

NASOLABIAL ANGLE: SEARCHING FOR A CONSENSUS AMONG ORTHODONTISTS, MAXILLOFACIAL SURGEONS AND PLASTIC SURGEONS

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ABSTRACT

Objective: To assess the level of consensus regarding nasolabial angle among Orthodontists, Maxillofacial surgeons and Plastic surgeons.

Study Design: Cross sectional study.

Place and Duration: Rawalpindi, Islamabad and Lahore, from Jan 2018 to Mar 2018.

Methodology: A total of 250 surveys forms were distributed by hand and online to the residents and consultants of Orthodontics, Oral and Maxillofacial surgery and Plastic surgery. 205 forms were received back and responses were then entered in and analyzed on SPSS version 22. Fishers exact test was used to associate the specialty and years of experience with the method of measuring nasolabial angle and *p*-value of <0.05 was considered statistically significant.

Results: Twenty six (12.7%) of the 205 respondents revealed that they assess the nasolabial angle on Photograph, 87 (42.4%) use Lateral cephalogram and 92 (44.9%) assess directly on patients. Maximum respondents i.e. 150 (73%) chose option A i.e., angle between columella and line intersecting subnasale and labrale superius as the method of measuring the angle. The reason of preference varied among all the specialties. Statistically significant differences were found among clinicians of different specialties and years of clinical experience for the preferred method for measuring the nasolabial angle (*p*-value <0.001). More experienced clinicians estimated the angle on the patients face on profile view, more orthodontists used lateral cephalogram and plastic surgeons preferred patients profile view clinically.

Conclusion: A consensus was reached for the method of measuring nasolabial angle but there was no consensus for the medium of measurement among different specialties.

Keywords: Cephalogram, Measurement, Nasolabial angle, Photograph.

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INTRODUCTION

For optimal facial esthetics, both hard and soft tissues parameters are deliberated on, though more recently the planning is centered around soft tissue factors^{1,2}. There are various soft tissue diagnostic parameters to assess facial harmony including nasolabial angle. Nasolabial angle, the angle formed between the base of the nose and upper lip with a normal value of 102 ± 103 , is one of the soft tissue parameters which is considered a dependable representative of the soft tissue profile and a clinical and cephalometric parameter to establish the treatment goals⁴. The nasolabial angle (NLA) is an important esthetic measure

for assessment and correction of nasolabial contour. Orthodontic treatment, orthognathic surgery as well as plastic surgery can all dramatically change the patient's soft tissue profile hence it is necessary to completely assess the soft tissue profile for successful treatment planning⁵. Orthodontists mainly assess nasolabial angle as part of profile assessment to determine the most ideal treatment plan^{6,7}. Oral and maxillofacial surgeons take nasolabial angle into consideration during orthognathic surgeries as well as rhinoplasties while plastic surgeons utilize this soft tissue parameter to assess the nose for rhinoplasty^{8,9}. The variability in construction of this angle in different specialties and even within specialties can lead to varied values and interpretation of the nasolabial contour during treatment planning.

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The objective of this study was thus to determine the level of consensus regarding the method and medium of measurement of nasolabial angle among orthodontists, maxillofacial surgeons and plastic surgeons to arrive at a standard definition of nasolabial angle which can be used by all concerned specialities.

METHODOLOGY

The study was approved by the Ethical Committee, Armed Forces Institute of Dentistry Rawalpindi (IRB form no. 905/Trg-ABP 1K2). This cross-sectional survey was conducted amongst residents and consultants of Orthodontics, Plastic surgery and Oral and Maxillofacial surgery practicing in different cities of Pakistan between January 2018 and March 2018. Sample size was calculated using the WHO formula and a sample of 205 was finalized (confidence level

amongst the participants of the study and 205 filled responses were received. Collected filled responses were entered in and analyzed on SPSS version 22. Fishers exact test was used to associate the speciality and years of experience with preferred method of measuring the nasolabial angle and p -value of <0.05 was considered significant. Frequencies and percentages were calculated for variables like preference of method (table), reason of preference, medium of measuring the angle and the difficulties faced while measuring the angle.

