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# Comparison of Lateral Cephalograms with Photographs for Assessing Anterior Malar Prominence in Maharashtrian Population

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**Abstract:- Midface is an important part of the face which is most concerned about aesthetics. With increase in malar prominence, the mid face becomes more angular. With the maxillary hypoplasia which tends to have hollow midface results in more prominent sclera inferior to pupil. Orthodontists want to enhance the beauty of the face by diagnosing and treating not only the oral structure but also the facial profile. This study aims at comparing cephalometric analysis with visual classification of anterior malar projection using vectors. The method used is to compare profile image for anterior malar projection with lateral cephalogram. People aged 18-25 with no orthodontics treatment history, craniofacial disorders or trauma were selected for the study. These people were then divided into 2 groups based on vector classification i.e. positive vector (Group A) and negative vector (Group B). Vectors were drawn on profile photos using scale and facade software was used to calculate SNO (Sella-Nasion-Orbitale) angle. Lateral cephalogram was then compared and statistically analysed with the malar projection from the profile image. No statistical significance was found between genders nor between age and SNO angle. However, SNO angles in positive vector group was larger than those in negative vector group on average with high significance (p<0.001). SNO angle obtained to distinguish between 2 vectors was 56°. This comparison can prove to be a useful mechanism in orthodontics for classifying malar support to the midface.**

***Keywords**:- Anterior Malar Projection, Cephalometric Study, Photographic Study, Façade.*

## I. INTRODUCTION

Midface is an important part of the face which is most concerned about aesthetics.[1] With increase in malar prominence, the mid face becomes more angular. With the maxillary hypoplasia which tends to have hollow midface results in more prominent sclera inferior to pupil[2-4]. Orthodontists want to enhance the beauty of the face by diagnosing and treating not only the oral structure but also the facial profile[5-7].

Surgeries related to malar prominence are very common amongst plastic surgeons. Different orthognathic surgeries like Le Fort I, II, and III used to increase malar prominence[8-11]. Though midface is very crucial there are very fewer diagnostic methods available that's why this study plays major role[12-15].

Orthodontist mainly focuses on premaxilla region. Anterior corneal plane and anterior cheek mass indicates bony support for esthetic blepharoplasty. Lateral cephalogram radiograph cannot show malar prominence it is located lateral and inferior to the orbitale. Always check prominence should be 2mm forward to anterior surface of the cornea along Frankfurt's horizontal plane[16-18]. If globe is anterior to malar eminence, then it indicates maxillary hypoplasia.

Midface is evaluated in horizontal plane using angle formed by Sella to nasion and nasion to orbitale[19-20]. If the angle is less than normal range indicates retrusive maxilla which needs malar augmentation. Recently study shown than significant comparison was seen between cephalometric analysis and visual classification in white population.

➢ *Aim of the Study is as Follows:*

- By using lateral Cephalogram with facad software determine anterior malar prominence
- By using profile view of photographs to determine anterior malar prominence using vector visual classification

To check for significance in comparing anterior malar projection using visual vector classification on profile photographs and lateral cephalometric analysis in Maharashtra population

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## II. MATERIALS & METHODS

Lateral cephalogram and photographs were taken of 40 patients in the age group 18-25 years from Maharashtrian population seeking for orthodontic treatment at PDU dental college Solapur. Patients were divided into 2 groups Group A with 22 patients 12 males and 10 females showing positive vector and Group B with 18 subjects with 8 males and 10 females showing negative vectors.

The distribution is outlined according to age group in Table I and gender in Table IV. Table II shows the sample distribution of negative and positive vectors in different age groups.

### *A. Inclusion Criteria*

- Standardised pre-treatment lateral cephalogram in natural head position
- Pre-treatment profile photograph in natural head position
- Patient's age in the range 18 to 25
- No medical history

### *B. Exclusion Criteria*

- Any history of plastic surgery
- History of orthodontic treatment
- History of any syndromes

### *C. Materials Used for the Study:*

- Standardised lateral cephalometric radiographs
- Standardised profile photographs
- Set squares
- Metal scales
- Lead acetate cephalometric sheets
- 0.3H lead pencil

## III. METHODOLOGY

By orienting the patients head in natural head position lateral cephalograms and profile photographs were obtained by the same operator. A line was drawn from anterior surface of cornea in the sagittal plane along the Frankfurt horizontal as shown in Fig 1a. This line was used to determine the patient's vector relationship. It was considered positive as positive relationship if the anterior surface of cornea is behind the cheek prominence and negative if cornea's anterior surface was ahead of cheek prominence.

