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Relation between nasofacial angle and nasomental angle: A study based on profilometric analysis

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Abstract
Background: Profilometric analysis is very useful while measuring the angles in the profile photographs. The benefit is that the profile analysis utilizes angular measurements, which are unaffected by image enlargement. This serves as a permanent record of the patients profile view and help in establishing the ideal aesthetic norms. The objective of this research was to determine the average values of the Nasofacial Angle and Nasomental Angle, which are the two significant nose angles that constitute a crucial component of Powell's aesthetic triangle.
Methodology: Standardized profile photographs of 60 subjects in age group of 12-18 yrs, comprising 30 males and 30 females were taken in this research. Nasofacial Angle and Nasomental Angle were analyzed using an Imaging IC measure software. The profilometric analysis for these two angles was done on the profile photographs and the obtained values were tablulated in an Excel sheet and sent for statistical analysis.
Results: IBM's SPSS (Statistical Package for Social Sciences) version 25.0 was employed to conduct the statistical tests. It was an unpaired student t test. The nasofacial angle (G-Pog/N-Nd) for Class I males (Mean=36.07) showed significant differences when compared with females (Mean=34.33).The Nasofacial Angle measurements significantly decreased across the genders, with notable variations. Nasomental Angle (N-Pn-Pog) in Class I males, (mean = 121.14) was significantly lower than those of females (Mean= 124.16). Overall, the results showed difference in facial convexity suggesting distinct facial developmental patterns.
Conclusion: Males and females were found to differ in their nasofacial and nasomental angles. The mean values derived from this sample could be utilized for comparison, diagnosis, and treatment planning in orthodontics, dentistry, and plastic surgery. There is an inverse relationship between the two angles. The greater the Nasomental angle, the smaller the Nasofacial angle.

Keywords: Profilometric analysis, nasofacial angle, nasomental angle, esthetic norms

Introduction
Over time, the idea of "normal" facial proportions and beauty has evolved. In addition, new facial proportions have resulted from interracial mixing as the population becomes more diverse. It is now apparent that what one culture has deemed to be the standard for beauty and acceptance may not be the same for another. The concept of a single aesthetic standard as well as beauty is grossly inadequate and naive. A new model of beauty and aesthetic criteria that are specific to various ethnic groups is needed in order to better suit their skin, skeletal, and facial characteristics as well as their culture [1].
The aesthetic units that make up the face are further subdivided into smaller units. The forehead, eyes, neck, chin, nose, ears, and lips are the main components that are conventionally specified for facial analysis. As the primary and most noticeable aesthetic component of the face, the nose is constantly evaluated in connection to the chin, lips, and eyebrows, which are the three most significant facial features. At the moment, Powell and Humpherys serve as the foundation for the main factors utilized in facial aesthetics [2].
Photogrammetric analysis is the foundation of the most modern treatment planning approach, which uses the measurement of soft tissue face profile as a guide for the aesthetic treatment aim. Photographic records can be analyzed to determine the morphology of a person's face and

how it relates to the underlying dentoskeletal structures [3].
Among the benefits of photogrammetric analysis are: 1. Unlike cephalometrics, photographic enlargement has little effect on angular measures. 2. Using cephalometric software, each anatomical reference point on the computer monitor may be freely altered to identify the best profile points. 3. Does not necessitate costly apparatus and intricate protocols, as it provides digitized outcomes that are readily assessed [4].
In orthodontics, art and science coexist, and the orthodontist's artistic intuition is reflected in face aesthetics. Comparable, photogrammetric, and cephalometric measurements have been used to assess facial features [5-8]. Because they affect the nose's length and projection, the radix- and consequently the nasofrontal and nasofacial angles-are crucial in creating an aesthetically pleasing nose [9, 10]. One important factor contributing to patients' post-operative dissatisfaction is orthodontic professionals' neglect or underestimation of the angular parameters related to the nose area prior to orthodontic treatment. Hence, the primary goal of this research was to examine the relationship between two significant angular parameters of Nose i.e: Nasofacial Angle and Nasomental angle in Class I, II & III groups, which can be useful for Orthodontic treatment.

