A New Diagnostic Tenet For The Esthetic Midface Clinical Assessment Of Anterior Malar Projection

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Abstract

AIM AND OBJECTIVES: Arnett's facial analysis is currently used for soft tissue analysis but it is designed for surgical treatment planning but lacks clinical convenience. There is a shortage of diagnostic criteria in orthodontic literature pertaining to midface analysis despite the role of midface in facial esthetics. Therefore this study hopes to create a new diagnostic tenet for the esthetic midface by seeking to determine whether visual classification of anterior malar projection using vector relationships is supported by cephalometric analysis.

METHODOLOGY: 60 subjects between the age group of 15-21 years were selected based on the visual assessment of malar globe relationship. They were further divided into 3 groups, Group A, Group B and Group C having 10 males and 10 females each and showing neutral, negative and positive vector relationship respectively. Lateral Cephalogram's were taken of the selected subjects and traced digitally using Dolphin cephalometric software. The SNO (Sella-Nasion-Orbitale) angle was traced and compared with the vector relationship photographs. The statistical analysis was done using ANOVA and Students unpaired t test.

RESULTS: The test showed that there was a statistical significance between the three groups ($P < 0.001$ %) with mean values of 54.1° for the neutral group, 60.7° for the positive and 48.9° for the negative group. The results showed that there was a statistically significant difference between the three groups and that the neutral value of SNO was statistically different for males and females.

CONCLUSION: Visual vector relationship is an effective clinical assessment of anterior malar projection and it is supported by cephalometric analysis.

Keywords: Soft tissue diagnosis; Midface esthetics; Malar projection.

Introduction

In Orthodontics, there is a shortage of diagnostic criteria despite the role of the midface in facial esthetics. Arnett's facial analysis currently offers the most comprehensive soft tissue analysis in both the frontal and sagittal planes, and he was the first author to systemize such an approach.[1]

Arnett and Bergman presented the Facial Keys to Orthodontic Diagnosis and Treatment Planning as a

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The cephalometric points which are sella, nasion and orbitale were traced on digital tracings using dolphin imaging software. The angle formed by the three points (SNO) were measured.

Cephalometric Analysis

In order to quantify skeletal support for each subject, sella-nasion-orbitale (SNO) angulations were used to evaluate the antero-posterior position of the malar eminence relative to the cranial base. All cephalograms were digitally traced by one examiner using Dolphin"s Imaging Software. Cephalograms were traced by the examiner three times with a minimum of 2 days between tracings.

Prior to the cephalometric analysis, 15 random lateral cephalograms from subjects in the study were selected, and SNO angles were traced and measured at two times within a week by the same operator. The intraclass correlation coefficients indicated excellent intra-observer agreement for SNO measurements using the specific criteria for landmark identification.

Recording Of The Data

Each Pre-treatment profile photographs were marked using Microsoft Power-point software.

Each lateral cephalogram were digitally traced by using Dolphin cephalometric software.

Results

The following tests were used for Statistical analysis.

1. Student"s unpaired t test were used to compare the gender differences between SNO measurements for group A, group B and group C.

2. ANOVA test was used to compare the difference between the three groups. The following SNO angle values were found from the cephalometric analysis and visual assessment of the neutral group. (Table I and II)

