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Research Article

EVALUATION OF DIAGNOSTIC CRITERIA FOR CLINICAL ASSESSMENT OF ANTERIOR MALAR PROJECTION IN RELATION TO MIDFACE ESTHETICS

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ABSTRACT

Introduction: There is a shortage of diagnostic criteria of midfaceesthetics in orthodontics literature. Orthodontists focus entirely on the premaxilla for classification of maxillary skeletal development because of difficulty in assessment of midface in lateral cephalogram. So, the lack of cephalometric landmark preclude the availability of normative data, making analysis and malar augmentation largely subjective.

Aim: To determine whether visual classification of anterior malar projection using vector relationship is supported by cephalometric analysis.

Material and Method: Pretreatment lateral cephalogram and profile photograph of 40 subjects were included in the study. Based on visual assessment of negative and positive vector relationships, subjects were equally divided into two groups of 20 each. Group Aexhibiting a positive vector relationship, comprised 20 subjects (10 male, 10 female). Group B displaying a negative vector relationship, comprised 20 subjects (10 male, 10 female).Toevaluate the subjects anteroposterior position of the malar eminence relative to the cranial base, SNO angulations were measured in both the groups. Mann-Whitney U-tests has been used for assessment of Gender differences and significant differences in SNO measurements between groups A and B **Results:** There was no statistically significant difference between genders. SNO angulations in the negative vector group were smaller than the positive vector controls by an average of 6.8 degrees. Highly significant difference were seen in anterior malar projection in patient with positive and negative vector relationship.

Conclusion: Compared with subjects exhibiting a positive vector relationship, individuals displaying a negative vector relationship had significantly reduced malar support.

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INTRODUCTION

A person's ability to recognize a beautiful face is innate, but translating this into defined treatment goals is problematic. Yet professionals have increased their ability to change faces, the necessity to understand what is and is not beautiful has intensified. Arnett's analysis is designed for surgical treatment planning and clinical convenience. For this analysis extensive records must be taken to evaluate maxillary soft tissue points relative to true vertical, and there are no instruments or parameter available for making accurate, reproducible measurements of orbital rim relationships [1-4].

There is a shortage of diagnostic criteria of midface esthetics in orthodontics literature [5]. Orthodontists focus entirely on the premaxilla for classification of maxillary skeletal development because of difficulty in assessment of midface in lateral cephalogram. So, the lack of cephalometric landmark preclude the availability of normative data, making analysis and malar augmentation largely subjective.

The Malar eminence not only affords protection to orbit laterally but cosmetically it is the high point of face and high cheekbone being regarded as esthetically pleasing. In the young adult, the ideal projection of the cheek prominence should be approximately 2 mm beyond the anterior surface of the cornea

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in the sagittal plane along the Frankfort horizontal plane[6]. Maxillary hypoplasia in this region produces what is called a negative vector relationship with the globe of the eye positioned anterior to the malar eminence which is esthetically not pleasing.

Association of maxillary development and vector relationship has much importance in plastic surgery world as well as orthodontic treatment planning. So, this study is planned to determine by using vector relationship whether visual classification of anterior malar projection is supported by cephalometric analysis. This study based on previous study done by S T frey in 2013[5].

MATERIAL AND METHOD

Pretreatment records of 40 subjects between the age of 15 to 25 years, seeking orthodontic treatment in H.K.E.S'S S.N. Institute of Dental Science & Research were included in the study between year 2014-2016. The patients with craniofacial syndrome, who had undergone maxillofacial plastic surgery or pregnant woman were excluded from the study. The ethical clearance was obtained from H.K.E.S'S S.N. Institute of Dental Science & Research and the informed consent was obtained from the patients. To evaluate the subjects anteroposterior position of the malar eminence relative to the cranial base, SNO angulations were measured in both the groups. Mann-Whitney U-tests has been used for assessment of Gender differences and significant differences in SNO measurements between groups A and B. We have taken same sample size as taken previous study by S T FREY [5].

METHODOLOGY

Here, patient's Lateral cephalograms and profile photographs were obtained from the patient's pretreatment records. Those were standardized by orienting the patient's head in the Frankfort horizontal position.