Materials & Methods

This study received ethical approval from the IRB of DAPMRV Dental College & Hospital, Bengaluru, Karnataka, India (IRB No: 336/VOL-2/2019).

Sample size

The calculated sample size had been 60 pre-treatment pictures of subjects who had to undego Orthodontic treatment in the department of Orthodontics, by employing the sample size calculators by Wan Nor Arifin, (β (1-power)- 99%).The pictures were divided into two groups Male: 30, Females: 30.

Sample population: Karnataka population
Inclusion Criteria (1) age range between 12-18 years, (2) ANB: for Angle's Class I: 0-4 degrees (3) No Facial or spinal abnormalities.
The Exclusion criteria are (1) Genetic syndrome, (2) subjects with any craniofacial and dental trauma, (3) gross facial asymmetry, (4) Cleft lip/ palate defects (treated /untreated) (5) Malformed face.

Photographic Technique

Extraoral profile photographs of patients were taken with a DSLR camera (D-52, Nikon Corporation). The facial muscles were relaxed, the teeth were in centric occlusion, as well as the ala-tragus plane of soft tissue was maintained parallel to the floor [11, 12]. The patient's face and neck were photographed at a suitable distance of about 4-4.5 feet, with a fair margin of space surrounding the camera lens in vertical position, in order to provide high-quality and consistent images. Cropped images in a 4 × 6 portrait layout using Microsoft Image Editor were saved at optimal quality without any compression as TIFF files with a resolution of 300 DPI. All guidelines of the American Board of Orthodontics 13 were adhered to while taking photographs.

Photographic Analysis

Profile photographs were analyzed using the software IC Measure, The Imaging Source Europe, Version 2.0.0.133, Type EXE. Numerous choices are available for identifying landmarks and measuring angular and linear dimensions with this software. It's user- friendly, easy to understand, doesn't slow down processing performance, and has lesser storage problems. The TIFF format of the patients' standardized extraoral photos was imported into the software. Using a mouse-driven pointer, landmark detection was done manually on profile photos and the software automatically reflected the measurements. Instant readings were recorded using software and sent for statistical analysis (Figure 1 & 2).

Statistical Analysis

IBM's SPSS version 25.0, based in Chicago, had been employed to conduct the statistical tests, and an Excel sheet was used to record all measurements. The use of descriptive statistics was used. Unpaired student t test was used. Statistically significant P-value was defined as less than or equal to 0.05 ($p \leq 0.05$) ? than 0.05.

Results

Nasofacial Angle In Class I males: the nasofacial angle (G-Pog/N-Nd) for males (Mean=36.07) showed significant differences when compared with females (Mean=34.33). Overall, the table reveals that the Nasofacial Angle measurements significantly decreased across the genders, with notable variations (Table 1).
Nasomental Angle in Class I males (mean = 121.14), were significantly lower than those of females (Mean= 124.16) Overall, the results highlight a consistent and significant difference in facial convexity suggesting distinct facial developmental patterns. Both males and females showed significant differences in Nasomental Angle (Total Convexity with Nose). Males had lower scores than females with consistent significant differences observed over time (Table 2).
The results indicate an inverse relationship between Nasofacial Angle and Nasomental Angle on Profile analysis. The smaller the nasofacial angle wider the nasomental angle.

Table 1: Comparison of Nasofacial Angle (G-Pog/N-Nd) scores between male and female by independent t- test

Class	Gender	Mean	SD	Mean Diff.	t-value	p-value
Class I	Male	36.07	0.77	1.74	8.37	.0001*
	Female	34.33	0.52			

*$p<0.05$

Table 2: Comparison of Total Convexity with Nose (N-Pn-Pog/Nasomental Angle) scores between male and female by independent t- test

Class	Class	Mean	SD	Mean Diff.	t-value	p- value
Class I	Male	121.14	0.02	-3.02	302.00	.0001*
	Female	124.16	0.04			

