



Original Research

Evaluation of upper and lower components of nasolabial angle in different malocclusions- A cephalometric study

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Abstract

Introduction: Nasolabial angle is composed of two components: a) upper and b) lower component. Various foreign authors have developed different methods for evaluating this but consistent and reproducible methods for Indian population are few. Therefore, this should be placed within acceptable limits by planning treatment procedures accordingly to get the best aesthetic profile result and patient satisfaction.

Aim of the study: To evaluate upper and lower components of nasolabial angle in different malocclusions in Bhopal population.

Material and methods: It is a retrospective study, of sample size 150 that comprised of 60 profile pictures of individuals who belonged to Bhopal, out of which 30 were selected as aesthetically pleasing. Their lateral cephalograms were taken and traced. The study also used 120 lateral cephalograms of different malocclusions. The recorded data was analyzed using one-way ANOVA Test.

Result: Significant results with p value < 0.001 were found for the nasolabial angle among ideal group, Class I bimaxillary protrusion, Class II Division 1 and Class II Division 2, Class I crowding.

Conclusion: Nasolabial angle is correlated with the type of malocclusion and the soft tissue variables also alter this angle.

Keywords: Nasolabial Angle, Upper Component, Lower Component, Malocclusion.

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INTRODUCTION:

Angle proposed that the soft tissue would take a harmonic position if the dentition was intact and positioned in an optimal occlusion. The nasolabial angle, a critical facial parameter, holds significant clinical relevance in treatment planning. Its evaluation, particularly concerning the upper and lower components, stands as a pivotal aspect in understanding facial harmony and aesthetic outcomes in individuals with varying malocclusions. In orthodontics, different authors have included soft tissue parameters in cephalometric analysis.^[1]

For diagnosis and treatment planning, soft tissue analysis has supplanted hard tissue measurements.^[2] An important soft tissue characteristic to be considered is the NLA. This angle is formed by a line from lower border of the nose to one indicating the inclination of upper lip. Variations or deviations in this angle can influence perceptions of nasal prominence, upper lip fullness, and overall facial symmetry. Consequently, understanding and evaluating the nasolabial angle aid clinicians in treatment planning, guiding interventions aimed at achieving optimal facial aesthetics and functional outcomes.^[3]

NLA is composed of two components, i.e., a) upper and b) lower. The upper component is determined by the angle of columella. This facet of the nasolabial angle is primarily defined by the angle of the columella, the fleshy column of tissue separating the nostrils. The angle formed by the columella in relation to the upper lip helps characterize the upper component of the NLA. Changes in this angle can significantly impact the perception of nasal projection and lip aesthetics. The lower component is determined by the upper lip. Specifically, the angle created between the upper lip and the base of the nose contributes significantly to the lower component of the NLA. Variations in this angle influence the perception of lip fullness, facial balance, and overall harmony.^[4]

This cephalometric study aims to delve into the nuanced relationship between different malocclusions and the components shaping the nasolabial angle. The purpose of this study is to evaluate upper and lower components of nasolabial angle in different malocclusions in Bhopal population.

MATERIALS AND METHODS

It is a retrospective study which comprised of 60 profile photographs of 30 males and 30 females from Bhopal population who do not require orthodontic intervention were taken out of which 30 photographs were selected by the group of observers as aesthetically pleasing. The group of observers comprised of laypersons, artists and orthodontists. The photographs were taken using a DSLR camera (100 mm macro lens) with a distance of 5 feet from the patient without flash. The samples were collected from Department of Orthodontics and Dentofacial Orthopaedics of colleges in Bhopal within the period of 2 years. Dahlberg's formula was applied and lateral cephalograms of 30 selected aesthetically pleasing profiles were taken and traced as ideal samples. 120 pre-treatment lateral cephalograms of different malocclusions grouped as following: A. Class I malocclusion with moderate to severe crowding, B. Class I bimaxillary protrusion, C. Class II division 1 and D. Class II division 2 were taken and traced. All the 30 cephalograms of aesthetically pleasing profiles were taken from a distance of 5 feet, 15 mA, 70Kvp for 0.6 seconds with lips relaxed, which is more natural position and allow a more accurate tonicity of the lip. The sample inclusion criteria was 1) Males and females between 18 to 35 years of age. 2) All permanent teeth should be intact except third molars. The nasolabial angle and its upper and lower component were evaluated and recorded. The study was retrospective. All data was collected, measured and statistically analyzed using statistical package for social sciences (SPSS) software. One way analysis of variance were applied

to all the groups. To determine the error of radiographic measurements random 30 cephalograms were remeasured by another examiner 3 weeks after first measurement. (Figure-1).

