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ORIGINAL RESEARCH

To evaluate and correlate nasolabial angle, mentolabial sulcus angle and throat angle using cephalometric and photographic measurement

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ABSTRACT

Background: This study was conducted to evaluate and correlate nasolabial angle, mentolabial sulcus angle and throat angle using cephalometric and photographic measurement.

Material and methods: A sample size of 30 subjects were included in the study. Lateral cephalograms were taken of all the subjects using CS 8000C (Carestream Health, Inc, France) in the department of Oral Medicine and Radiology, Inderprastha Dental College and Hospital. The lateral cephalograms were manually traced by one investigator. 3 parameters were evaluated in each lateral cephalogram. Similarly lateral profile photograph for each subject in NHP (natural head position) was also taken from canon 1500d DSLR camera. 3 parameters were also evaluated in each lateral profile photographs. All the data were collected and statistically analyzed using SPSS statistical software. Comparison was assessed by using Student t-test. Correlation was assessed by Pearson correlation test.

Results:The average value for nasolabial angle, mentolabial angle and throat angle were found to be 92.46°± 9.43º, 103.66°± 20.27° and 129.6°± 13.86° respectively when assessed from cephalometric radiograph. The average value for nasolabial angle, mentolabial angle and throat angle were found to be 93.4°± 10.61°, 108.1°± 2.97° and 129.1°± 16.03° respectively when assessed from profile photograph.

Conclusion: The current study came to the conclusion that photography, which enables the recording of significant numbers of photographs for analysis, is a reliable and cost-effective tool for identifying soft tissue landmarks.

Keywords:mentolabial angle, nasolabial angle, throat angle, cephalogram, photographs, profile, orthodontics.

INTRODUCTION

Orthodontic diagnosis and Orthodontic treatment planning both follow a process that is quite compatible with the modern problem-oriented approach to healthcare as a whole. Similar to other dental and medical specialties, diagnosis in orthodontics includes compiling a sufficient database of patient data and distilling from that data a thorough yet concise summary of the patient's issues.Orthodontic diagnosis entails identifying a malocclusion, determining its severity, and developing a strategy to normalize the malocclusion.The two steps which constitute diagnosis are development of adequate diagnostic database and formulation of problem list (the diagnosis) from the database

An organized approach to diagnosis and record keeping, as well as diligent monitoring of treatment progress, are necessary for successful orthodontic treatment; a subpar record may be a sign of subpar care. Photographs and lateral cephalogram radiograph comes under the list of essential diagnostic aid in orthodontics [(2)]

In case of orthodontic records, a diagnostic report which is supported by study models, radiographs, and images are required to establish the case's status before to the treatment and for tracking progress during treatment.[(3)]

A pleasing and appealing face has a harmonious alignment of both the jaws and the teeth, which are emphasized by the skin's colour and texture, as well as by a balanced and complementing match of the nose, lips, eyes, and ears.[(4)]

Cephalometric radiograph's facial change prediction is more accurate than diagnosis and treatment planning, which are based on model analysis. When bite changes are the only factor used to guide treatment and are determined by model assessment, the face outcome may be adverse.[(5)]

Now a days, the focus of orthodontics has shifted from the oral and skeletal components to the soft tissue parts. Orthodontic philosophy and practice have primarily been founded on the Angle's paradigm over the past 100 years.[(6)]

The orthodontic procedure's effectiveness is generally evaluated by assessing improvements inboth the soft and the hard tissues. One of the most crucial aspects of the planning and execution of orthodontic treatment is evaluating and measuring soft tissue changes. To do this, lateral cephalogram radiographs have been used to objectively analyze soft tissues.[(7)]

In addition to the traditional cephalogram, several methods have been utilized to evaluate the changes in the soft tissues. Two-dimensional (2D) and three-dimensional (3D) photogrammetry are examples of this.

There is a growing need to turn to techniques that can produce outcomes that are at least as good. Since then, clinical photography has been increasingly important in orthodontic offices.Photogrammetry is the science, art, and technology of capturing, measuring, and analyzing photographic pictures in order to gather accurate information about physical things.Stoner following Sheldon (1940s), who proposed that standardized pictures might assist in capturing precise anthropometric measurements, and later introduced photogrammetry in the discipline of orthodontics.[(7)]Common cephalometric evaluations concentrate on the relationships between the surrounding soft tissues (the nose, lips, and chin) and the hard tissues (the bone and teeth).[(8)]One of the important elements to take into account when making an orthodontic diagnosis and providing direction for the aesthetics of the nose and facial profile is the**Nasolabial angle (NLA).** It is described as the intersection of two lines that cross between the upper lip's border and the bottom edge of the nose (the columella). The optimal nasolabial angle is said to be between 90° and 95° for men and 95° to 115° for women, however these values may change according on the phenotypical group.[9]One of the most significant aesthetic features of the lower face is the **mentolabial sulcus**, commonly known as the labiomental fold.