*$p<0.05$

Discussion

The nasofacial angle has been defined by the facial plane and the line tangential to the dorsum nasi. This angle describes the nasal projection on the patients profile. From the aesthetic standpoint values close to 300 and 400 are favored for women and men respectively.
The Nasomental angle lies at the intersection with the dorsum Nasi Line. It is the most important angle within the aesthetic triangle. Its normal value is between 1200 to 1320 degrees. This angle relates the nose and chin, two surgically modifiable masses. The chin can also be modified by means of Orthopaedic and Orthodontic maneuvers.
The study's findings indicated that the average nasofacial

angle (G-Pog/N-Nd) is between 300 and 400 degrees, and the average nasomental angle (N-Pn-Pog) is between 120 0 and 132 0 degrees. The values for the various face aesthetics angles in this investigation are within the anticipated ranges noted by Powell and Humphreys [2].

Additional researchers, including Oghenemavwe *et al*. [14] with Urhobo ethnic group of Nigeria, Anibor *et al*. [15] with the Itsekiri ethnic group of Nigeria, and two other investigations conducted in Mexico, have similarly documented gender disparities in the Nasofacial and Nasomental angles, consistent with the findings of this study.16 Additionally, the Ibo ethnic group was mentioned in the earlier work of Anibor and Okumagba [17]. Nevertheless, no statistically significant gender difference was found, which contradicts the current study.

According to Jacques Joseph, the German father of rhinoplasty, who studied both contemporary as well as historic artwork, the optimal nasal prominence was 30 degrees, with a range of 23 to 37 degrees [18]. According to Clements, the nasal prominence in the majority of great artworks was 30 degrees or less on average. Significant sexual variations were seen in the columellar length angle, which is consistent with the study's findings.

According to a study by Sim *et al*. [19], there is no ethnic difference between the Chinese and White populations, and their nasal and face angles are identical. The observed values in their study are near the range found in the current study.

These values for Nasomental Angle in this research were lower than those presented by Pattanaik and Pathuri (Southern India; males= 130.82° & females= 131.71°) and Reddy *et al*. for the North Indian Population20 (127.11°±1.81° for females &127.71°±1.97° for males) [21].

In the current investigation, the angle was measured from the glabella rather than the nasion, as demonstrated by Bishara *et al*. [22]. According to Bishara *et al*., angle rose by 2.1° and 1.3° in males & females, correspondingly, between the ages of 25 and 45. This may be attributed to either a more anterior displacement of the soft tissue pogonion or a more vertical development of the nose tip.

It is commonly known that the nose is thought to be the primary source of variations in the aesthetic angle of the face [23]. Different angular nasal parameters are routinely used in Orthodontic diagnosis and treatment planning and have showed significant variation in terms of type of malocclusion in both sagittal and vertical plane [24]. The present study findings demonstrated that standards for South Indian patients can differ significantly from those of other racial, ethnic, and demographic groups. The Orthodontist, Oral surgeon, plastic surgeon while planning the treatment for the patient should take into consideration the nasal measurements. Further research on the relationship of these aesthetic angles on Class II and III subjects is the area to be explored.

