Research Article

JRAD Journal of Research and Advancement in Dentistry

J Res Adv Dent 2020;11:1:95-102.

Assessment of Anterior Malar Region Clinically and Cephalometrically in North Indian Population

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ABSTRACT

Background: To observe anterior malar region clinically and cephalometrically and to correlate positive and negative vector with linear and angular measurements, as well as to check the reliability of these parameters.

Material and Method: Lateral cephalograms and profile photographs, standardized by orienting the patient's head with the Frankfort horizontal plane parallel to the floor. Each subject's vector relationship was determined, using only profile photographs.

Results: In positive vectors, the SNO and SNA is increased; Or-Pt A and O⊥NA distance is decreased and in negative vectors SNO and SNA is less, Or-Pt A and O⊥NA distance is more. Correlation amongst these parameters was significant.

Conclusion: Positive vectors showed an increased malar support and negative vectors showed decreased malar support. Correlation between the photographs and cephalogram can help us to judge midfacial deficiency in a patient by just contemplating the photographs.

Keywords: Malar region, malar prominence, cephalometrics, cephalometric assessment, vector classification, positive vector, negative vector, midface deficiency.

INTRODUCTION

The malar eminence is defined as the most prominent portion of the zygomaticomaxillary complex[1]. It is a dominating feature of lateral midface , gives definition to the cheek and acts as a key factor in ocular globe position[2]. Also it is a determining factor to judge facial symmetry with the help of various vertical and horizontal parameters[3]. Being the second most frequently fractured facial bone[4] it is of utmost interest in the field of surgical trauma and facial esthetics[5,6]. An attractive malar is an important perception, especially among the youth and beauty[7]. To achieve facial beauty there must be balance among the facial promontories[8].These include a balance in the positioning of the nose, lips, chin, glabella, and malar prominence, which are related to each other and create perspective within the face[9].

Ideal projection of the cheek prominence should be approximately 2mm beyond the anterior surface of the cornea in the sagittal plane along the Frankfurt Horizontal[10,11,12]. Globe of the eye positioned anterior to the malar prominence is negative vector

Received: Aug. 21, 2020: **Accepted**: Oct. 15, 2020
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pISSN 2278-0076
eISSN 2321-9270

and posterior to the malar prominence is positive vector.

Orthodontic treatment does not affect malar globe relationships directly, the balance between dentoalveolar and malar support has a significant influence on the nasal base-lip contour (Nb-LC)[13,14]. If the adequate malar support is not there, accelerated distortion of the Nb-LC and facial decline can lead to retraction of the dentition. Also these effects become evident with age, mainly due to attenuation in the initial compensatory activity of the orbicularis oculi muscle and age related changes of the soft tissue envelope and underlying skeleton[15].

A comprehensive dento-facial analysis is thus the key to the achievement of functional and cosmetic excellence in orthodontic treatment. Its relationship with the vector further provides the orthodontist with an additional useful diagnostic reference. Evaluating malar support helps building up esthetic outcomes and refine surgical orthodontic planning. Also, establishing the role of the hard tissue to nasolabial contours, vector relationships can be pivotal in deciding the need for alloplastic augmentation of the inferior orbital rim and appropriate surgical procedure[16].

So, the aim of the study is to assess anterior malar region with lateral photographs and lateral cephalometric radiographs in North Indian population and objectives are (1) To observe anterior malar region clinically and cephalometrically in north Indian population. (2) To correlate all the cephalometric parameters to each other (3) To correlate positive and negative vectors with angular and linear cephalometric measurements.

MATERIALS AND METHODOLOGY

This study was carried out at the Department of Orthodontics and Dentofacial Orthopedics, MM College of Dental Sciences and Research, MMU, Mullana, after obtaining approval from the institute ethics committee.

60 subjects seeking orthodontic treatment in the Department of Orthodontics and Dentofacial Orthopaedics, were included in the study.

Inclusion criteria: (1) Age – 15 to 25 years (2) No pervious orthodontic treatment (3) No ophthalmic problems (4) No history of craniofacial trauma (5) Symmetrical faces with pleasing profile and no apparent abnormality in facial form

Exclusion criteria: (1) Previous orthodontic treatment (2) Craniofacial syndromes (3) History of maxillofacial or plastic surgery (4) Eye problems (5) Asymmetrical faces with distorted facial form.