The visible dip in the frontal view that divides the lower lip from the chin is known as the mentolabial groove or crease. In the side view, it is easy to observe how the lower lip and soft-tissue chin connect. The bottom component of the sulcus angle is the soft-tissue chin's inclination with respect to the true horizontal line across the sublabiale, and the top component is the lower lip's inclination with respect to that line. A mentolabial angle of 107°-118° (for men: 115°-145° and for women: 120°-130°) is regarded as typical, according to Naini et al. [(9)]The chin-throat angle, which is known as the submental-cervical or cervico-mental angle (as opposed to the mento-cervical angle), has been measured to be at lows of 90° and highs of 124°.The ideal value for this angle's attractiveness, according to a recent survey, was 95°.[(8)]

The purpose of the current study was to determine if face landmarks could be accurately determined using picture analysis.

MATERIAL AND METHODS

A sample size of 30 subjects were included in the study. Lateral cephalograms were taken of all the subjects using CS 8000C (Carestream Health, Inc, France) in the department of Oral Medicine and Radiology, Inderprastha Dental College and Hospital. The lateral cephalograms were manually traced by one investigator. 3 parameters were evaluated in each lateral cephalogram. Similarly lateral profile photograph for each subject in NHP (natural head position) was also taken from canon 1500d DSLR camera. 3 parameters were also evaluated in each lateral profile photographs. All the data were collected and statistically analyzed using SPSS statistical software. Comparison was assessed by using Student t-test. Correlation was assessed by Pearson correlation test.

Figure 1: Lateral Cephalogram

Figure 2: Armamentarium For Cephalometric Tracing

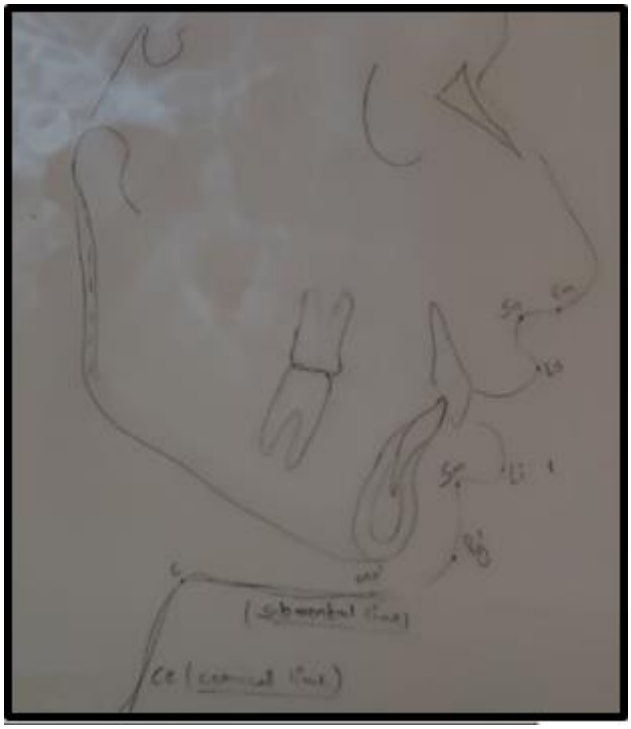


Figure 3: Landmark Tracing

RESULTS

The goal of the current study was to compare and assess the correctness and dependability of digital images against lateral cephalograms. The study involved 30 patients who sought orthodontic treatment at the Inderprastha Dental College and Hospital, Sahibabad, Ghaziabad, India, Department of Orthodontics and DentofacialOrthopaedics.

The consent was taken from the patients after being informed about the study. The lateral cephalograms along with their right side profile photographs were taken from canon 1500d DSLR digital camera.

After the comparision of photograph with lateral cephalogram's soft tissue parameters it was seen that the angular measurements i.e. Nasolabial angle (NLA), Mentolabial angle (MLA) and Throat angle (TA) showed no significant difference, (p value = 0.720, 0.350 and 0.869 respectively). Although the difference was non significant all the parameters were found to be increased in right side profile photograph when compared with lateral cephalogram.

