

## NASAL MORPHOLOGY ASSESSED THROUGH POWEL'S TRIANGLE IN PATIENTS WITH CONVEX PROFILE

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### ABSTRACT

*Introduction: It can safely be said that nose has a great impact on the facial appearance of a person. An orthodontist must keep this consideration in mind while planning treatment. Too big or too small nose can be camouflaged by tooth movements. If the prominence and length of the nose is acceptable to the patient, it must be made sure that it remains the same way even after the orthodontic treatment. Moreover some orthodontic procedures like Rapid Palatal Expansion, face mask therapy, extractions and orthognathic surgery has an effect on the nasal morphology. Aim of this study is thus to assess nasal morphology in patients with convex profile using Powel's Aesthetic Triangle, with the objective that this will help in planning the orthodontic cases better.*

*The study was conducted on lateral profile photographs of thirty five patients at university College of Dentistry, The University of Lahore. All reported patients, ages twelve and above, who had retrognathic profile on visualization were selected irrespective of their sex and their nasal morphology was assessed by Powell's Aesthetic Triangle.*

*In patients with retrognathic profile and the Dental Class II div 1 Nasomental angle was found to be decreased  $119 \pm 2.28$ , Naso-frontal angle was found to be increased  $141.70 \pm 6.06$  and Naso-facial angle was found to be similar  $36.46 \pm 3.05$  to the values in patient with orthognathic profile.*

*In patients with retrognathic profile a decrease in nasomental angle, an increase in naso-frontal angle and comparable nasofacial angle were recorded.*

**Key Words:** *Powell's Triangle, Nasomental Angle, Nasofacial Angle and Nasofrontal Angle.*

### INTRODUCTION

In the recent past there is a shift of paradigm from Angles to soft tissue profile as soft tissues largely determines the limitations of orthodontic treatment, from the perspectives of esthetics, function, anchorage planning, retention, relapse and stability.<sup>1,2</sup> Growth modification and surgical orthodontics are also aimed at improving the esthetics.<sup>3,4</sup> Surgical camouflage including rhinoplasty, genioplasty, cheiloplasty and maloplasty as adjunctive orthodontic procedure has become popular in the recent past again with the aim to improve the profiles.<sup>5,6</sup> Orthodontist thus must plan treatment within the patient's limits of soft tissue adaptation and soft tissue contours.

Nose is one of the most important parts on face other than lips and chin. There is direct impact of expansion, face mask therapy, extraction decision, growth modification, surgical orthodontics and growth on the nasal appearance.<sup>7-11</sup> Expansion therapy broadens the nose, early the expansion greater is the impact on the nasal width and nasal prominence.<sup>7</sup> Face mask therapy improves the maxillary prominence but may affect adversely in patients with already short nose.<sup>8</sup> Nasal prominence also effects the extraction decision as in patients with already prominent nose extraction of maxillary 1st premolars will further worsen the profile.<sup>9</sup> Nasal morphology and prominence is affected by surgical maxillary impaction, advancement, setback and expansion.<sup>10,11</sup> It is also important to note that nasal profile is different in patients with underlying skeletal sagittal, transverse and vertical dysplasia.<sup>12,13</sup> If we take the profile view and thus the sagittal patient we find that patients with straight profile, convex profile and concave profile have different nasal morphology with a definite impact on diagnosis, treatment plan and treatment outcome.<sup>14</sup>

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The nose may be evaluated by direct clinical measurements (morphometry), by photogrammetry, by radiographs (cephalometry) or more recently by three-dimensional stereo-photogrammetric systems.<sup>15-20</sup> However photographic methods have been rated as the easiest, reliable and least expensive for the nasal assessment and nasal deformity assessment.<sup>21</sup> One of the most common methods for nasal assessment has been the Powel's triangle for nasal assessment.<sup>22</sup> Aim of this study is thus to assess nasal morphology in patients with convex profile using Powel's Aesthetic Triangle, with the objective that this will help in planning the orthodontic cases better.

## METHODOLOGY

The study was conducted on lateral profile photographs of thirty five patients who reported at the Orthodontic Department of the University College of Dentistry, The University of Lahore. All reported patients, ages twelve and above, who had retrognathic profile on visualization were selected irrespective of their sex. Ages twelve and above were selected only because nasal growth completes at age ten, if patients below twelve years are taken there is a chance that the length and prominence will change during the study. Selected patients were then examined intra orally to confirm that they had Class 2 dental relationship with normal angle ( $<SNM = 32 \pm 4$ ). Patients having previous history of orthodontic treatment, craniofacial disorders such as cleft palate, syndromic patients, history of facial trauma and obvious nasal deformity were excluded from the study. Before including the patients in the study, they were asked to give their formal consent. After the patients agreed to become a part of this study, their lateral photographs were taken in their natural head positions. Digital printouts were taken for each lateral photograph on 1:1 bases. This means that the patients' actual facial measurements equal the measurements on the photograph. Powell's Aesthetic Triangle was then analyzed for each patient. Powell's Aesthetic Triangle includes following measurements as shown in Fig 1.<sup>22</sup>