RESULTS

Total 250 questionnaires were distributed out of which 205 filled responses (82% response rate) were received. The participants were further categorized on the basis of their speciality and years of experience. Our respondents were 22

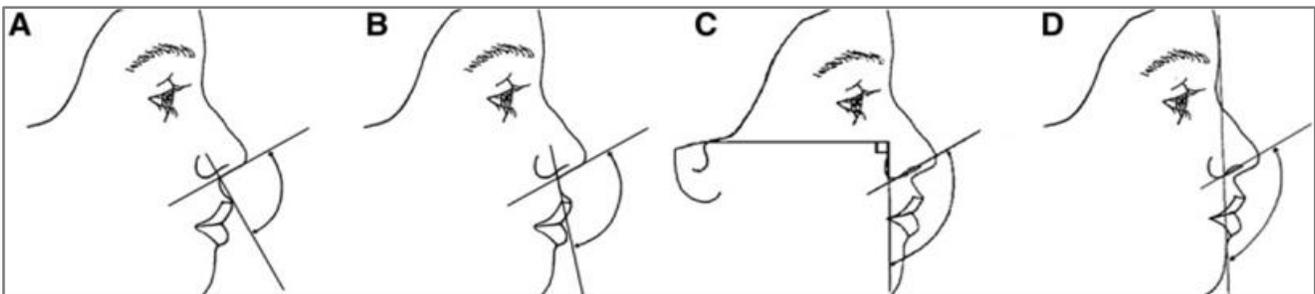


Figure-1: Four common ways of measuring the nasolabial angle used in our survey.

(A angle between columella and line intersecting subnasale and labrale superius; B. Angle between columella and line tangent to cutaneous upper lip proper C. Angle between long axis of nostril and line perpendicular to Frankfort horizontal D. Angle between long axis of nostril and line intersecting glabella and pogonion. Adapted with permission from Leach J. Aesthetics and the Hispanic rhinoplasty. Laryngoscope 2002; 112: 1903-1916).

95%, margin of error 5%, population size 450, response distribution 50%). A survey form comprising of 8 questions was formulated. Paper surveys were distributed among residents and consultants of the above mentioned specialities in the hospitals/institutes and attendees of a plastic surgery conference by non probability purposive sampling. Some questionnaires were filled online. The information collected was speciality, resident or consultant status, years of practice, city of practice, medium of measuring NLA, problems encountered while measuring NLA, method of choice (fig-1), and reason of preference. Approximately 250 questionnaires were distributed

(34.8%) and 71 (10.2%) Orthodontic residents and consultants respectively, 32 (15.6%). Oral and Maxillofacial surgeons and residents each, 23 (12.2%) and 25 (11.27%) Plastic/Rhinoplastic surgeons and residents respectively. 138 participants had 1-5 years of experience, 63 had an experience between 5 to 30 years whereas 4 had more than 30 years of experience. The participants were asked about the medium on which they normally measure the nasolabial angle and whether they face any difficulty on their preferred medium. 155 (75.6%) respondents said they "sometimes" faced difficulty, 9 (4.4%) faced "most of the time" while

41 (20%) respondents" never faced any difficulty" in measuring the angle.

The participants were asked to choose their preferred method for measuring the nasolabial angle from the four methods as shown in (fig-1), the response to this question is shown in (table-I). 149 (72.6%) respondents chose option A, 25 (12%)

determined the angle directly on the patient in profile view whereas less experienced clinicians used lateral cephalogram or photograph (fig-3).

The participants were then asked to select their reason of preference for using the selected angle from the given options in which they could select more than one options. Ease of use was the

Table: Preference of method of measuring nasolabial angle among different groups.

	A	B	C	D	A+B
Orthodontic Consultants	16 (7.8%)	2 (0.97%)	1 (0.48%)	-	2 (0.97%)
Orthodontic Residents	66 (32.1%)	5 (2.4%)	-	-	-
Oral and Maxillofacial Surgeons	25 (12.1%)	7 (3.4%)	-	-	-
Oral and Maxillofacial Residents	21 (10.2%)	7 (3.4%)	4 (1.9%)	-	-
Plastic / Rhinoplastic Surgeons	11 (5.3%)	3 (1.4%)	3 (1.4%)	5 (2.4%)	1 (0.48%)
Plastic / Rhinoplastic Residents	10 (4.8%)	1 (0.48%)	5 (2.4%)	8 (3.9%)	2 (0.97%)

chose B, 13 (6.3%) chose C, 13 (6.3%) chose D and 5 (2.4%) chose both A and B.

