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EVALUATION OF CORRELATION BETWEEN CEPHALOMETRIC ANALYSIS AND PHOTOGRAPHIC FACIAL ANALYSIS

Orthodontics

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ABSTRACT

Aim: The aim of this study is to find the correlation between the cephalometric analysis and the photographic analysis by various angular and linear measurements. **Materials and method:** The study was conducted in Department of Orthodontics and Dentofacial Orthopaedics in Mansarovar Dental College. The inclusion and exclusion criteria were devised. The sample size was 100 individuals with no apparent facial asymmetries. The lateral cephalogram was done for the subjects. The facial photographs in frontal and profile views at both rest and at smile were taken. The radiographic analysis and the photographic analysis were done, the mean values were calculated and tabulated. The statistical analysis was done for the obtained values and probability of $p< 0.05$ were considered significant. **Results:** The study concluded that there was highly significant correlations and no statistically significant differences were found for sagittal and vertical diagnostic variables in the cephalometric analysis and photographic analysis. **Conclusion:** The study concluded that the clinical photographs can be used as an adjunct to lateral cephalograms provided that the anatomical landmarks are marked properly.

KEYWORDS

Cephalometric analysis, Photographic analysis, linear measurements, angular measurements.

INTRODUCTION:

Cephalometry was introduced by Broadbent in 1931 after which the diagnostic evaluation of facial forms and different craniofacial features saw a monumental change [1]. Even to this day, cephalometry is considered as a gold standard for orthodontic diagnosis. The entire orthodontic treatment planning involves a plethora of records which includes study models, radiographs and clinical photographs. Among these, radiographs are invasive procedures for the patients. They have as many limitations of which radiation exposure is most important and they are not cost effective and are very also technique sensitive which requires extensive instrumentation. With rising concerns about radiation exposure, unnecessary irradiation should be avoided since there is no threshold dose below which biologic damage does not occur [2].

The shift from Angle's paradigm to soft tissue paradigm saw the rise in the usage of clinical photographs which was at a time considered a luxury as a part and routine of the diagnostic records. There is an increasing need of resorting to methods that can give equal if not better results to the cephalograms. Owing to this, clinical photography is on an uphill and is becoming a constant. In comparison to radiographs, Photographic analyses are inexpensive, and they help in better assessment of the harmonic relationships among external craniofacial structures, which includes influence of muscles and adipose tissue [3,4]. There are two forms of smiles, the happiness or Duchene smile and the posed or social smile [5].

The posed smiles have acquired significance in Orthodontics and in general dentistry, fundamentally on the fact that they are replicated easily after some time. Clinical photographs are also helpful for educational purposes. The necessity has raised in balancing the soft tissue in accordance to the skeletal and dental changes brought about by the Orthodontic treatment.

In literature, the number of studies supporting the view, that photographs can be used for facial assessment are very less to nil. This study aims in finding the correlation between the cephalometric analysis and clinical photographs for facial assessment.

MATERIALS AND METHOD

The study was conducted as a retrospective type of study. The records of patients who has reported to the Department of Orthodontics and Dentofacial Orthopaedics in Mansarovar Dental College, Bhopal, for treatment purposes were randomly chosen. The lateral cephalogram and clinical photographs which were taken as a part of routine records was obtained from the archives of the Department. The sample size was designated as N =100 with a confidence level of 95%.

The study included subjects of age 15 to 20 years without any previous history of orthodontic treatment, facial asymmetries, developmental and craniofacial abnormalities and history of craniofacial or maxillofacial surgeries.

Subjects above 20 years of age, any previous history of orthodontic treatment, facial asymmetries, any developmental and craniofacial abnormalities and previous history of craniofacial or maxillofacial surgeries were excluded from the study.

The photographs were taken to help in examining all the macro-, mini-, and micro-aesthetic features. The photographs were taken with a DSLR Camera and followed the criteria from American Board of Orthodontics. The criteria included that the patient's head to be oriented accurately in all three planes of space and on Frankfurt horizontal, ears exposed for the purpose of orientation, eyes open and looking straight ahead, glasses removed, soft tissue areas are of concern and of diagnostic value (should be recorded in these photos), white or light background, free of shadows and distractions, quality lighting revealing facial contours and photographs should be approximately one-quarter life size.

To determine if the photographs are one-quarter life size, the vertical distance from the hairline to the inferior border of the patient's chin is measured [6]. Profile image permits the visualisation of the contours of chin, nose and neck area as well as the profile of image like convex, concave or straight. Profile-smile image allows one to see the angulation of maxillary incisors [7].

The following parameters were measured in both the cephalograms (Figure 1) and photographs (Figure 2). 4 angular and 3 linear measurements were taken.

- ***ANB*** angle according to ***Steiner's [8] analysis***
- ***FMA*** angle according to ***Tweed's [9] analysis***
- ***Nasofrontal*** angle according to ***Powell's [10] analysis***
- ***Nasolabial*** angle according to ***McNamara's [11] analysis***
- ***Anterior facial height*** according to ***Jarabak's [12] analysis***
- ***Posterior facial height*** according to ***Jarabak's [12] analysis***

- ***Lower anterior facial height*** according to ***Jarabak's [12] analysis***

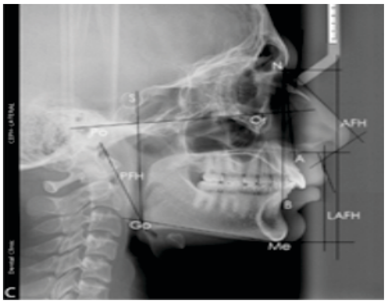

Figure 1: Linear and angular measurements in lateral cephaogram.