Tracing was done on lateral side photograph using lacquered polyester acetate tracing paper with lead pencil. The reference points were marked on paper as shown in Fig. 4.

- S - Sella turcica
- N - Nasion
- Orbitale

## IV. STATISTICAL ANALYSIS

Karl Pearson correlation between SNO angulation and age of the subjects was performed as depicted in Table III which shows that there is no statistically significant correlation between age and SNO angulation ($p>0.05$).

Analysis for sexual dimorphism was also done as shown in Table VI. The p-value of 0.6393 (>0.05) depicts that there is no significant difference between genders with a mean SNO angle of 56.323° in females and 57.02° in males.

Table VIII shows the analysis of skeletal differences between positive and negative vectors. A highly significant difference ($p<0.001$) is depicted in skeletal support between the negative and positive vector groups assessed using SNO angles.

The SNO angulations in the negative vector group were smaller than the positive vector group by an average of 9.08º.

Perfect test is represented by area (=1.000) under the curve and accuracy of ROC analysis in table IX.

Table X describes coordinates of the curve for ROC analysis showing the cut off value of SNO angle is 56° with 100% sensitivity and specificity.

## V. RESULTS

No statistical significance was found between genders nor between age and SNO angle in the Maharashtrian population. However, SNO angles in positive vector group was larger than those in negative vector group on average with high significance ($p<0.001$). SNO angle obtained to distinguish between 2 vectors was 56° which was obtained using ROC analysis.

This comparison can prove to be a useful mechanism in orthodontics for classifying malar support to the midface.

## VI. CONCLUSION

Based on our findings, we can draw the following conclusions:

- To differentiate positive and negative vector, the SNO cutoff angle is 56 degrees.
- Cephalometric analysis supports classifying anterior malar support. It can be used to classify malar support to midface and serve as an important tool.
- Profile photographs can be used for determining anterior malar projection via visual vector classification.

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## VII. DISCUSSION

In the study conducted by Frey St on white subjects[16] he found on that there is an average of 6-degree difference between positive and negative vector group the negative vector group being smaller. This according to him was highly significant difference in skeletal support.

Similar to Frey's observation in white population, Maharashtrian population also didn't show any significant difference for SNO angulation based on gender. However he found something very interesting about male subjects. It was very difficult for him to find male subjects that had positive malar architecture. In her study on Angami Nagas, Suri R found that majority of females showed slight malar prominence whereas males has medium to pronounce Miller prominence.

As also observed by Frey in white population, there is no significant relation between age and SNO angulation even in present study[24]. Pessa JE et al in their study[36] highlighted that with growing age, there is a posterior movement in the orbital rim relative to anterior cornea pronouncing the negative vector. They also discovered that as age increased, the midface collapsed, anterior projection was lost in the inferior orbital rim, vertical height of midface was lost and there was a posterior recession in the pyriform aperture[35-40].

The present study of Maharashtrian population is for age 18-25 during which midface prominence is relatively stable. Scleral show, which has been a hallmark of maxillary hypoplasia[44] is not displayed by many subjects showing a negative vector relation. Positive vector relation has been identified as crucial element of youthful face and malar complex[18] in anthropometric studies.

In ROC analysis, it was found that the cutoff to differentiate negative and positive Maharashtrian population aged 18-25 is SNO angle of 56 degrees. The normative data of SNO angle for adult Caucasians aged 16+ was provided as 60+/-4 for males and 53+/-4 for females by Zide B et al[20]. Sufficient maturation and growth of both hard and soft tissues is necessary for aesthetic facial features.

A deficient malar & midfacial projection results in premature lower lid and aged appearance. Nasal base lip contour (Nb-LC) is highly influenced by the balance between malar and dentoalveolar support. Negative vector relationship, results in ptosis and distortion of the Nb-LC due to soft tissue descent. Distortion of Nb-LC and facial decline can be seen in absence of adequate malar support[28-29].

Facial aging patterns must be understood by orthodontics. Vector relationships provide another diagnostic reference. Aesthetic orthodontic outcomes and surgical orthodontic planning can be improved by assessing malar support. Vector relationships can help the orthodontist in selecting appropriate maxillary surgery.

A negative vector can be an indicator of skeletal dysplasias according to recent evaluations of BAMP (bone anchored maxillary protraction) [46-47]. The present study's findings conclude the vector relationship to be a means of classifying anterior malar support and take better treatment decisions. Further studies covering other ethnicities and wider age group is required to establish norms for them and use vector angulation in daily practice.