A statistically significant difference was observed among different specialties in determining nasiolabial angle through different methods using Fishers exact test (*p*-value <0.001). Orthodontists mostly used lateral cephalogram, plastic surgeons mostly assessed the angle directly on

most common answer (80%). 42% clinicians said their chosen method was reliable, according to 27% of respondents their method was reproducible, 26% of respondents found the reference structures used in their chosen method to be stable and 1% of them said that their reference points were not affected by surrounding structures. 1% of the participants marked all options

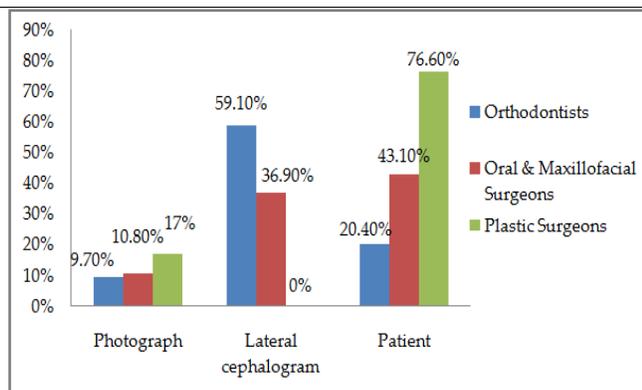


Figure-2: Medium used by different specialties in determining Nasolabial angle.

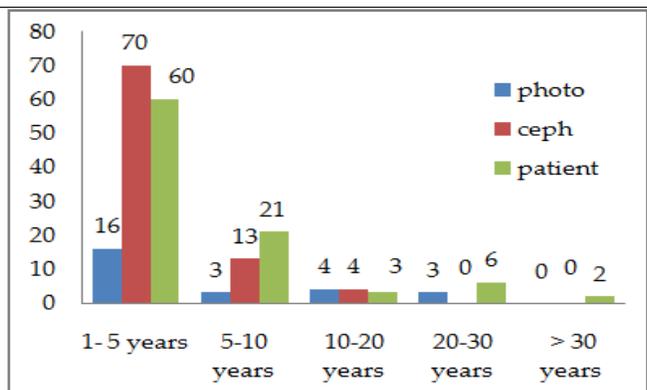


Figure-3: Preference for medium of measuring nasolabial angle with experience of clinicians.

the face whereas maxillofacial surgeons used both lateral cephalogram and face for assessment (fig-2).

Similarly, using the Fishers exact test the difference in preferred method for determining nasolabial angle was statistically significant in clinicians with various years of clinical experience (*p*-value <0.001). More experienced clinicians

as the reason of their preference.

DISCUSSION

Plastic surgery, Orthodontics and Oral and Maxillofacial surgery all deal with the aesthetics of a patient. The treatment plan of a patient is finalized after thorough evaluation. This evaluation is done using different parameters with nasolabial angle being one of them. The

nasolabial angle is roughly defined as the angle between the columella of the nose and the philtrum of the upper lip and is usually in the range of 90 to 120 degrees. The ideal NLA has classically been described in the literature as being 90 to 95° for males and 95 to 115° for females¹⁰. However, some of the definitions as per literature review are angle between columella and line intersecting subnasale and labrale superius, angle between columella and line tangent to cutaneous upper lip proper, angle between long axis of nostril and line perpendicular to Frankfort horizontal and angle between long axis of nostril and line intersecting glabella and pogonion (fig-1)¹¹. Moreover the angle can be assessed with the help of photographs, cephalograms or directly on patients however there is a lack of universally accepted method to measure this soft tissue variable^{12,13}.

The nasolabial angle is affected by several factors such as the anteroposterior position of the maxilla, the anteroposterior position of the maxillary incisors, the vertical position or rotation of the nasal tip and by the soft tissue thickness of the maxillary lip¹⁴. The variability in the structures affecting the nasolabial angle, both hard and soft tissue structures, renders the applicability of a uniform nasolabial angle difficult for all patients. In addition, the angle fails to indicate whether the variability is due to the lip, nose or any other factor¹⁵. To analyze the four methods of calculating nasolabial angle used in our study, one can divide the NLA into Horizontal and Vertical components. The horizontal component includes columella in options 1 and 2 and long axis of nostril in options 3 and 4 (fig-1). While considering the horizontal components, we found out that methods A and B, which were chosen by 72.6% and 12% of respondents respectively, though being reproducible, take into account the columella of the nose which is greatly affected by caudal septum and the maxillary spine¹⁶. Thus, two people with similar noses can have different nasolabial angles if one has a hanging columella and the other hasn't; therefore in a patient with a hanging columella, this would incline an ortho-

dentist towards an extraction treatment plan. On the other hand, definitions C and D, which were selected by 6.3% and 5.8% of respondents respectively, utilize the nostril's long axis, which overcomes the hanging columella problem, but can give a misrepresentation of the angle due to misaligned nasal tip projection or can be confounded by the shape and position of the nostril¹⁷.