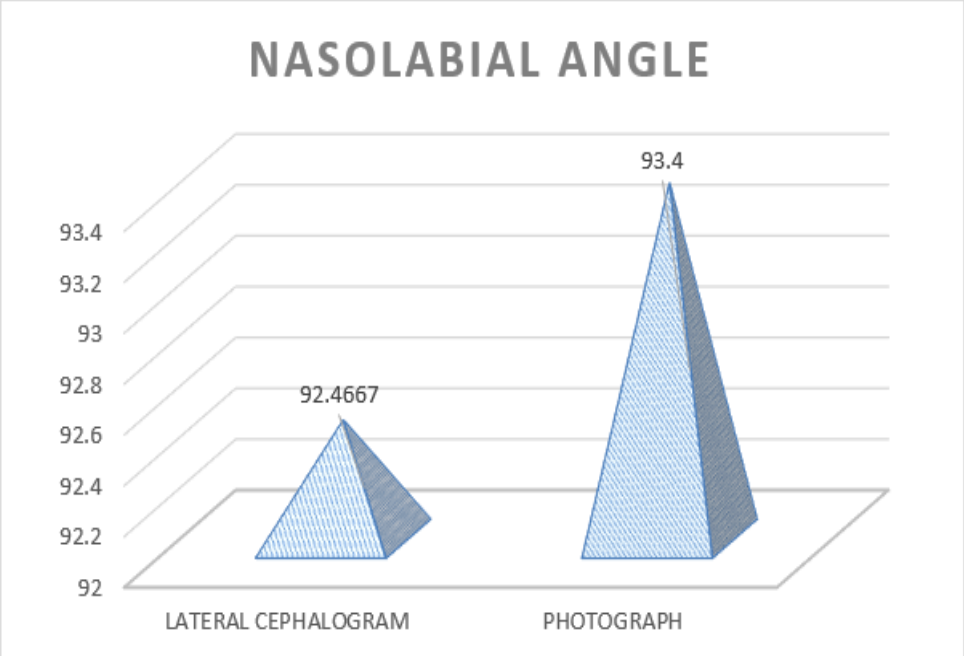
Among all the three angular measurement Mentolabial angle showed to have increased the most.

Mean Nasolabial angle for right side profile photograph was found to be 93.4°± 10.61° where as for lateral cephalogram it was found to be 92.46°± 9.43°.

Mean Mentolabial angle for right side profile photograph was found to be 108.1°± 15.87° where as for lateral cephalogram it was found to be 103.66°± 20.27°

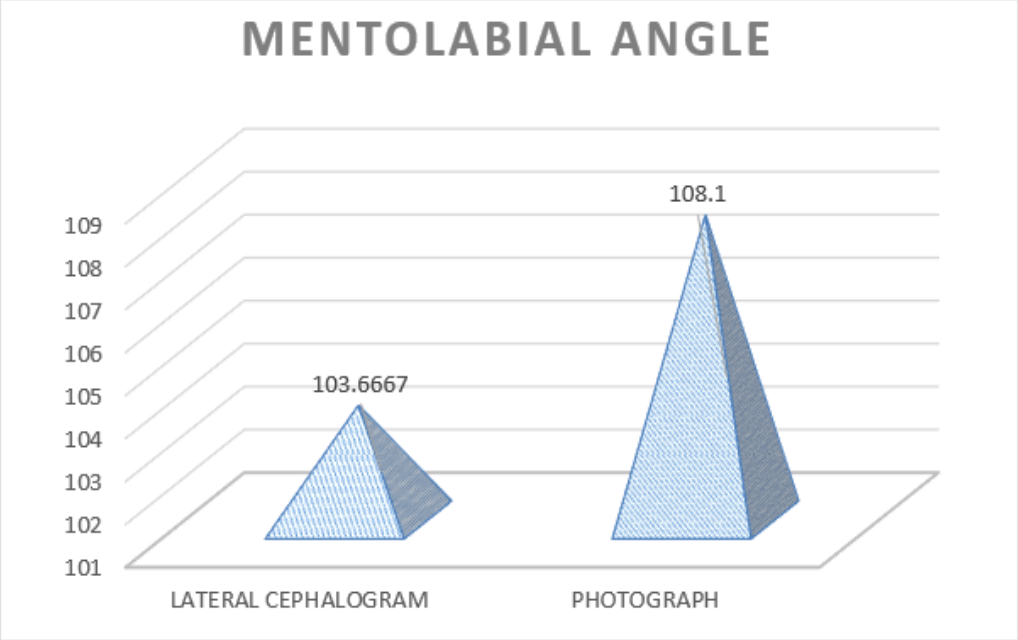
Table 1: Comparison Of Angles Between Photograph & Cephalogram