## VIII. TABLES

Table 1: Age

| Age | Frequency | Percent |
|---|---|---|
| 18-20 | 10 | 25 |
| 21-23 | 20 | 50 |
| 24-25 | 10 | 25 |
| Total | 40 | 100 |

Table 2: Distribution of Samples based on age Groups

| Age(Years) | Vector Relationship | | Total |
|---|---|---|---|
| | Negative | Positive | |
| 18-20 | 4<br>40%<br>10% | 6<br>60%<br>15% | 10<br>100%<br>25% |
| 21-23 | 9<br>45%<br>22.5% | 11<br>55%<br>27.5% | 20<br>100%<br>50% |
| 24-25 | 5<br>50%<br>12.5% | 5<br>50%<br>12.5% | 10<br>100%<br>25% |
| Total | 18<br>45% | 22<br>55% | 40<br>100% |

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| | | | |
|---|---|---|---|
| | 45% | 55% | 100% |

Table 3: Distribution of Negative and Positive Vectors amongst Age Groups

| Correlations | Karl Pearson Correlation Coefficient r Value | p | |
|---|---|---|---|
| Age (years) SNO Angulation (degree) | .114 | .226 | NS |

Table 4: Correlation between SNO angle and subjects' age acc. to Karl Pearson. No significance found

| SEX | FREQUENCY | PERCENT |
|---|---|---|
| F | 20 | 50% |
| M | 20 | 50% |
| TOTAL | 40 | 100% |

Table 5: Distribution of samples according to gender.

| | | Vector relationship | | Total |
|---|---|---|---|---|
| | | Negative vector | Positive vector | |
| Sex | F | 10 | 10 | 20 |
| | | 50.0% | 50.0% | 100.0% |
| | | 50.0% | 50.0% | 50.0% |
| | M | 8 | 12 | 20 |
| | | 50.0% | 50.0% | 100.0% |
| | | 50.0% | 50.0% | 50.0% |
| Total | | 18 | 22 | 40 |
| | | 45.0% | 55.0% | 100.0% |
| | | 100.0% | 100.0% | 100.0% |

Table 6: Distribution of Negative and Positive Vectors amongst Genders

| Sex | N | Mean | Std. Deviation | T test p value |
|---|---|---|---|---|
| F | 20 | 56.323 | 4.8416 | 0.6393 |
| M | 20 | 57.02 | 4.4814 | NS |

Table 7: Analysis for Sexual Dimorphism. No Statistically Significant Difference was Found amongst Genders. 56.323° in Females and 57.02° in Males is the Mean SNO Angle

| Vector Relationship | Frequency | Percent |
|---|---|---|
| Negative vector | 18 | 45.0 |
| Positive vector | 22 | 55.0 |
| Total | 40 | 100.0 |

Table 8: Distribution of Samples According to the Vector Relationship

| SNO Angulation (Degree) | N | Mean | Std. Deviation | 95% Confidence Interval for Mean | | t value | |
|---|---|---|---|---|---|---|---|
| | | | | Lower bound | Upper bound | | |
| Negative Vector | 18 | 51.68 | 0.60 | 50.89 | 52.62 | 45.20 | P<0.001 |
| Positive Vector | 22 | 60.76 | 0.65 | 59.78 | 61.8 | | HS |
| Total | 40 | 56.22 | 4.61 | 50.89 | 61.8 | | |

Table 9: ROC Analysis

| Area | Std. Error(a) | Asymptotic sig.(b) | Asymptotic 95% Confidence interval | |
|---|---|---|---|---|
| | | | Lower Bound | Upper Bound |
| 1.000 | .000 | .000 | 1.000 | 1.000 |

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Table 10: Coordinates of the Curve. The Cut Off Value of SNO Angle i.e; 56° with 100% Specificity and Sensitivity

| Positive if Greater Than or EqualTo(a) | Sensitivity | 1 - Specificity |
|---|---|---|
| 46.500 | 1.000 | 1.000 |
| 47.750 | 1.000 | .980 |
| 48.250 | 1.000 | .960 |
| 48.750 | 1.000 | .940 |
| 49.250 | 1.000 | .900 |
| 49.750 | 1.000 | .860 |
| 50.250 | 1.000 | .800 |
| 50.750 | 1.000 | .780 |
| 51.250 | 1.000 | .740 |
| 51.750 | 1.000 | .720 |
| 52.250 | 1.000 | .580 |
| 52.750 | 1.000 | .460 |
| 53.250 | 1.000 | .300 |
| 53.750 | 1.000 | .200 |
| 56.000 | 1.000 | .000 |
| 58.250 | .960 | .000 |
| 58.750 | .840 | .000 |
| 59.250 | .640 | .000 |
| 59.750 | .500 | .000 |
| 60.250 | .340 | .000 |
| 60.750 | .300 | .000 |
| 61.500 | .240 | .000 |
| 62.500 | .160 | .000 |
| 63.250 | .080 | .000 |
| 63.750 | .060 | .000 |
| 64.250 | .040 | .000 |
| 64.750 | .020 | .000 |
| 66.000 | .000 | .000 |