Whereas, the vertical component includes soft tissue structures such as subnasale, contour of the upper lip and labrale superius in definitions A and B¹⁸. Advocates of these methods say that since NLA is an indicator of soft tissue contour therefore the structures defining the angle should be on the facial soft tissue outline. However, the drawback of this method is that these 2 options can be affected by distortions in the underlying bone and soft tissue abnormalities for instance in prognathic maxilla, Class II malocclusion and short upper lip length. On the other hand, options C and D are dependent on the hard tissue landmarks which may not have any bearing on the soft tissues but can be affected by the variations in the position of chin, forehead etc².

One can find several definitions of the angle in literature. Many authors use the conventional definitions whereas others have come up with new ones. Bunnell *et al*, determined the angle by drawing tangents to upper lip and columella⁵. Nandini *et al* measured the angle between PCm tangent to midnose and PCm tangent to Ls¹³. Similarly people use various mediums to determine the angle. De-Freites *et al* calculated the angle on photograph in their study whereas Bunnell *et al*¹³, used a lateral cephalogram. Harris *et al*, attempted to find a consensus among rhinoplasty surgeons regarding the angle. They found no consensus among rhinoplasty surgeons regarding the definition of NLA. They proposed an NLA algorithm which enabled to select the most suitable NLA according to the surrounding structures and proposed that it may be unnecessary and counterproductive to have one definition for all patients¹⁰. Most of their participants of study were plastic surgeons whereas Orthodon-

tists and maxillofacial surgeons are also involved in planning and performing surgeries of the mid-face and nose. Therefore it is needed to determine a consensus among Orthodontists, Maxillofacial surgeons and plastic surgeons, which has not been done before, as all three carry out this procedure as a team and determine any standard method and medium of calculation of the angle.

In our study there was a consensus for definition A as it was selected by 72.6% of respondents. After option A, option B was chosen by most of the respondents (12%), followed by option C (6.3%), and then option D (5.8%) while some of the respondents chose both option A and B (2.4%). Although options C and D were preferred by very few participants in general but many plastic surgeons opted for them, 16% of them chose option C and 25% chose option D. This could be because plastic surgeons are involved in orienting the nose with respect to the upper and lower part of the face as is with the case of options C and D which involve Frankfurt horizontal plane, glabella and pogonion whereas orthodontists and maxillofacial surgeons take nasolabial angle more in relation to the lips, maxillary incisors and the maxilla. Two of the participants suggested their own way of measuring the angle. One of them, an orthodontist, who had greater than 30 years of experience suggested that an angle between the line along the columella and along the lower curvature of the upper lip would give a more accurate angle. The other who was a plastic surgeon suggested the angle between the line joining pronasale and sub-nasale and line joining subnasale and labrale superius .

According to our study more experienced clinicians determine the angle directly on the patient than using lateral cephalogram or pictures whereas less experienced clinicians need a tool like lateral cephalogram. Moreover the Orthodontists in general use a lateral cephalogram to calculate the angle, plastic surgeons determine it directly on the patient and maxillofacial surgeons use all the three methods.

Moreover one of the drawbacks of our study was a greater percentage of orthodontists and a lesser percentage of plastic surgeons with 45.36% and 23.41% of the sample size respectively. This could have biased the results in favour of option A. Further studies involving an equal representation of the people from all specialities using this angle would give a more accurate consensus on the angle.

In our study although the majority opted for option A but results could be biased as a greater number orthodontists participated in the study. Furthermore, 67.3% of the participants had an experience of 1-5 years only.

CONCLUSION

There was no consensus between different specialties for the preference of the medium for determining nasolabial angle. There was a consensus for option A that is the angle between columella and line intersecting subnasale and labralesuperius in our study as the maximum number of respondents chose this option of measuring nasolabial angle. More experienced clinicians estimated the angle directly on the patients profile.