Materials used :- (1) Profile Photographs were taken by positioning the patient with Frankfort horizontal plane parallel to the floor and using a Digital camera NIKON D 3200. It's a single lens camera with lens type "Nikon F mount" with approximate 1.5X lens focal length with 24.2 million effective pixels. The distance between the patient and the examiner was 4 feet.

(2) Lateral Cephalometric radiographs were taken using Orthophos XG 5 (Sirona)

Methodology :- Lateral cephalograms and profile photographs , standardized by orienting the patient's head with the Frankfort horizontal plane parallel to the floor.

Photographs: Each subject's vector relationship was determined, using only profile photographs. A perpendicular was dropped from anterior part of the cornea of the eye in the sagittal plane along the Frankfort horizontal. The criteria for assigning them to any group was as follows:

Positive vector*:* The cheek prominence is beyond the anterior surface of cornea (Fig-1)

Negative vector*:* The cheek prominence is behind the anterior surface of cornea (Fig-2)

Fig-1 Positive vector

Fig-2 Negative vector

The subjects were divided into two groups - Group 1 comprising of 30 patients (22 females and 8 males) exhibiting positive vector relationship and Group 2 comprising of 30 patients (17 females and 13 males) exhibiting negative vector relationship. Patients were informed and proper consent was taken on in-house generated consent forms.

Lateral Cephalogram: The lateral cephalograms were traced manually by one observer and the reference points were marked. To rule out any errors in the readings another examiner, who was blinded to the vector classification of the subjects, traced random cephalograms from the sample. Reliability analysis between the two observers was estimated using test-retest method of reliability and no statistical significance difference was found in the measurements between the two observers.

1. Reference points of the cephalograms used in the study were: S (Sella turcica), N (Nasion), O (Orbitale), Point A , ANS, PNS, Palatal plane

2. Variables used in the study: (Fig-3)

1. Sella-Nasion-Orbitale (SNO) angulation was used to evaluate the anteroposterior position of the malar eminence relative to the cranial base.

2. SNA angulation was used to evaluate the anteroposterior position of maxilla relative to cranial base.

3. Linear distance of point O and point A – was the linear distance measured on the palatal plane from lines projecting perpendicularly from point O and point A on palatal plane. This was used to evaluate position of malar eminence relative to maxilla. (Or-Pt A was taken after conducting a pilot study in the institution)

4. Linear distance of point O and NA line – was the linear measurement from orbitale along a line perpendicular to NA. It was used to evaluate position of orbital rim relative to facial plane.

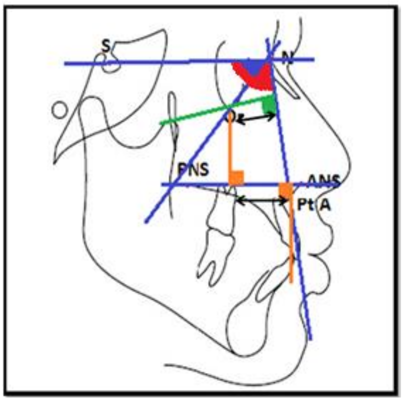

Fig 3: Variables

Statistical Analysis

All the readings were tabulated using SPSS 21 and $p<0.05$ was considered as level of significance. In an exploratory analysis using the Kolmogorov-Smirnov test, the data showed a non-normal distribution, thus nonparametric statistics were applied. Descriptive statistics were computed for angular measurements of positive and negative vectors. Mean differences between positive and negative vectors were examined using Mann-Whitney U-tests. Correlation between all the linear and angular measurements was estimated using Pearson's Correlation Coefficient. The sexual dimorphism was analyzed by unpaired independent t-test. Reliability analysis between the two observers was estimated using test-retest method of reliability.