## IX. FIGURES

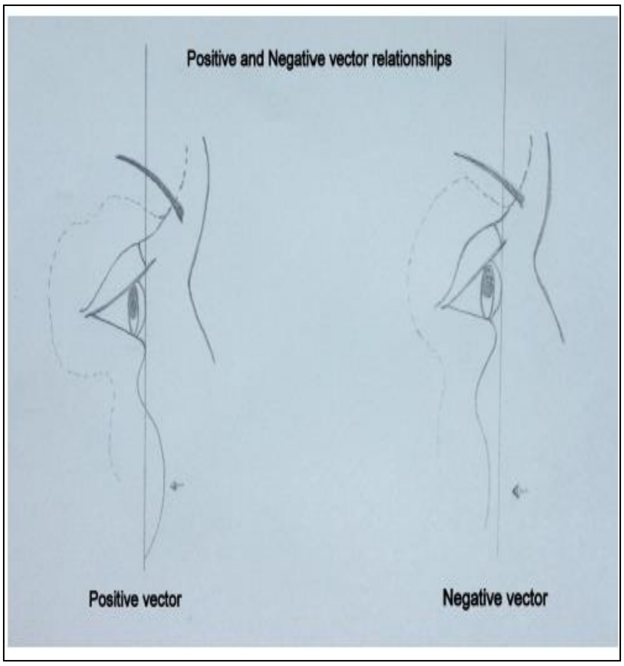


Fig 1(a): A Line Drawn from the Anterior Surface of Cornea in the Sagittal Plane Along the Frankfurt Horizontal

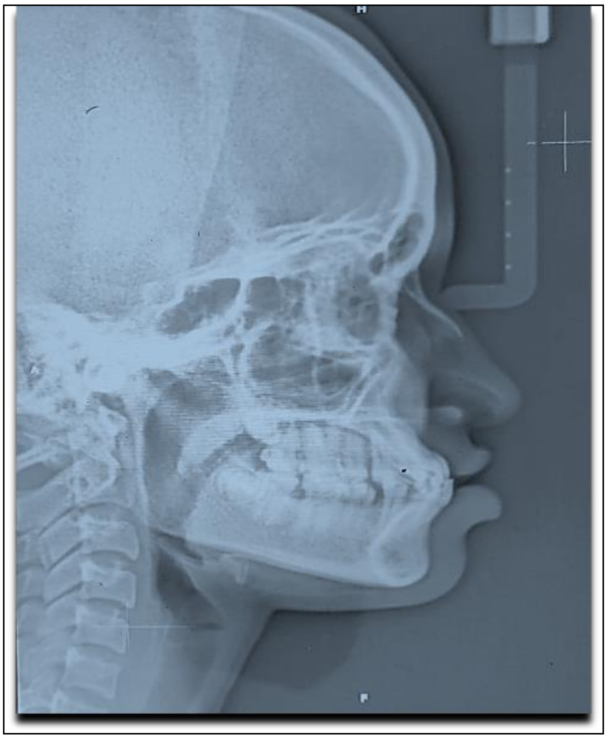

Fig 1(b): Standardized Pre-Treatment Lateral Cephalogram Used in the Study

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Fig 2: Standardized Pre-Treatment Profile Photograph Used