Orthodontists determined the angle more on the lateral cephalogram, plastic surgeons estimated on the face and maxillofacial surgeons used both the lateral cephalogram and the patient.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

REFERENCES

1. Giri J, Pokharel PR, Gyawali R, Bhattarai B, Shrestha GK. Comparison of Reproducibility of Nasolabial Angle Constructed by Anatomic point method and Tangent line method. *Orthodontic Journal of Nepal* 2017; 6(2): 10-23.
2. Proffit W, Fields H, Larson B, Sarver D. *Contemporary orthodontics*. 6th ed. North Carolina: Elsevier 2018; p, 744.
3. Naini FB, Cobourne MT, McDonald F, Wertheim D. The aesthetic impact of upper lip inclination in orthodontics and orthognathicsurgery. *European journal of orthodontics* 2014; 37(1): 81-86.
4. Ashraf A, Khan H, Iqbal N. Correlation of Nasolabial angle with Maxillary Incisor Inclination and Upper lip thickness. *Pakistan Oral & Dental Journal* 2018; 38(3): 317-79.

5. Bunnell A, Fattahi T. Nasolabial Angle Modifications Following Maxillary Surgery. *Journal of Oral and Maxillofacial Surgery* 2014; 72(9): e22-23.
 6. Lo FD, Hunter WS. Changes in nasolabial angle related to maxillary incisor retraction. *American journal of orthodontics* 1982; 82(5): 384-91.
 7. Sarver DM. Interactions of hard tissues, soft tissues, and growth over time, and their impact on orthodontic diagnosis and treatment planning. *American Journal of Orthodontics and Dentofacial Orthopedics* 2015; 148(3): 380-86.
 8. Sinno HH, Markarian MK, Ibrahim AM, Lin SJ. The ideal nasolabial angle in rhinoplasty: a preference analysis of the general population. *Plastic and reconstructive surgery* 2014; 134(2): 201-10.
 9. De Freitas DS, De Freitas MR, Janson G, De Freitas KM, Cardoso CL. Nasolabial Angle at Rest and Upon Smiling. *Journal of Oral and Maxillofacial Surgery* 2014; 72(12): e2567-71.
 10. Harris R, Nagarkar P, Amirlak B. Varied definitions of nasolabial angle: Searching for consensus among rhinoplasty surgeons and an algorithm for selecting the ideal method. *Plastic and Reconstructive Surgery Global Open* 2016; 4(6): e752-61.
 11. Spörri S, Simmen D, Briner HR, Jones N. Objective assessment of tip projection and the nasolabial angle in rhinoplasty. *Archives of facial plastic surgery*. 2004; 6(5): 295-98.
 12. McNamara Jr JA. A method of cephalometric evaluation. *American journal of orthodontics* 1984; 86(6): 449-69.
 13. Nandini S, Prashanth CS, Somiah SK, Reddy SR. An evaluation of nasolabial angle and the relative inclinations of the nose and upper lip. *The journal of contemporary dental practice* 2011; 12(3): 152-57.
 14. Scheideman GB, Bell WH, Legan HL, Finn RA, Reisch JS. Cephalometric analysis of dentofacial normals. *American journal of orthodontics* 1980; 78(4): 404-20.
 15. Armijo BS, Brown M, Guyuron B. Defining the ideal nasolabial angle. *Plastic and reconstructive surgery* 2012; 129(3): 759-64.
 16. Kim DW, Egan KK. Metrics of nasal tip rotation: a comparative analysis. *The Laryngoscope* 2006; 116(6): 872-77.
 17. Gunter JP, Rohrich RJ. Lengthening the aesthetically short nose. *Plastic and reconstructive surgery* 1989; 83(5): 793-00.
 18. Guyuron B. Precision rhinoplasty. Part I: The role of life-size photographs and soft-tissue cephalometric analysis. *Plast Reconstr Surg* 1988; 81(4): 489-99.
 19. Leach J. Aesthetics and the Hispanic rhinoplasty. *The Laryngoscope* 2002; 112(11): 1903-16.
 20. Choi SY, Kim SJ, Lee HY, Chang DS, Choi MS. Esthetic nasolabial angle according to the degree of upper lip protrusion in an Asian population. *American journal of rhinology & allergy* 2018; 32(1): 66-70.
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