RESULTS

Descriptive statistics for comparison of subject ages in positive and negative vector for both males and females showed that the mean age for males and females exhibiting positive vector was 18.09 years and 19.42 years respectively whereas mean age for males and females exhibiting negative vector was 17.61 years and 18.89 years. (Table 1)

Table 1: Descriptive Statistics for Subject Ages and Comparisons

	Negative Vector		Positive Vector	
	Mean	SD	Mean	SD
Male	17.61	3.01	18.09	2.94
Female	18.89	3.14	19.42	3.27

The mean SNO of positive vector group was 62.3 degree and that of negative vector group was 52.85 degree with a mean difference of 9.45±24.1 degree which was statistically significant as $p<0.05$ ($p=0.024$). Analysis of Linear distance between Or and Pt A showed that the mean for positive vectors and negative vector was 9.23 mm and 13.5 mm respectively. The difference between the two (4.27±0.79 mm) was statistically significant. O⊥NA distance showed that mean value for positive vectors was 12.73±2.13 mm and for negative vectors was 14.4±1.58 mm. The mean difference between the two was 1.67±0.55 mm which was statistically significant as $p=0.001$ ($p<0.05$). Comparison of SNA angle between positive and negative vectors showed significant difference between the two groups as the p value was 0.034 ($p<0.05$). The mean SNA for positive and negative vectors was 83.5 degree and 79.12 degree with a SD of 3.45 degree and 3.92 degree respectively and the mean difference between the two was 4.38±0.68. (Table 2)

Table 2: Analysis of SNO, Or- Pt A, O⊥NA, SNA between Positive and Negative Vectors.

SNO		Mean	SD	Mean Difference	Z-value	Significance
	Positive Vector	62.3	6.4	9.45±2.41	5.78	0.024 S,p<0.05
Or-Pt A	Negative Vector	52.85	3.99			
	Positive Vector	9.23	1.55	4.27±0.79	4.6	0.01 S,p<0.05
	Negative Vector	13.5	2.34			
O⊥NA linear distance	Positive Vector	12.73	2.13	1.67±0.55	3.37	0.001 S, p<0.05
	Negative Vector	14.4	1.58			
SNA	Positive Vector	83.5	3.24	4.38±0.68	3.7	0.034 S,p<0.05
	Negative Vector	79.12	3.92			

Analysis of sexual dimorphism showed no statistically significance difference of SNO angle was observed between the two genders. Mean values for males and females exhibiting positive vector were 57.41 degree and 56.71 degree respectively. Difference between the two was 0.7 degree which is statistically insignificant as $p=0.804$. Mean values for males and females exhibiting negative vector was same i.e. 56.08 degree, difference between the two was insignificant. Analysis of sexual dimorphism with respect to mean of Or-Pt A showed no statistically significant as $p>0.05$. The mean distance for males and females was 14.36 mm and 12.50 mm respectively for the positive vector group while the mean difference between the two genders for this group was 1.86 mm. In the negative vector group the mean for males and females was 12.85 mm and 12.76 mm respectively. Mean difference between the two being 0.09 mm. Analysis of sexual dimorphism between the two groups showed the mean value for males exhibiting positive vector was 14.1 mm and for females was 12.05 mm. The difference between the two was significant as $p=0.011$ ($p<0.05$). For negative vector group the mean values for males and females were 14.2 mm and 14.5 mm. The mean difference between the two was 0.03 mm which was insignificant as $p=0.618$ ($p>0.05$). Analysis of sexual dimorphism for SNA angle showed the mean value for females with positive vector was 80.87 degree and males was 82.32 degree. The mean difference between the genders in this group was 1.45 degree which was insignificant as $p=0.255$ ($p>0.05$). In the negative vector group the mean value for females was 81 degree and males was 81.35 degree, difference between the two was 0.35 degree and this was statistically insignificant as $p=0.829$ ($p>0.05$). (Table 3)

Table 3: Analysis of sexual Dimorphism for SNO, Or-Pt A distance, O⊥NA distance, SNA.

		Male		Female		Difference	F-value	P-value
		Mean	SD	Mean	SD			
SNO	Positive Vector	57.41	11.4	56.71	3.5	0.7	4.656	0.804 NS, p>0.05
	Negative Vector	56.08	3.09	56.08	4.77	0.00	2.638	0.69 NS, p>0.05
Or-Pt A distance	Positive Vector	14.36	2.5	12.50	2.4	1.86	0.168	0.056 NS, p>0.05
	Negative Vector	12.85	2.5	12.76	3.4	0.09	0.670	0.941 NS, p>0.05
O⊥NA distance	Positive Vector	14.1	2.2	12.05	1.7	2.05	0.393	0.011 NS, p<0.05
	Negative Vector	14.2	1.6	14.5	1.5	0.03	0.058	0.618 NS, p>0.05
SNA	Positive Vector	82.32	3.9	80.87	2.8	1.45	0.815	0.255 NS, p>0.05
	Negative Vector	81.35	4.4	81.00	4.1	0.35	0.007	0.829 NS, p>0.05