PARAMETER	GROUP	N	MEAN (in degree)	STD. DEVIATION	P-VALUE	REMARKS
NASOLABIAL ANGLE	LATERAL CEPHALOGRAM	30	92.4667°	9.43118	.720	Ns*
	PHOTOGRAPH	30	93.4000°	10.61099		
MENTOLABIAL ANGLE	LATERAL CEPHALOGRAM	30	103.6667°	20.27115	.350	Ns*
	PHOTOGRAPH	30	108.1000°	2.97		
THROAT ANGLE	LATERAL CEPHALOGRAM	30	129.6667°	13.86470	.869	Ns*
	PHOTOGRAPH	30	129.1379°	16.03951		



Mean of Nasolabial Angle between

Lateral Cephalogram and Photographs



Mean of Mentolabial Angle between

Lateral Cephalogram and Photographs

Mean Throat angle for right side profile photograph was found to be 129.1°± 16.03°whereas for lateral cephalogram it was found to be 129.6°± 13.86°.

When all the parameter i.e. nasolabial angle, mentolabial angle and throat angle of lateral cephalogram and right-side profile photograph were correlated it was seen that Nasolabial angle of right-side profile photograph was positively correlated with lateral cephalogram value having coefficient of correlation as 0.529.

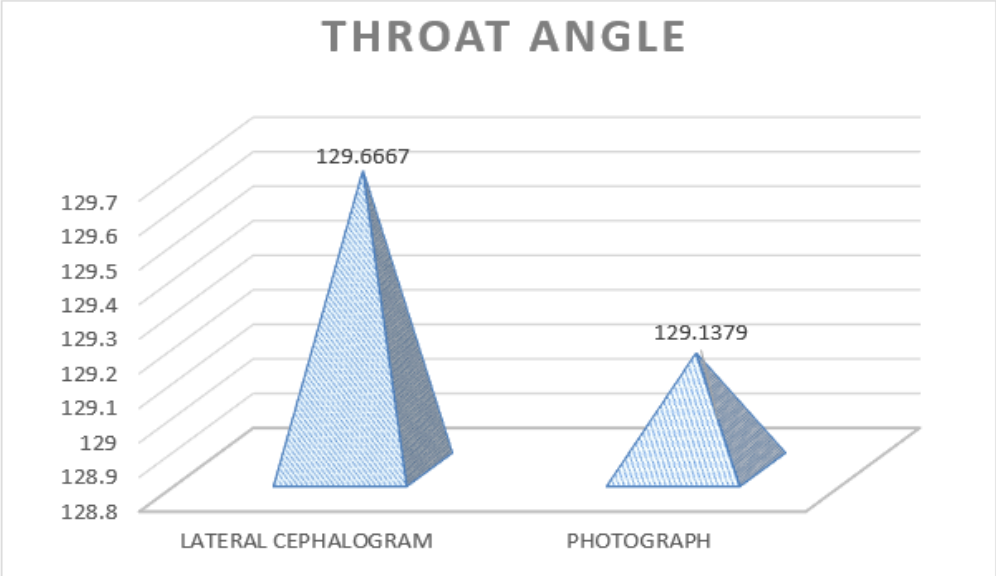
Similarly, Mentolabial angle of right-side profile photographs was found to be positively correlated with lateral cephalogram value having coefficient of correlation as 0.662.

Again, throat angle of right side profile photograph was also seen to be positively correlated with lateral cephalogram value having coefficient of correlation as 0.679.

The coefficient of correlation for Nasolabial angle, mentolabial angle and Throat angle in right side profile photograph and lateral cephalogram were shown in table 2.

All of the angular parameters on profile photograph and cephalograms differed in a statistically insignificant way.

- With no statistically significant variations in the recorded mean values, the dependability of the digital photos was equivalent to that of the cephalograms (P 0.05).
- The T-Test results which display a statistically insignificant difference occurring between the angular parameters on right side profile photographs and cephalograms were shown in Table 1.



Mean of Throat Angle between

Lateral Cephalogram and Photographs

Table 2: Correlation Value Between Lateral Cephalograms & Right-Side Profile Photographs

Parameter Correlation	Nasolabial Angle (Photographic)	Mentolabial Angle (Photographic)	Throat Angle (Photographic)
Nasolabial Angle (Cephalometric)	0.549	-	-
Mentolabial Angle (Cephalometric)	-	.662	-
Throat Angle (Cephalometric)	-	-	.679

$-1 < r < 1$, r = coefficient of correlation

DISCUSSION

Extraoral photographic records play a significant role in treatment planning therefore it comes under one of the essential diagnostic aids in orthodontics. The digital revolution has had a significant influence recently in the field of dentistry and orthodontics, making it easier and faster to manage patient data and records while also requiring less storage space. The orthodontist must carefully analyse the patient's soft tissue profile as a part of the treatment planning process. One of the crucial steps in assessing the stability and efficacy of treatment outcomes in orthodontics is soft tissue analysis along with determining the attractiveness of the face as well.