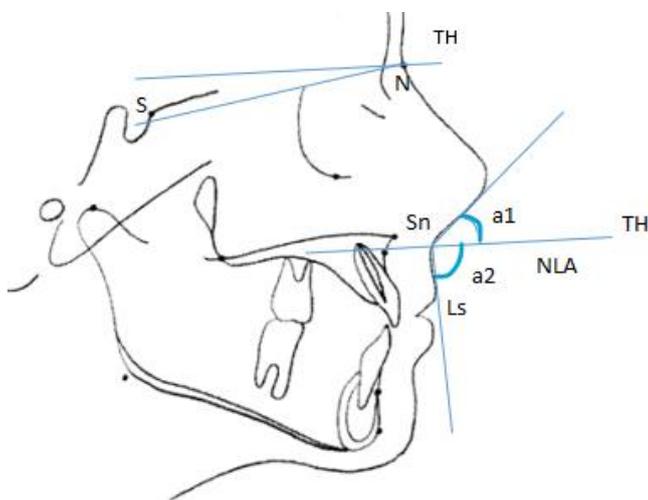


Figure 1(a): Nasolabial angle: a; a1: upper component; a2: lower component

Cephalometric Parameters Used For This Study:

Soft Tissue Parameters	Skeletal Parameters
Labrale superius (Ls): A point indicating the mucocutaneous border of the upper lip. Usually the most anterior point of the upper lip	True Horizontal: A horizontal line 7° from SN plane.
Base of the nose: An imaginary line between the most lateral points of the external inferior attachments of the alae nasi to the face.	Sella: Geometric centre of the pituitary fossa, located by visual inspection.
Subnasale (Sn): The point at which the columella (nasal septum) merges with the upper lip in the midsagittal plane.	Nasion: Most anterior aspect of the frontonasal suture.

RESULTS:

A group of 10 Artists, 10 Orthodontists, and 10 Lay persons were asked to score the photographs based on aesthetics. According to scores, it was divided into 3 categories. According to the scores obtained 30 were selected and considered as Ideal group. The mean scores were calculated based upon group of males and females, given by all artists, orthodontists and laypersons. The results were summarized.

Group	Scores	GROUP					
		Male		Female		Total	
		Count	Percentage	Count	Percentage	Count	Percentage
Laypersons	1-3	9	30.0%	9	30.0%	18	30.0%
	4-6	14	46.7%	15	50.0%	29	48.3%
	7-10	7	23.3%	6	20.0%	13	21.7%

Table 1: Mean scores given to the samples based on aesthetics by a group of Lay persons

Overall, there were 120 participants, grouped as Class I bimaxillary protrusion, Class II division 1, Class II division 2, and Class I malocclusion with moderate to severe crowding. The nasolabial angle, upper component and lower component were measured. The means and standard deviation of all variables were analyzed with summarization of all groups. [Table 1]

S.NO	COMPONENT	IDEAL GROUP		CLASS I BIMAX		CLASS II DIV 1		CLASS II DIV 2		CLASS I CROWDING		P-VALUE
		MEAN	S.D.	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.	
1	NASOLABIAL ANGLE	95.73	12.42	86.03	11.82	95.20	11.65	98.77	11.36	89.07	15.31	0.001**
2	UPPER COMPONENT	19.60	9.82	16.10	10.17	22.83	9.34	20.00	9.79	19.37	8.83	0.12
3	LOWER COMPONENT	75.80	9.48	67.63	13.61	72.70	10.34	78.43	6.22	70.03	10.21	<0.001**

Table 2: Mean values of nasolabial angle among various groups.