Correlation between SNO angle and linear distance between Or-Pt A showed mean of SNO angle for both groups was 56.69 degree and the distance of Or-Pt A was 12.99 mm. The correlation 'r' value was -0.43. The p value came out to be less than 0.05 which indicated a positive correlation between the two measurements. Correlation between O⊥NA and SNO angle showed a significant correlation ('r' value was -0.317, p=0.014) between the two. The SNO and SNA angle were highly correlated as p=0.004 (less than 0.05). The mean SNO for 60 patients was $56.69\underline{+}5.83$ mm and mean SNA was 81.28+3.76 degree. A high correlation was found between SNA and O⊥NA. The mean SNA for 60 patients was 81.28 degree and O⊥NA distance was 13.57 mm. The correlation 'r' was 0.278 with a p value of 0.031. Mean SNA for 60 patients was 81.28 degree and mean Or-Pt A was 12.99 mm. These two parameters showed a correlation 'r' of 0.598 and p value of 0 which indicated that there was significant correlation between the two. O⊥NA and Or-Pt A showed a positive correlation, mean of the two being 13.57 mm and 12.99 mm respectively. The 'r' value was 0.724 and p=0. (Table 4)

Table 4: Analysis correlation between the two. O⊥NA and Or-Pt A.

Correlations	Mean	SD	N	Correlation 'r'	p-value
SNO Angle & Or- Pt A	56.69	5.83	60	-0.43	0.01 S,p<0.05
	12.99	2.79	60		
Linear distance of O⊥NA & SNO angle	13.57	2.04	60	-0.317	0.014 P < 0.05 Significant
	56.69	5.83	60		
SNO Angle & SNA	56.69	5.83	60	0.364	0.004 P < 0.05 Significant
	81.28	3.76	60		

SNA Angle & O⊥NA	81.28	3.76	60	0.278	0.031 P < 0.05 Significant
	13.57	2.04	60		
SNA Angle & Or-Pt A	81.28	3.76	60	0.598	0.000 P < 0.05 Significant
	12.99	2.79	60		
Or-Pt A &O⊥NA	12.99	2.79	60	0.724	0.000 P < 0.05 Significant
	13.57	2.04	60		

DISCUSSION

There are various tools used to diagnose a patient that aid in formulation of a treatment plan. Cephalogram is one important tool but various skeletal structures of the midface have till now been quite difficult to assess in lateral cephalograms. Although the relationship between the maxilla and orbital rim has not been studied widely, it is used extensively in the field of plastic surgery[17]. This aspect of deficiency in validity of relationship between maxillary development and vector relationship has led us to do this study. The study was designed to observe clinically the positive and negative vectors and to correlate this with the various angular and linear cephalometric measurements. This study is inspired by the results of the study done by Frey ST[18], where he has compared subjects exhibiting a positive vector relationship with individuals displaying a negative vector relationship, and has shown that the latter had significantly reduced malar support. He had supported his results with the help of Sella-nasion-orbitale (SNO) angulations only.

However, we here have made use of SNO, SNA angle, Or-Pt A distance and O⊥NA distance to correlate with the positive and the negative vectors.

After compiling the data of the study, the mean value for SNO angle for positive vectors was 62.3 degree with a standard deviation of 6.4 degree and for negative vectors was 52.85 degree with a standard deviation of 3.99 degree. The mean difference between the two groups was 9.45±2.41 degree which was statistically significant ($p=0.024$). This suggested that an increased SNO correlated with positive vectors and a decreased SNO correlated with negative vectors. In the study conducted by Dr Frey[18] the mean SNO for positive vector group was 69.3 degree and for negative vector group was 63.3 degree with a mean difference between the two groups being 6 degree which was highly significant. Although our study does not have the same range of SNO as that of Dr Frey, the difference of mean between the groups was significant in both the studies. This can be due to the fact that both the studies were done in two different set of populations, Dr Frey's being White and ours being North Indian. Also in both the studies increased SNO angle was associated with prominent malar eminence and a positive vector relationship whereas decreased angle was associated with malar retrusion and a negative vector relationship. When the results regarding sexual dimporphism were analyzed, the difference of SNO between genders in the two groups was insignificant. This may be attributed to the fact that unequal number of males and females were included in the study as no attempt was made to divide the sample equally between males and females. Despite the fact that equal number of males and females were comprehended in the study by Dr Frey[18], no significant difference between the genders in the two groups was discerned. So our study is in agreement with the study by Dr. Frey[18] as far as gender variability was concerned.