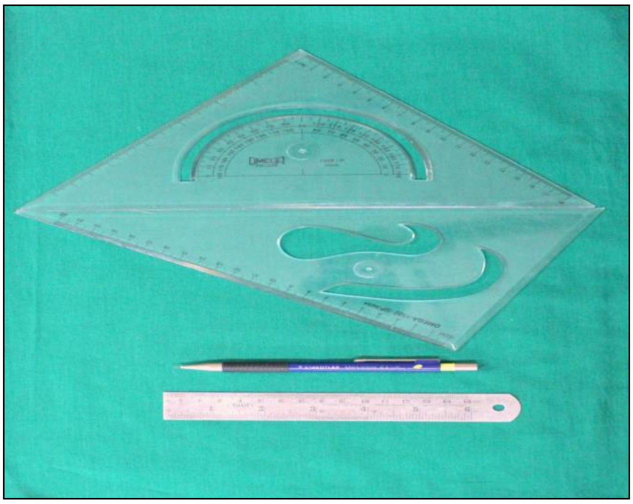
Fig 3: Materials Used

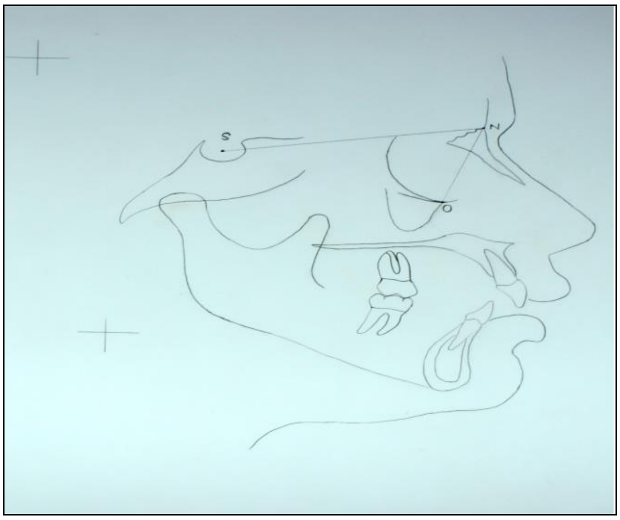
Fig. 4: Cephalometric Reference Points and Variable (SNO Angle)

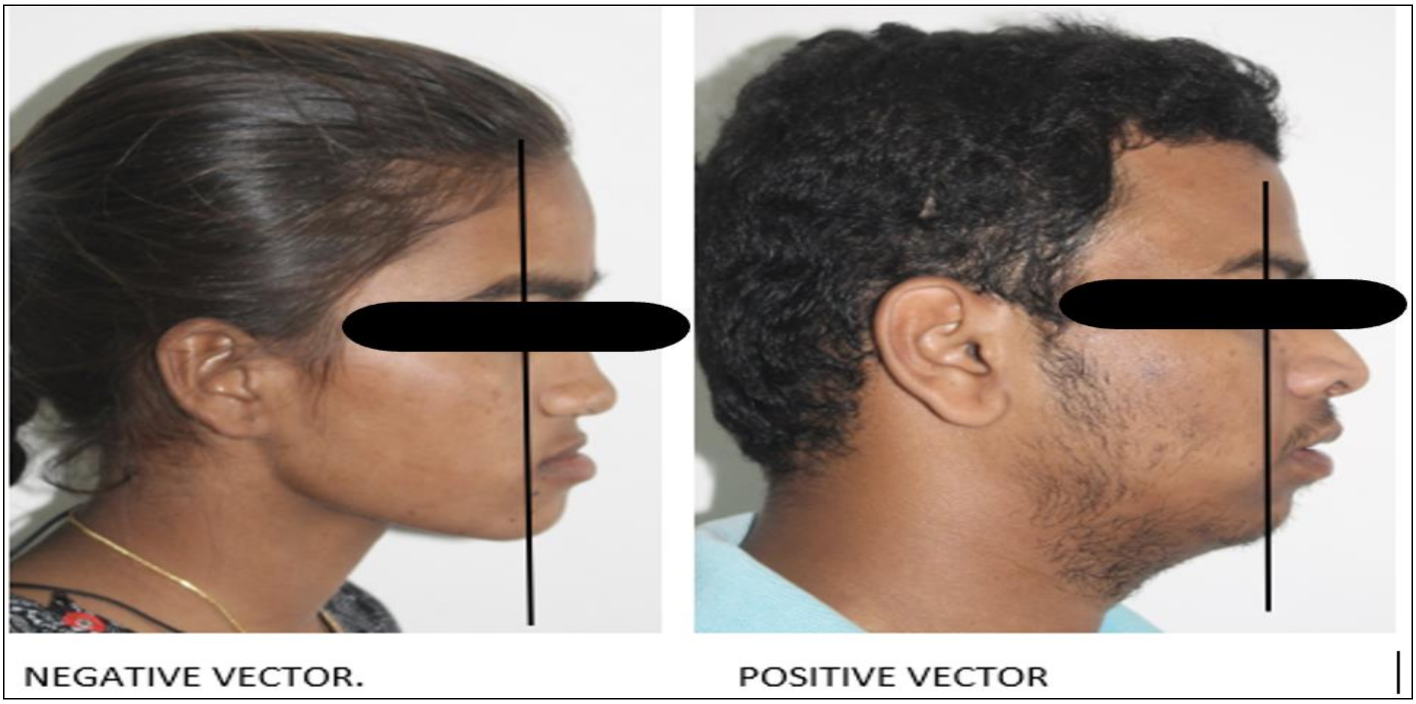

Fig 5: Assessing Vector Relationships on Profile Photographs

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