Each subject's vector relationship was determined by one operator, using only pretreatment profile photographs. The relationship of anterior cheek mass to the anterior corneal plane was established by marking a perpendicular line from the Frankfort horizontal plane to corneal projection

Figure 1

For the purpose of this study, if the cheek prominence was behind the anterior surface of cornea, it was considered as negative vector relationship (Table/fig 1) while if the cheek prominence was beyond the anterior surface of cornea, it was considered as positive vector relationship. (Table/Fig 2)

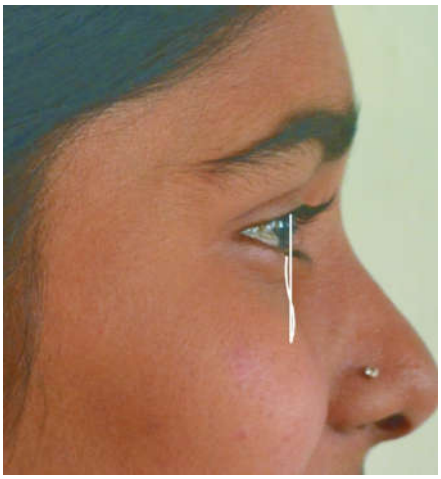

Figure 2

All the lateral cephalograms obtained were carefully hand traced by the same observer Under the same illumination and magnification on single matte lacquered polyester acetate tracing paper of thickness 35µ, using 3H lead pencil. In order to quantify skeletal support for each subject, sella-nasion-orbitale (SNO) angulation was used to evaluate the anteroposterior position of the malar eminence relative to the cranial base. Orbitale was identified to coincide with Walker's cephalogram point 109. The key ridge and the maxillary sinus were used as guides to consistently locate this landmark. (Table/Fig3)8 All cephalograms were traced by one examiner manually with the examiner blinded to the vector classification of the subject. Cephalograms were traced by the examiner three times with a minimum of 2 days between tracings to check manual tracing accuracy.

Figure 3

Prior to the cephalometric analysis, 10 random lateral cephalograms from subjects in the study were selected, and SNO angles were traced and measured at five times within a month by the same operator check the intraobserver agreement The intraclass correlation coefficients (ICC) indicated excellent

intraobserver agreement for SNO measurements (ICC.98) using the specific criteria for landmark identification.

Statistical Analysis

Initially the data analyzed by karmogorovsmirnov test. The data didnot showed normal distribution. Thus non parametric statistics were applied. Descriptive statistic analysis were computed for angular measurement of group A and group B. Mann Whiteney U test was used for significant differences between SNO angle measurements for groups A and B. Gender difference were also examined using mann whiteny u test.

RESULTS AND OBSERVATIONS

In this study, all parameters were measured by protractor tool showed minor error in angulation. (1^0) Mann whitney u test was applied in following three parameters.

1. Age and its relation with positive and negative vector relation.
2. Sex dimorphism
3. Differences in skeletal support between the negative and positive vector groups assessed using SNO angles.

Age and its relation with positive and negative vector relation shows (Table/Fig 4) no significant difference.

Table/figure 4 Mean and Standard Deviation (SD) of age (in years) and its comparsion between positive and negative vector for male and female by Mann Whiteney test.

Vector	Positive (N=20)		Negative (N=20)		Difference	Z Value	Remark
	Mean	SD	Mean	SD			
Male	19.3	1.95	17.7	2.37	1.6	1.51	NS
Female	19.9	2.47	18.0	2.49	1.9	1.55	NS

Conclusion: Z VALUE < 1.96 for P=0.05, shows no significant difference (NS)

So, it shows no relation between age and vector relationship. An analysis for sexual dimorphism (Table/fig 5) showed no statistically significant difference between genders.

Table/Figure- 5 Mean and standard deviation (SD) of SNO angle and its comparsion between male and female for positive and negative vector by Mann Whiteneny test.

Vector	Male (N=20)		Female(N=20)		Difference	Z Value	Remark
	Mean	SD	Mean	SD			
Positive	61.6	1.20	61.4	1.36	0.2	0.1512	NS
Negative	54.3	2.00	55.1	1.81	-0.8	0.9449	NS

Conclusion: Z Value < 1.96 for P=0.