The mean nasolabial angle and their standard deviation among various groups were analyzed and summarized. The p Value was calculated as 0.001 [Table 2]

The mean upper component and their standard deviation among various groups were analyzed and summarized. The p Value was calculated as 0.12 [Table 2]

The mean lower component and their standard deviation among various groups were analyzed. The p Value was calculated as 0.001 [Table 2]

DISCUSSION:

In orthodontics, soft tissue diagnosis is crucial for treatment planning and mechanics involved.^[5] Nasolabial angle is one of the important elements to take into account when making an orthodontic diagnosis and providing direction for aesthetics of nose and facial profile. Hence, detailed study of this area and knowledge of any cosmetic changes brought on by planned orthodontic therapy are necessary for comprehensive treatment planning.^[6]

According to a study conducted by F. B. Naini et al. in 2014, the lower component, named upper lip inclination, observed between 79° and 85°, was considered aesthetically pleasing. The results were based on scores given by orthognathic patients, laypeople, and clinicians.^[3]

The results were similar to the results obtained in the current study. Top 30 scorers among 60 were considered as ideally aesthetically pleasing profiles.

In a study conducted by Mubassar Fida et al,^[7] the mean NLA was found to be similar to the present study. Also, a study conducted by S Nandini et al,^[8] the mean NLA was found to be similar to the present study. The similarities in between these studies and current study are observed because the age group of the sample were similar. Also, the method of constructing NLA was similar. They also used true horizontal as reference plane.

The results differed with a study conducted by, Kohila Kandhasamy et al,^[9] where the mean NLA was found to be $116.1^\circ \pm 10^\circ$, the means of upper and lower components $18.50^\circ \pm 7.9^\circ$ and $98.78^\circ \pm 5.9^\circ$, respectively. Although the upper component was found to be in concurrence with the current study, the NLA and the lower component were found to be higher when compared to the current study. The probable reason for the difference could be the basis of selection of ideal samples.

The mean lower component of the current study was found to be in concurrence with the study conducted by F. B. Naini et al,^[3] where they named the lower component as the upper lip inclination with an ideal range. Not many studies were found that analyzed the lower and upper components separately for the aesthetics or treatment planning.

Dua et al conducted a study in which the p value for lower component in males and females was found to be 0.57 and 0.7 respectively, and for upper component in males and females the p value was 1.2 and 0.9 respectively.^[10] The results were similar with the current study because all patients exhibited Class I occlusions with no history of orthodontic treatment for ideal group.

In a study conducted by Bryan S Armijo et al,^[11] the ideal NLA was found to be 93.4° among men and 95.5° among women. In a study conducted by Ayesha Ashraf et al,^[3] p value <0.05 was taken as significant. The mean NLA was found to be 99.67° in males and 90.8° in females, in a study conducted by Vinaya Bhat et al.^[2] In a study conducted by Pradeep babu Kommi et al,^[5] the p value was 0.05 which showed no significant difference between males and females.

According to Orten and Hilger,^[12] the ranges for males and women are respectively 90°–95° and 95°–115°. According to Papel and Capone,^[13] the range for men is 90°–100°, and for women it is 100°–110°. Similarly in the current study the mean NLA of the ideal group was measured and it was found to be $95.73^\circ \pm 12.42^\circ$, which is similar with the current study.

The NLA was found to be varied significantly among the various types of malocclusions, with a p value of 0.001. The Class I bimaxillary protrusion showed lower nasolabial angle, followed by Class I crowding then, Class II Division 1 and Division 2. Similarly, followed by upper and lower components, but there was no

significant difference found with the upper component, where nasolabial angle and the lower component varied in a highly significant manner. The results obtained were similar with the current study.

It can be stated that the NLA is influenced by the type of malocclusion, but the nasolabial angle is not solely dependent on it. Although it was found that NLA was correlated with the type of malocclusion, the soft tissue variables like morphology of upper lip, position of the upper lip and nose also alter the NLA. According to the literature, soft tissues don't appear to totally mimic hard tissues, despite the fact that they are laying on top of them.

CONCLUSION

The nasolabial angle (NLA), nasal prominence, upper and lower lip position, and depth of the labial sulcus are only a few of the aspects to consider in order to maintain the aesthetics of the facial profile

The Class I bimaxillary protrusion showed lower nasolabial angle, followed by Class I crowding then, Class II Division 1 and Division 2. Similar pattern was followed by upper and lower components, but there was no significant difference found with the upper component, where nasolabial angle and the lower component varied in a highly significant manner. Therefore, the lower component of nasolabial angle is significantly influenced by malocclusion.

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CONFLICTS OF INTEREST

No conflicts of interest exist

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