Analysis of Or-Pt A distance showed that the mean value of this measurement for positive vectors was 9.23 mm and for negative vectors was 13.5 mm. The mean difference between the two groups was 4.27 mm which was statistically significant. The increase in this value in negative vector indicated a posteriorly positioned orbital rim relative to maxilla. However, in case of positive vectors, the distance was decreased indicating an anteriorly positioned orbital rim. Hence by looking at the photographs of the patient one can get to know that this measurement will be more for negative vectors and less for positive vectors. This will aid in determining the malar deficiency relative to maxilla. This parameter was introduced by doing a pilot study in our institution.

O⊥NA denotes the linear measurement from orbitale along a line perpendicular to NA. In our study the positive vectors displayed a mean of 12.73±2.13 mm and negative vectors of 14.4±1.58 mm. The mean difference between the two was 1.67±0.55 mm which was significant. The increase in this measurement in negative vectors indicated that orbital rim was posteriorly positioned relative to NA line and in positive vectors it was anteriorly positioned. The enlarged O⊥NA distance confirms the upper midface hypoplasia. This measurement corroborates the SNO measurement or it may substitute for SNO in cases where abnormal cant of the SN plane exists. Thus the vector measurements obtained from the photographs and the values obtained from the cephalogram indicate a strong interrelation between the two entities.

The SNA angle describes the position of anterior limit of maxillary apical base in relation to upper craniofacial complex. The mean value of SNA for negative vector was significantly less as compared to the positive vector group indicating a retropositioned maxilla in negative vectors as compared to the positive vectors. Group 1 showed a mean SNA of 83.5 degree whereas Group 2 showed a mean SNA of 79.12 degree. This measurement would be smaller in cases of lower midface deficiency[19].A study by Leonard and Walker[1] in white females compared relationship of malar bones and maxilla. They divided patients on the basis of SNA angle into three groups i.e one with SNA less than 80, then 80-86 and last more than 86. They found that a retruded maxilla entails a distally positioned malar eminence and orbital rim whereas a prominent point A does not necessarily entail a prominent malar eminence or orbital rim. In our study the SNA angle was in the normal range as the subjects were divided using photographs and not the cephalometric data, so we analyzed the position of orbital rim relative to the maxilla. The results showed a posteriorly positioned orbitale in negative vectors and an anteriorly positioned orbitale in positive vectors (maxilla being normal in both groups). This can aid in treatment planning and to select an appropriate surgery for the underlying problem.

The appearance of midface consists of a dynamic relationship between globe of the eye, orbital rim, overlying soft tissue, malar eminence and maxilla[20]. A defect in either of these, results in an unesthetic profile. In order to make the profile pleasing in cases of midface deficiency various treatment modalities are there. In a growing patient if maxilla is deficient a protraction facemask and be given to bring the maxilla forward to some extent. If the growth has been completed then Le Fort osteotomies can be done to improve the profile. Also bone anchored maxillary protraction has shown good amount of improvement in the profile of the patient since advancement of both maxilla and orbitale occurred.

In cases of normal maxilla and deficient malar eminence, malar augmentation with the help of malar implants can be done. Another procedure to improve the appearance of midface is infraorbital ridge augmentation in cases of malar hypoplasia, sclera show and prominent eyes[21]. Although this study established a positive correlation between the photographs and the cephalogram taken to assess the malar region, we cannot complelety rely on the SNA angle and Or-Pt A distance as the point A is not completely reliable. Also the angular measurements used to estimate anterior malar projection are the projections of three dimensional object on two dimensional surface[22]. Future studies can use three-dimensional imaging techniques to assess the anetior malar region.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

CONCLUSION

In positive vectors, the SNO and SNA would be increased; Or-Pt A and O⊥NA distance would be decreased and in negative vectors SNO and SNA would be less, Or-Pt A and O⊥NA distance would be more. So this correlation between the photographs and cephalogram can help us to judge midfacial deficiency in a patient by just looking at the photographs and correct diagnosis can be made by using photographs of the patient and incase a midface deficiency exists, an adequate treatment plan can be provided.