- 1 Nasofrontal angle (115-1300): it is formed by drawing a line tangent to glabella through the nasion that will intersect a line drawn tangent to nasal dorsum.
- 2 Nasofacial angle (30-400): it is formed by drawing a vertical line tangent to forehead at the glabella and tangent to the chin at the pogonion so that a line drawn along the nasal dorsum intersects it.
- 3 Nasomental angle (120-1320): The nasomental angle is described by a line drawn through the nasal dorsum intersecting a line drawn from the nasal tip to the soft tissue at the pogonion. This angle correlates with the tip projection, chin, and forehead.

SPSS 18.0 was utilized for analysis of data, whereas descriptive statistics for each parameter, for each patient were assessed.

## RESULTS

The study was conducted on 35 subjects with retrognathic profiles with age range of 12-25 years. Descriptive statistics for each variable used in the study was calculated as shown in Table 1. In patients with retrognathic profile and the underlined Skeletal Class II pattern  $ANB > 4^\circ$  (Dental Class II div 1) Naso-frontal angle was found to be increased  $143.21 \pm 3.72$ , Naso-facial angle was found to be normal  $35.42 \pm 3.43$  and Naso-mental angle was found to be decreased  $114.89 \pm 3.16$ .

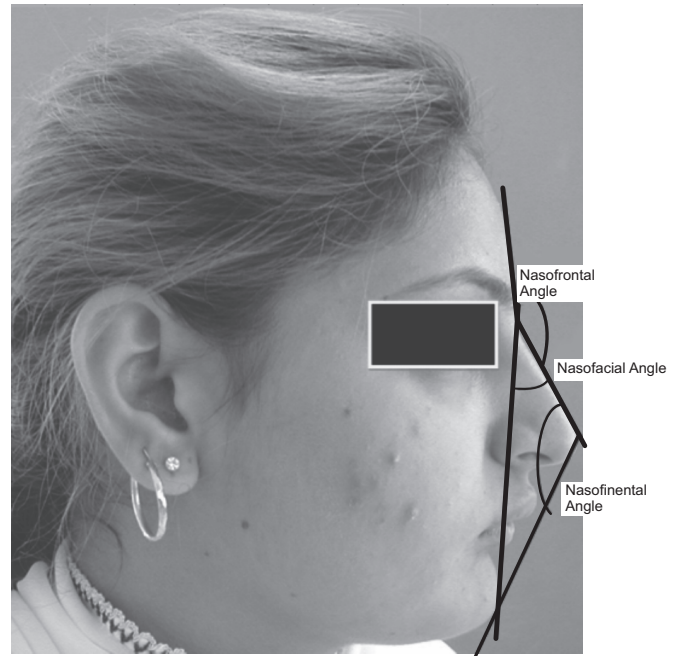


Fig 1: Powell's Triangle

TABLE 1: DESCRIPTIVE STATISTICS

	Mini- mum	Maxi- mum	Mean	St. Dev
Nasomental Angle	115	123	119	2.28
Nasofrontal Angle	128	153	141.7	6.06
Nasofacial Angle	33	41	36.46	3.05

## DISCUSSION

The study was conducted on thirty five patients who reported at the Orthodontic Department, University College of Dentistry, The University of Lahore to assess the nasal morphology in patients with retrognathic profiles. Many studies are present discussing different nose characteristics in a patient with orthognathic profile.<sup>15-20</sup> However, little information is available on the relationship between nose characteristics in retrognathic profiles especially in Pakistani origin.

Arshad, T, Shaikh A and Fida M in their study found that Skeletal Class I, II, and III subjects have different nasal profiles.<sup>23</sup> Ferrario VF et al assessed the effects of age, gender and skeletal class on size and shape of soft-tissue facial profile. They concluded that facial soft-tissue size and shape were influenced by age and sex and to a minor extent by skeletal class.<sup>24</sup>