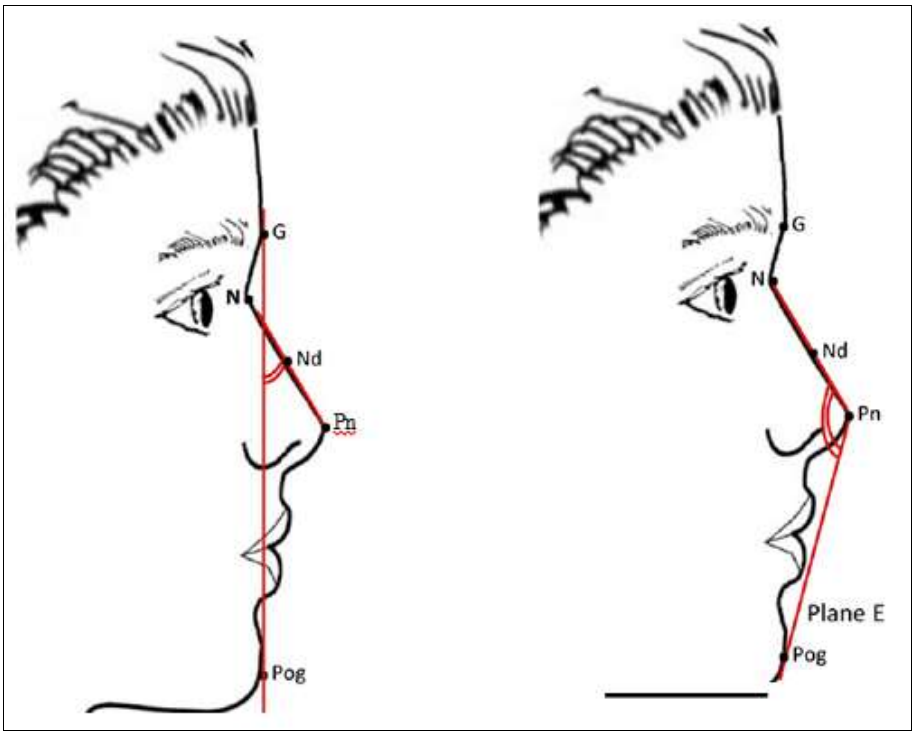

Fig 1: Nasofacial angle (G-Pog/N-Nd) & Nasomental Angle/ Total Convexity with Nose (N-Pn-Pog)

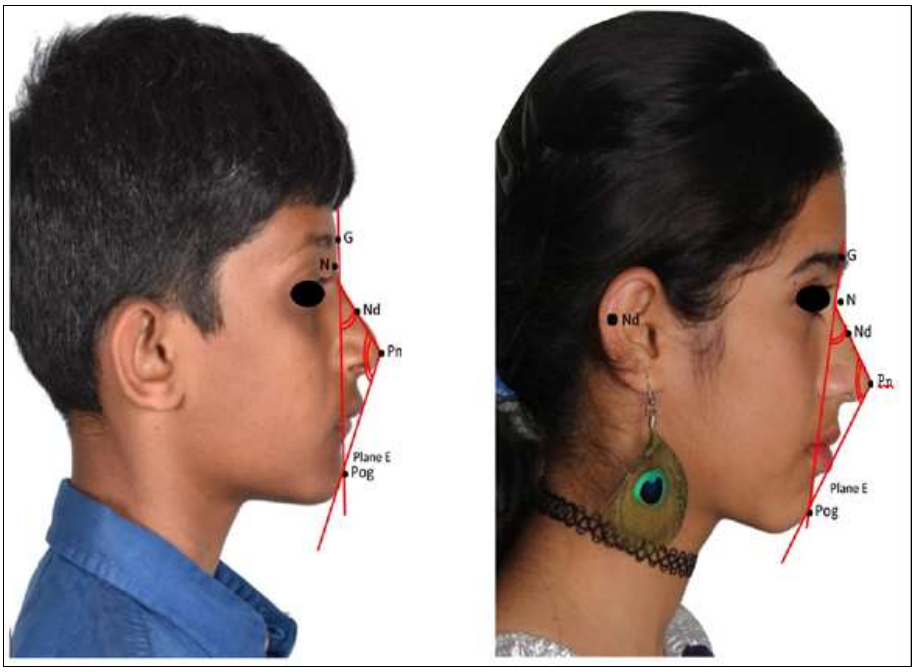

Fig 2: Profilometric Analysis of male and female subjects

Conclusion

The mean values for Nasomental and Nasofacial angle obtained from this study can be used for comparing the records during various stages of treatment in Orthodontics using the same photographic analysis.

The present study revealed that the Class I males have higher Nasofacial angle than females. The Nasomental angle was observed to be slightly more in Class I females than males. A significant finding which was revealed was that both the angles share inverse relationship with each other: A smaller Nasofacial Angle indicates a wider Nasomental Angle.

Conflict of Interest

Not available

Financial Support

Not available

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