Differences in skeletal support between the negative and positive vector groups assessed using SNO angles were highly significant (P .0001). SNO angulations in the negative vector group were smaller than the positive vector controls by an average of 6.8 degrees (Table/Fig 6).

Table/Figure- 6 Mean and standard deviation (SD) of SNO angle comparsion between positive and negative vector by Mann Wtihey test

Angle	Vector				Difference	Z Value	Remark
	Positive		Negative				
SNO	Mean	SD	Mean	SD			
	61.5	1.28	54.7	1.95	6.8	5.383	S

Conclusion: Z Value>5.383or P=0.05, Shows significant difference(S). P value < 0.0001.so, its highly significant difference.

Female Samples

Sr no	AGE	M/F	VECTOR	SNO ANGLE
1	17	F	NEGATIVE	58
2	19	F	NEGATIVE	55
3	21	F	NEGATIVE	55
4	15	F	NEGATIVE	53
5	17	F	NEGATIVE	56
6	16	F	NEGATIVE	58
7	23	F	NEGATIVE	53
8	20	F	NEGATIVE	53
9	16	F	NEGATIVE	54
10	16	F	NEGATIVE	56
1	22	F	POSITIVE	61
2	17	F	POSITIVE	63
3	17	F	POSITIVE	63
4	19	F	POSITIVE	62
5	19	F	POSITIVE	61
6	16	F	POSITIVE	63
7	22	F	POSITIVE	60
8	22	F	POSITIVE	62
9	22	F	POSITIVE	60
10	23	F	POSITIVE	59

Male Samples

1	15	M	NEGATIVE	54
2	18	M	NEGATIVE	55
3	23	M	NEGATIVE	52
4	20	M	NEGATIVE	56
5	17	M	NEGATIVE	54
6	15	M	NEGATIVE	53
7	18	M	NEGATIVE	59
8	18	M	NEGATIVE	53
9	15	M	NEGATIVE	55
10	18	M	NEGATIVE	52
1	21	M	POSITIVE	62
2	17	M	POSITIVE	63
3	18	M	POSITIVE	60
4	19	M	POSITIVE	62
5	16	M	POSITIVE	61
6	20	M	POSITIVE	62
7	22	M	POSITIVE	61
8	18	M	POSITIVE	61
9	20	M	POSITIVE	64
10	22	M	POSITIVE	60

DISCUSSION

A full cheek is considered as youthful appearance. Malar projection has great impact on facial esthetics. This study has been undertaken to evaluate the validity of vector relationship as means of diagnosing and describing the anterior malar projection and midface esthetics.

Natural Head Position has been used routinely for clinical examination in medicine and dentistry by plastic and maxillofacial surgeons, as well as by orthodontists. As Frankfort horizontal plane has smallest variability in particular racialgroup, In our study, we have standardized patient's Lateral cephalograms and profile photographs by orienting the patient's head in the Frankfort horizontal position[9,10].

In this study, Comparison of SNO angulations of negative vector and positive vector group has been done. This comparison showed highly significant protrusion of malar projection by 6.8degree in the subject with positive vector relationship. This finding suggests that vector relationships are an effective means of classifying anterior malar support during macro esthetic evaluation of pattern. No significant difference was found in SNO angulations of positive and negative vector

between males and females. We also found the considerable difficulty in identifing male subject with positive male architecture for use in the study. Potentially, malar retrusion is more prevalent in male population [5].

Additionally derived growth curve of sagittal orbital relationship have demonstrated the stability of vector relation from adolescence to adulthood allowing for malar retrusion to be identified in development. [11] By using protocol outline we have prevented the variation in landmark identification of orbitale. So, this study showed excellent intraobserver agreement for SNO measurement.

In our study mean of SNO angulations for positive and negative vector was higher compared to this study. Difference may be due to age group of patient in this study.

Positive vector relationship is important element of malar complex and youthful face and should be considered as esthetically ideal. However, esthetic norms are not a substitute for good artistic judgment and naturally care should be exercised in applying guidelines too rigidly across different racial backgrounds.