Gulsen A et al investigated the relationship between craniofacial structures and the nose in Anatolian Turkish adults through cephalometric evaluation. They confirmed that nasal length, prominence, and form are associated with height and length of the maxilla and the mandible.<sup>25</sup> Genecov et al in another study found different nasal morphology in patients with convex profile.<sup>26</sup> Robison JM et al studied the relationship of skeletal pattern and nasal form. They investigated the relationship of skeletal facial pattern and soft-tissue nasal form. This analysis indicated that more than 86% of patients in the sample of 123 demonstrated a correlation of nasal shapes with specific skeletal groupings. Patients with straight profiles tended to have straight noses; convex profiles accompanied convex nasal shapes; and concave profiles were found with concave nasal shapes.<sup>27</sup> In this study nasal morphology was also found different in patients with convex profile based upon the Powell's Aesthetic Triangle. On the other hand Saeid Sadeghian et al in their study on nasal profile in patients with Class II skeletal malocclusion in a sample of Iranian population concluded that all Class II patients have varied nasal forms and there is no significant relationship between skeletal pattern of Class II patients and their nasal form.<sup>28</sup> Similarly in another study conducted by Nahidh M on the relationship of nose and skeletal pattern concluded that the sagittal relation parameters had no influence on the nasal parameters in contrary to the facial heights.<sup>29</sup>

The nasomental angle is an angle between a line drawn through the nasal dorsum and a line drawn from the nasal tip to the soft tissue at the pogonion. This angle correlates with the tip projection, chin, and forehead and its Normal value of Nasomental angle is 120-132°.<sup>30</sup> Arshad, T, Shaikh A and Fida M in their study found that Nasomental Angle in skeletal Class I is 128.33±10.95, in Skeletal Class II is 122.14±8.56 and in Skeletal Class III is 136.50±5.80.<sup>23</sup> Mauya RP et al in another study found significantly lower nasomental angle. These results are comparable with our results for nasomental angle.<sup>31</sup>

Nasofrontal angle is an angle between a line tangent to glabella through the nasion and a line drawn tangent to nasal dorsum. Its normal value is 115-130°.<sup>22,30</sup> Milošević SA, Varga ML and Šljaj M in their study on Croatian sample with class I occlusion found nasofrontal angle in females= 139.11 degrees and in males 136.38

degrees.<sup>32</sup> In this study higher nasofrontal angles were found in patients with convex profile.

Nasofacial angle is formed by drawing a vertical line tangent to forehead at the glabella and tangent to the chin at the pogonion so that a line drawn along the nasal dorsum intersects it. Its normal value is 30-40°. Jain et al in their study found that nasofacial angle is between 20-45°.<sup>33</sup> In this study higher nasofacial angles were found similar in patients with convex profile with those who have straight profile.

## CONCLUSION

In patients with retrognathic profile (skeletal class II pattern) a decrease in nasomental angle, an increase in naso-frontal angle and comparable nasofacial angle were recorded.

## REFERENCES

- 1 Ackerman JL, Proffit WR, Sarver DM. The emerging soft tissue paradigm in orthodontic diagnosis and treatment planning. *Clin Orthod Res.* 1999 May; 2(2): 49-52.
- 2 Proffit, WR.; White, RP.; and Sarver, DM. *Contemporary Treatment of Dentofacial Deformity*, Mosby, St. Louis, 2003.
- 3 Almuhtaseb E. et al. The Recent About Growth Modification Using Headgear and Functional Appliances in Treatment of Class II Malocclusion: A Contemporary Review. Volume 13, Issue 4 Ver. IV. (Apr. 2014), PP 39-54.
- 4 Ai-Ruhaimi, A.L. Nwoku, H.S. Shaikh. Orthognathic Surgery: Planning And Treatment With Illustration On Six Cases K. *The Saudi Dental Journal*, Volume 3, Number 2, May 1991.
- 5 Bui KK, Rinchuse DJ, Zullo TG, Cozzani M. Perception of facial attractiveness following modification of the nose and teeth. *Int Orthod.* 2015 Jun; 13(2): 195-209.
- 6 Gendler E, Nagler A. Aesthetic use of BoNT: Options and outcomes. *Toxicon.* 2015 Dec 1; 107(Pt A): 120-28.
- 7 Johnson BM, McNamara JA, Bandeen RL, Baccetti T. Changes in soft tissue nasal widths associated with rapid maxillary expansion in prepubertal and postpubertal subjects. *Angle Orthod.* 2010 Nov; 80(6): 995-1001.
- 8 Bavbek NC, Tuncer BB, Tortop T. Soft tissue alterations following protraction approaches with and without rapid maxillary expansion. *J Clin Pediatr Dent.* 2014 Spring; 38(3): 277-83.
- 9 Catharina Weyrich. Jörg A Lisson. The Effect of Premolar Extractions on Incisor Position and Soft Tissue Profile in Patients with Class II, Division 1 Malocclusion. *Fortschritte der Kieferorthopädie* . 04/2009; 70(2): 128-38.
- 10 Rahpeyma A, Khajehahmadi S. Effects of bimax and segmental surgeries for correction of bimaxillary dentoalveolar protrusion class I on soft tissue parameters: upper lip thickness and curvature, nasolabial angle and nasal prominence. *J Contemp Dent Pract.* 2013 Nov 1; 14(6): 1087-93.
- 11 Fabrício Souza Landim et al. Repercussions of Surgically Assisted Maxillary Expansion on Nose Width and Position of Septum and Inferior Nasal Conchae. *Int J Med Sci.* 2011; 8(8): 659-66.
- 12 Stephan, C. N.; Henneberg, M. & Sampson, W. Predicting nose projection and pronasale position in facial approximation: a test of published methods and proposal of new guidelines. *Am. J. Phys. Anthropol.*, 122(3): 240-50, 2003.
- 13 Karan Nehra and Vineet Sharma. Nasal morphology as an indicator of vertical maxillary skeletal pattern. *Journal of Orthodontics*, Vol. 36, No. 3, 160-166, September 2009.