REFERENCES

1. Papel ID. *Facial Plastic and Reconstructive Surgery.* 3rd ed. New York, NY: Thieme; 2009

2. Czerwinski M, Martin M, Lee C. Quantitative topographical evaluation of the orbitozygomatic complex. Plast Reconstr Surg. 2005;115(7):1858-186215923829

3. Kaptein YE, Kaptein JS, Markarian A. Vertical Localization of the Malar Prominence. Plast Reconstr Surg Glob Open. 2015 Jun; 3(6): e411.

4. Covington DS, Wainwright DJ, Teichgraeber JF, Parks DH. Changing patterns in the epidemiology and treatment of zygoma fractures: 10-year review. J Trauma. 1994;37(2):243-2488064924

5. Meyer-Marcotty P, Alpers GW, Gerdes AB, Stellzig-Eisenhauer A. Impact of facial asymmetry in visual perception: a 3-dimensional data analysis. Am J Orthod Dentofacial Orthop. 2010;137(2):168, e161-168

6. Moubayed SP, Duong F, Ahmarani C, Rahal A. A Novel Technique for Malar Eminence Evaluation Using 3-Dimensional Computed Tomography. *Arch Facial Plast Surg.* 2012;14(6):403–407

7. Leonard MS and Walker GF. A cephalometric study of the relationship between the malar bones and the maxilla in white American females. Angle Orthod 1977; 47(1): 42-5.

8. Terino EO. Alloplastic facial contouring by zonal principles of skeletal anatomy. Clin Plast Surg 1992; 19(2): 487-510.

9. Wilkinson TS. Complications in aesthetic malar augmentation. Plast Reconstr Surg 1983; 71(5): 643-9.

10. Jelks GW, JelksEB. The influence of orbital and eyelid anatomy on the palpebral aperture. ClinPlastSurg 1991; 18:183-195.

11. Patil B.C et al. Evaluation of Diagnostic Criteria for Clinical Assessment of Anterior Malar Projection In Relation To Midface Esthetics. Int J Recent Sci Res. 2017;8(5), 17018-17022.

12. Sodawala J, Ali SM, Sodawala F, Gandhi S, Hamdani S, Bhuyan D. Photographic Assessment of Anterior Malar Eminence using Anterior Corneal Plane. World J Dent 2018;9(6):513-516.

13. Arnett G , Bergman R. Facial keys to orthodontic diagnosis and treatment planning, part I. Am J Orthod Dentofacial Orthop 1993; 103:299-312.

14. Arnett G, Bregman R. Facial keys to orthodontic diagnosis and treatment planning, part II. Am J Orthod Dentofacial Orthop 1993; 103:395-411.

15. Pessa J. An algorithm of facial aging: verification of Lambros's Theory by three-dimensional stereolithography, with reference to the pathogenesis of midfacial aging, scleral show, and the lateral suborbital trough deformity. Plast Reconstr Surg 2000; 106: 479-488.

16. De Clerck H, Cevidanes L, Baccetti T. Dentofacial effects of bone-anchored maxillary protraction: a controlled study of consecutively treated class III patients. Am J Orthod Dentofacial Orthop 2010; 138: 577-581.

17. Agbon C. Augmentation and correction malarplasty. Ann Plast Surg 1979; 2: 306.

18. Frey ST. New diagnostic tenet of the esthetic midface for clinical assessment of anterior malar projection. Angle Orthod 2013; 83:790-794.

19. Zide B, Grayson B, McCarthy JG. Cephalometric Analysis: Part I. Plast Reconstr Surg 1981; 68(5): 816-23.

20. Mulliken JB, Godwin SL, Pracharktam N, Altobelli DE. The concept of the sagittal orbital-globe relationship in craniofacial surgery. Plast Reconstr Surg 1996;97:700-706.

21. Yaremchuk M. Infraorbital rim augmentation. Plast Reconstr Surg 2001;107:1585-1592.

22. Doddamani GM, Swathi PV, Tan KF. Assessment of anterior malar projection using visual photographs and lateral cephalograms: A comparative study. J Orthodont Sci 2018;7:15.