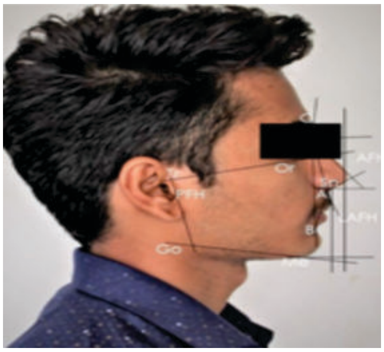

Figure 2: Linear and angular measurements in clinical photograph

Both the cephalograms and photographs were digitalised and analysed by Nemoceph Dental NX studio software for windows. Statistical analysis was done by SPSS 20.

RESULTS

One hundred subjects comprised the sample size.

Table 1: Comparison between the angular and linear measurements in lateral cephalograms and clinical photographs

	GROUP	N	Mean	Std. Deviation	Std. Error Mean
ANB	PROFILE PICTURES	100	4.2550	2.35762	.52718
	CEPH	100	3.9900	2.38745	.53385
FMA	PROFILE PICTURES	100	25.2050	6.36508	1.42327
	CEPH	100	24.7150	6.55931	1.46671
NLA	PROFILE PICTURES	100	100.8100	11.16724	2.49707
	CEPH	100	102.3400	11.14320	2.49170
NFA	PROFILE PICTURES	100	138.3600	6.34975	1.41985
	CEPH	100	137.6050	7.16868	1.60297
LAFH/AFH	PROFILE PICTURES	100	.54245	.039895	.008921
	CEPH	100	.53563	.020710	.004631
PFH/AFH	PROFILE PICTURES	100	.4945	.10570	.02364
	CEPH	100	.6670	.07519	.01681

Table 2: Correlation between the angular and linear measurements in lateral cephalograms and clinical photographs

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
ANB	.010	.921	.353	38	.726	.26500	.75028	-1.25385	1.78385
FMA	.162	.690	.240	38	.812	.49000	2.04375	-3.64737	4.62737
NLA	.021	.885	-.434	38	.667	-1.53000	3.52759	-8.67124	5.61124
NFA	.485	.491	.353	38	.726	.75500	2.14137	-3.57998	5.08998
LAFH /AFH	2.805	.102	.679	38	.502	.006820	.010051	-.013527	.027167
PFH/ AFH	2.298	.138	-5.947	38	.408	-.17250	.02901	-.23122	-.11378

Table 1 gives the descriptive statistics like mean and standard deviation of the parameters measured. Table 2 gives the Levene's test for equality of variances measured. Among all the parameters measured, no statistical differences were noted and significant correlations were found between the groups.

DISCUSSION

The main objective behind this study was to find whether lateral photographs can be a reliable method of diagnosis when and where lateral cephalography is not possible for the patients. The reliability of the photographic method was excellent, indicating that facial landmarks can be located consistently. This makes the use of photography in epidemiologic studies of large groups possible because of its reproducibility [13].

On comparing the cephalometric and photographic variables for the entire sample [Table 1], significant correlations were found for all the variables studied. Highly significant correlations were found for the facial height measurements. Similar results were found by Zhang et al[13]., Christine[14], Bittner[15] in their study. This shows that facial length can be judged reliably from the photographs. The main reason behind these correlations in facial height is owing to the reason that the anatomic landmarks for those measurements are not variable in both the skeletal and soft tissue aspects. Studies have also reported significantly larger values for LAFH and PFH in male subjects in comparison to female subjects, which was also true in this observations [3, 16-18]. However, the LAFH/AFH and PFH/ LAFH ratios showed no significant sexual dimorphism in our study. Therefore, although male subjects showed greater absolute measurements, the values maintain similar proportions for both the subjects[2].

In this study, a positive correlation was seen between the ANB angle. This was similar to the findings by Gomes et al[2]., who also noticed highly positive correlation. Christine et al[14]., in their study of Class III subjects found strong correlations between ANB to A'N'B'. Bittner and Pancherz[15] found moderately positive correlations for ANB to A'N'B' angles. The findings from Fernandez-Riveiro et al[18]., did not agree with our findings as he noticed that the Sn point was more prominent in male subjects, which may explain in part the A'N'B' angle dimorphism in his observations.

FMA values according to Tweed's analysis for measuring the growth pattern also showed significant correlation in this study. Moderately positive and significant correlations were found for FMA according to DP Patel[19]. The results from this study were also in accordance with the observations from Zhang[13]. Bittner and Pancherz [15] in their study found strong correlations for the mandibular plane angle when a comparison of angular measurements was made from facial photographs and lateral head films. Hence, photographs can be used reliably to judge the facial growth pattern.

The relationship between the nasal base (columella) and the upper lip, analysed by the nasolabial angle, is one of the facial profile parameters with broader clinical uncertainty. The nasolabial angles are more highly prone to method error [18]. In this study, there was a correlation between the nasolabial angle in lateral films and in the lateral facial photographs.

The nasofrontal angle showed correlation among the two groups. There was sexual dimorphism in nasofrontal angle according to Riveiro et al [18]., owing to the position of the forehead in female population.

CONCLUSION:

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The study concludes that among the various parameters measured, they were all significantly correlating between the two groups. Hence, when and where cephalograms are not available and possible, photographs can be considered as a very valuable adjunct for it. But cephalometrics and photography cannot be used interchangeably since they measure different aspects of craniofacial morphology. But even then, photography assumes equal importance as an essential diagnostic aid as there is a paradigm shift towards the soft tissue in orthodontic treatment planning.

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