- 14 Robison JM, Rinchuse DJ, Zullo TG. Relationship of skeletal pattern and nasal form. *Am J Orthod.* 1986 Jun; 89(6): 499-506.
- 15 Garandawa HA, Nwaorgu OG, Oluwatosin OM. Morphometric nose parameters in adult Nigerians. *Internet J Orthorhinolaryngology* 2009; 10: 2.
- 16 Oladipo GS, Olotu JE, Didia BC. Anthropometric study of nasal parameters of the Ogonis in Nigeria. *Sci Afr* 2007; 6: 69-71.
- 17 Fernández-Riveiro P, Smyth-Chamosa E, Suárez-Quintanilla D, Suárez-Cunqueiro M. Angular photogrammetric analysis of the soft tissue facial profile. *Eur J Orthod* 2003; 25: 393-99.
- 18 Starch WJ, Epker BN. Cephalometric analysis of profile nasal aesthetics. Part 1. Method and Normative data. *Int J Adult Orthodon Orthognath Surg* 1996; 11: 91-103.
- 19 Dong Y, Zhao Y, Bai S, Wu G, Wang B. Three-dimensional anthropometric analysis of the Chinese nose. *J Plast Reconstr Aesthet Surg* 2010; 63: 1832-39.
- 20 Omar Gabriel da Silva Filho et al. Photographic assessment of nasal morphology following rapid maxillary expansion in children. *J. Appl. Oral Sci.* Vol. 19 No. 5 Bauru Sept./Oct. 2011.
- 21 Peter Prinsley. Measurement of nasal displacement by photography. *The Journal of Laryngology & Otology / Volume 106 / Issue 03 / March 1992*, pp 211-213.
- 22 Jain et al. Photometric Facial Analysis - A Baseline Study *J. Anat. Soc. India* 53 (2) 11-13, 2004.
- 23 Tania Arshad, Attiya Shaikh, Mubassar Fida. Comparison of Nasal Profiles In Various Skeletal Patterns. *J Ayub Med Coll Abbottabad* 2013; 25(1-2).
- 24 Ferrario VF, Sforza C. (1997). Size and shape of soft-tissue facial profile: effects of age, gender, and skeletal class. *Cleft Palate Craniofac J.* 34 (6), 498-504.
- 25 Gulsen A, Okay C, Aslan BI, Uner O, YavuzerR. (2006). The relationship between craniofacial structures and the nose in Anatolian Turkish adults: a cephalometric evaluation. *Am J Orthod Dentofacial Orthop.* 130 (2), 15-25.
- 26 Genecov JS, Sinclair PM, Dechow PC. Development of the nose and soft tissue profile. *Angle Orthod* 1990; 60: 191-98.
- 27 Robison JM, Rinchuse DJ, Zullo TG. Relationship of skeletal pattern and nasal form. *Am J Orthod* 1986; 89: 499-506.
- 28 Saeid Sadeghian, Amin Shirvani, Nooshin Fakhari. (2013). Morphometric analysis of nasal profile in patients with C1 II skeletal malocclusion. *Journal of Isfahan Dental School.* 8 (6), 503-11.
- 29 Nahidh M. (2009). Nose and skeletal patterns, is there a relationship?. *J Bagh College Dentistry.* 21 (3), 113-17.
- 30 Powell N & Humphries B. Proportions of the Aesthetic face New york: Thieme-Stratton. 1984; 51-55.
- 31 Mauya RP et al. Soft-tissue characteristics of Class-II Division-1 malocclusion in North Indian adult population: A cephalometric study. 2014 (2): 60-66.
- 32 Milošević SA, Varga ML and Šlaj M. Analysis of the soft tissue facial profile by means of angular measurements. *Eur J Orthod.* 30(2): P135-40.

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<b>Saqib Naeem:</b>	Main author.
<b>Saad Asad:</b>	Supervisor.
<b>Arooj Zafar:</b>	Helped in methodology & proof reading.