Inadequate projection of the midface skeleton results in midface concavity. Patients with this skeletal morphology tend to have prominent eyes and noses. Lack of skeletal support for the midface soft tissue envelope predisposes to premature cheek descent, resulting in palpebral fissure distortion and lower eye lid ‘‘bags’’, an appearance of early aging. It not only may result in occlusal disharmony, but also may compromise globe protection and airway adequacy [12].

One assumption stated that the malar eminence is “always lateral and inferior to the orbitale” and thus orbitale was chosen to represent the malar eminence on the lateral cephalometric x-ray. Hinderer resolved difficulty in diagnosing malar deficiency by highlight the intersection of two lines to find the malar eminence .The first line was drawn from the buccal angle to the outer canthus of the eye and the second was drawn from the alar base of the nose to the tragus[13].Many other methods for evaluation of malar prominence given by different authors include Powell, Bell, Whitakar and Kaptein[14-17].

Leonard and Walker found that a posteriorly positioned maxilla defined by a small SNA and a retruded orbital rim were found conjointly, but that an anteriorly positioned maxilla defined by a large SNA was not always related to an anteriorly positioned orbital rim. They concluded that in maxillary advancement cases it was essential to consider the malar prominences in diagnosing the maxillary deficiency; else one might not fully correct the appropriate deficiency[18].

Even though, orthodontic treatment does not directly alter malar globe relationships, but the balance between dentoalveolar and malar support has significant influence over the nasal base-lip contour.

The nasal base-lip contour (Nb-LC) line is an indicator of maxillary and mandibular skeletal anteroposterior position. Deficient development of the dentoalveolus or over-retraction of the dentition, can produce flattening of this region as well as undesirable nasolabial folding. In the absence of adequate malar support, accelerated distortion of the Nb-LC and facial decline may be seen with retraction of the dentition. It should also be noted that these effects become evident with age, 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[19].

There is strong correlation in the profile assessment between orthodontists and oral surgeons. Comprehensive Dentofacial analysis is central to the achievement of functional and cosmetic excellence in orthodontic treatment, and vector relationships provide the orthodontist with another useful diagnostic reference[4]. Assessment of malar support will be helpful in enhancement of esthetic orthodontic outcomes and to improve surgical orthodontic planning. In addition to determining the hard tissue contributions to nasolabial contours, vector relationships can assist the practitioner in evaluating the need for alloplastic augmentation of the inferior orbital rim and selecting the appropriate maxillary surgery.

Less severe midface hypoplasia is a common facial skeletal variant. In patients with this morphology occlusion is normal or has been compensated by orthodontics. In this population midface skeletal augmentation with multiple implants can simulate the visual effects of skeletal osteotomy and advancement include those that augment the infraorbitalrim and the malar area[6]. Malar-midface augmentation has been done using several method and materials. osteotomies and bone grafting has been done with the use of autogenous material for augmenting the malar midface region. Success of these methods is dependent on accurate midface anatomy assessment and very specific surgical technique [20,21]

Additionally, recent scientific evaluations of the effects of bone-anchored maxillary protraction (BAMP) on the malar eminence suggest that a negative vector can be viewed as an indicator of skeletal dysplasias, which may benefit from BAMP but It is effective during pubertal growth[22,23]. Still, Further investigation is indicated. Using vector relationships as part of a Dentofacial analysis provides the orthodontist with a convenient means of classifying malar support to the midface and will help to better inform treatment decisions.

This study has been done with small sample size in south Indian population. So, This parameter can be studied further to assess it relation to other cephalometric landmark and also assess the change in this parameter with the age with large sample size.

CONCLUSION

On the basis of result obtained from present study the following conclusions were drawn.

1. No significant relation between age and vector relationship.
2. No sexual dimorphism seen in patient with positive and negative vector relationship.
3. Highly significant difference was seen in anterior malar projection in patient with positive and negative vector relationship. Compared with subjects exhibiting a positive vector relationship, individuals displaying a negative vector relationship had significantly reduced malar support.

This parameter can be used to diagnosing and describing the anterior malar projection and midface esthetics.

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