Mento Cervical Angle

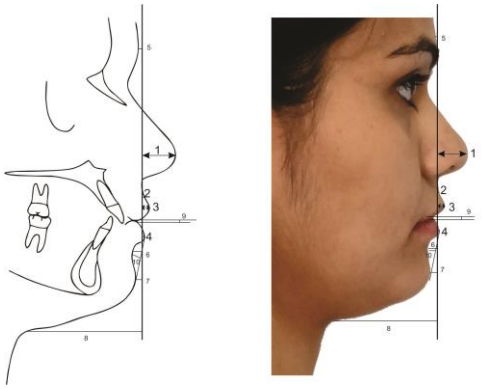

Fig-3: Linear Measurements: 1. Nasal projection, 2. Soft tissue point A to TVL, 3. Upper Lip Anterior to TVL, 4. Lower Lip Anterior, 5. Glabella to TVL, 6. Soft tissue point B to TVL, 7. Soft tissue Pogonion to TVL, 8. Throat Length, 9. Interlabial Gap, 10. Inferior Labial Sulcus, 11. Upper lip Length, 12. Lower Lip Length, 13. Lower 1/3 Facial height, 14. Total Facial Height

Statistical Analysis

To compare cephalometric and photogrammetric measurements in class I and Class II malocclusion student's 't' test was used. Descriptive statistics (mean values and standard deviation) and comparison are shown in table 2 (angular parameters) and table 3 (linear parameters).

RESULTS

A mean difference between the angular and linear parameters of Group Ia with Group Ib and of

Group IIa with Group IIb were found to be statistically insignificant.

DISCUSSION

As said now a days it is believed that malocclusion should be treated from an aesthetic point of view depending on the patient's face, and not alter the face in light of teeth when it is in harmony. Thus, the assessment of soft tissue is of utmost importance in diagnosis and treatment planning in orthodontics. Considering this we tried to compare angular and linear measurements of soft tissue profile between cephalogram and photograph in class I and class II malocclusion.

As shown in the table 2 the difference between mean value of all angular parameters between photograph and cephalogram of class I and class II malocclusion patients was statistically non-significant and were similar to the results obtained by Munish Reddy et al for Facial convexity angle, Nasofrontal angle, Nasofacial angle, Nasomental angle and Cervicomental angle in their study.

And shown in the table 3 the difference between mean value of all linear parameters between photograph and cephalogram of class I and class II malocclusion patients was statistically non-significant. However, no other studies have been done to compare parameters between cephalogram and photograph hence no other comparison could be made.

Though cephalometric remains the method of choice for evaluation of dentoskelatal and soft tissue structure of patients, it can be summarized from the results of this study that photographs might be used as an alternative for large-scale epidemiologic studies, especially when there is a need for a low-cost, noninvasive method that can be used in diverse clinical and field settings. The basic limitations with the photographs are that the assessment of hard tissue structures is not possible but photographs can be used as a valuable diagnostic tool for soft tissue assessment. Hence, to validate the findings of our study, further research is needed in future, comparing large number of subjects in different Class of malocclusion and in different races of population. The norms for photographs should be determined in future studies as well.

Table-2

Parameters	Class I						Class II					
	Group Ia		Group Ib				Group IIa		Group IIb			
	Mean	SD	Mean	SD	'p'	Inter Pretation	Mean	SD	Mean	SD	'p'	Inter pretation
Facial convexity Angle	14.91	4.87	16.05	5.24	0.542	NS	16.44	4.49	18.30	4.34	0.259	NS
Neck& lower 3rd Angle	108.29	8.31	108	10.20	0.419	NS	111.75	9.26	111.96	6.27	0.942	NS
Upper Lip Angle	17.39	8.33	18.69	8.57	0.676	NS	16.48	6.38	16.57	6.20	0.968	NS
Naso labial Angle	100.90	12.12	94.1	11.06	0.118	NS	103.44	12.83	103.64	11.43	0.964	NS
Naso frontal Angle	118.57	48.75	115.1	48.46	0.848	NS	133.81	10.64	129.88	12.45	0.360	NS
Naso facial Angle	33.97	3.78	35.73	4.83	0.277	NS	32.56	4.54	35.27	4.46	0.110	NS
Nasomental Angle	127.70	5.87	125.3	7.12	0.318	NS	129.41	5.12	125.31	5.19	0.037	
Mento cervical Angle	100.26	8.41	99.2	9.40	0.750	NS	102.56	9.46	101.49	6.89	0.725	NS
	Comparision of group Ia with Ib for angular parameters						Comparision of group IIa with IIb for angular parameters					

Table-3

Parameters	Class I						Class II					
	Group Ia		Group Ib				Group IIa		Group IIb			
	Mean	SD	Mean	SD	'p'	Inter Pretation	Mean	SD	Mean	SD	'p'	Inter pretation
Inferior Labial Sulcus	-3.41	1.88	-5.25	2.31	0.024	NS	-5.18	2.08	-5.91	2.24	0.366	NS
Inter labial Gap	2.37	1.60	3.49	2.36	0.137	NS	3.26	2.99	3.85	2.60	0.568	NS
Upper lip Length	18.36	2.87	18.60	2.29	0.802	NS	19.09	2.55	18.92	2.55	0.855	NS
Lower Lip Length	40.91	4.78	39.37	4.72	0.384	NS	40.38	5.38	39.65	4.85	0.699	NS
Lower 1/3 height	61.49	5.50	61.4	5.31	0.975	NS	62.01	6.96	61.62	6.16	0.870	NS
total facial hight	109.67	6.61	108.19	6.67	0.548	NS	110.77	8.99	108.7	8.04	0.511	NS
Glabela to TVL	-5.82	5.26	-6.63	5.09	0.7	NS	-8.71	4.54	-9.70	3.95	0.5	NS
Nasal Projection To TVL	11.63	4.61	10.51	4.11	0.49	NS	10.26	7.96	12.01	2.59	0.42	NS
Soft Tissue A Point to TVL	0.35	1.10	0.03	0.96	0.404	NS	0.27	0.68	0.11	1.03	0.619	NS
Upper Lip Anterior to TVL	3.09	2.35	3.57	2.22	0.570	NS	3.26	1.35	3.47	1.56	0.708	NS
Lower Lip Anterior to TVL	1.73	3.13	1.71	2.87	0.955	NS	-0.44	1.82	-0.47	1.48	0.967	NS
Soft Tissue B Point To TVL	-5.31	3.90	-6.35	4.02	0.478	NS	-8.68	3.85	-8.94	3.43	0.848	NS
Soft Tissue Pogonion to TVL	-5.45	4.24	-5.83	4.58	0.818	NS	-6.95	3.76	-6.44	3.12	0.686	NS
Throat Length	53.57	5.46	55.02	5.64	0.481	NS	53.15	9.64	52.93	5.82	0.940	NS
	Comparision of group Ia with Ib for Linear parameters						Comparision of group IIa with IIb for Linear parameters					

CONCLUSION

There was no statistically significant difference in the angular and linear parameters measured for soft tissue on cephalogram and photographs.

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