The current gold standard for assessing and analysing skeletal craniofacial morphology is cephalometric analysis. Its accessibility is still problematic in many areas, particularly in a developing nation like India because it needs a large amount monetary support. As photographs are non-invasive and inexpensive, it has become one of the more important current topic to find ways to use them in accurately estimating the morphology of the craniofacial region.[10]. The standardised photography method provides a number of benefits. Additionally, measurements may be repeated and data can be kept permanently , making more longitudinal follow-up research possible.[11]Additionally, there are certain drawbacks also to the photography process, such as the distortion which makes the items closer to the camera looks larger than those which are farther away. This component, however, is only important when attempting to compare objects that are situated in several planes of space.

Cephalometry's capacity to see bone landmarks is undoubtedly a benefit. This benefit is particularly significant when the hard-tissue site is far from the soft-tissue landmark. For instance, the bony landmark Pog(pogonion) differs greatly from the soft-tissue landmark Pog' in some patients. In these patients, mandibular anteroposterior positions would be overestimated by photography. Hence reduced correlations between cephalogams and photographs which is partially due to this dense soft-tissue integument.[12]

The purpose of the current study was to determine if facial landmarks could be accurately determined using photographic analysis.In this study only 3 angular variables were used, which also partially invalidate the problem of magnification. Also, the correlation between measurements on photograph and the lateral cephalogram was evaluated.

The findings of the current investigation demonstrated that there was a statistically insignificant difference between the 3 angular measurement (nasolabial angle, mentolabial angle and throat angle)taken on lateral cephalograms and right side profile photograph using the ANOVA test which is in conjunction with the results of the study done by Jaiswal, et al[7].

It was found in the investigation by Jaiswal et al[7], where a total number of 21 parameters (11 vertical and 10 horizontal) in all were measured. All 21 parameters showed a statistically non-significant difference between photogrammetric and cephalometric analysis using ANOVA (p-value ≤ 0.05). The 21 evaluated criteria were all in agreement with one another. All soft-tissue landmarks were reliable on both photograph assessment and radiographic assessment.[7]

Similar studies were done by Gomes et al.[11], where most sagittal and vertical diagnostic factors showed very significant associations between cephalometric and radiographic parameters, taken in a sample of about 123 subjects (65 girls, 58 boys). The A'N'B' and FMA' angles were the photographic variables that best explained the variability of its analogous cephalometric measurement. Reliability of the photographic technique was found to be satisfactory with highly significant correlations (P # .001)

A statistically significant correlation was found between photographic, radiographic and direct measurements in a study done by Negi et al[13]. They discovered in a cross-sectional study conducted on 30 subjects, taking their frontal cephalograms and standardized frontal

photographs, concluded that highly significant correlation exist between the two, with $p<0.001$ stating that photogrammetry has proven to be an alternative diagnostic tool.
Staudt CD et al., also found good reliability (r=0.08) for ANB angle in his study by comparing radiographs with photographs of 29 skeletal Class III and 13 Class I patients[31]
However the result of present study are not in with the study done by Pooja Mehta et al[14], they compared few of the angular and linear parameter of cephalometric and photographic variables in the skeletal class II participants like FMA, MP-OP angle, OP angle, ANB, convexity, gonial angle and facial angle. There was a significant p-value for parameters like ANB and face plane angle, showing that there was a substantial difference in values between the photographic and cephalometric readings and that the photographic parameters could not be reliable in place of the cephalometric values. Additionally, they found that when they compared the linear variables, the cephalometric values, Witts, convexity (in mm), and mandibular body length all had significant difference between these photographic and cephalometric parameters as a result the photographic values could not be used as an alternative. This difference can be argued on the basis of Magnification error as they have taken millimetric measurements in photographs, difficulty in evaluation of some landmarks points as described in their study also with a single operator bias, along with different assessment parameter from former study.
Study conducted by Nicoo et al[15] does not harmonize with present study where they randomly selected participants (38 women and 37 men), No significant correlation was found between the photographic and cephalometric data of face height ($r = -0.03$, $P > 0.05$), the difference was due to the linear parameter taken in the study from where magnification error comes into play, suggesting that there is always a need of lateral cephalometrics for the correct orthodontic treatment plan and as a golden standard.

CONCLUSION

The current study came to the conclusion that photography, which enables the recording of significant numbers of photographs for analysis, is a reliable and cost-effective tool for identifying soft tissue landmarks.

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