Table I

MALE NEUTRAL VECTOR

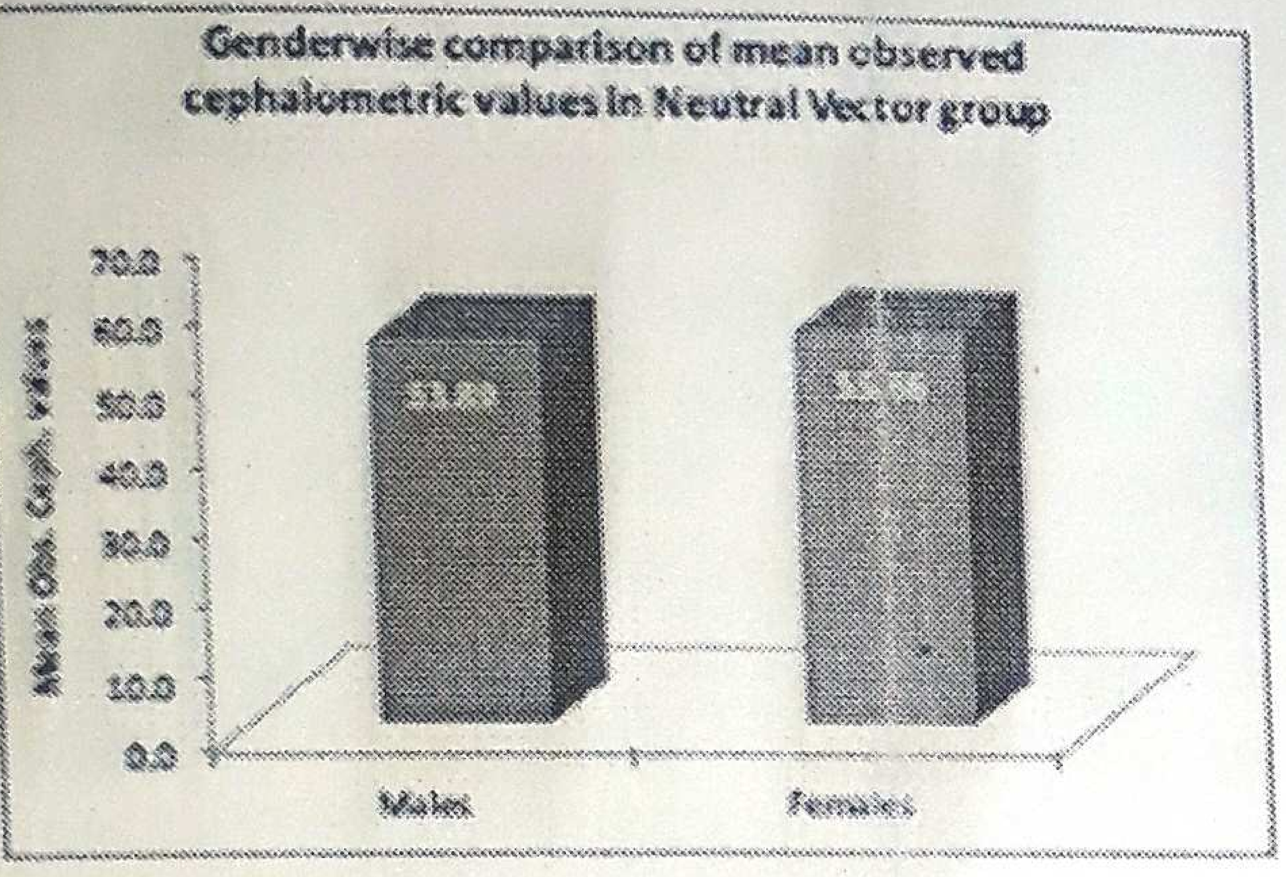
SR. NO	NAME	GENDER	OBSERVED CEPHALOMETRIC VALUE	NORMAL CEPHALOMETRIC VALUE	VISUAL ASSESSMENT
1.	MN1	MALE	53.7	54	NEUTRAL VECTOR
2.	MN2	MALE	54.1	54	NEUTRAL VECTOR
3.	MN3	MALE	53.7	54	NEUTRAL VECTOR
4.	MN4	MALE	53.1	54	NEUTRAL VECTOR
5.	MN5	MALE	53.4	54	NEUTRAL VECTOR
6.	MN6	MALE	55	54	NEUTRAL VECTOR
7.	MN7	MALE	53.9	54	NEUTRAL VECTOR
8.	MN8	MALE	53	54	NEUTRAL VECTOR
9.	MN9	MALE	53	54	NEUTRAL VECTOR
10.	MN10	MALE	56	54	NEUTRAL VECTOR

Table II

FEMALE NEUTRAL VECTOR

SR. NO	NAME	GENDER	OBSERVED CEPHALOMETRIC VALUE	NORMAL CEPHALOMETRIC VALUE	VISUAL ASSESSMENT
1.	FN1	FEMALE	53.5	54	NEUTRAL VECTOR
2.	FN2	FEMALE	52.8	54	NEUTRAL VECTOR
3.	FN3	FEMALE	55.6	54	NEUTRAL VECTOR
4.	FN4	FEMALE	55.7	54	NEUTRAL VECTOR
5.	FN5	FEMALE	55.6	54	NEUTRAL VECTOR
6.	FN6	FEMALE	56.4	54	NEUTRAL VECTOR
7.	FN7	FEMALE	56.2	54	NEUTRAL VECTOR
8.	FN8	FEMALE	56.9	54	NEUTRAL VECTOR
9.	FN9	FEMALE	56.7	54	NEUTRAL VECTOR
10.	FN10	FEMALE	57.2	54	NEUTRAL VECTOR

Genderwise comparison of mean observed cephalometric values in the neutral group were compared and in this group, the mean observed SNO value is 53.89° (52.8°-57.2°) for females and 55.6° (53°-56°) for males respectively. This showed a statistically significant difference ($P < 0.0005$ *) between the values. The difference found was about 2°. This showed that the average SNO value would change according to the gender.



The following SNO angle values were observed from the positive vector group.

Table IV

FEMALE POSITIVE VECTOR

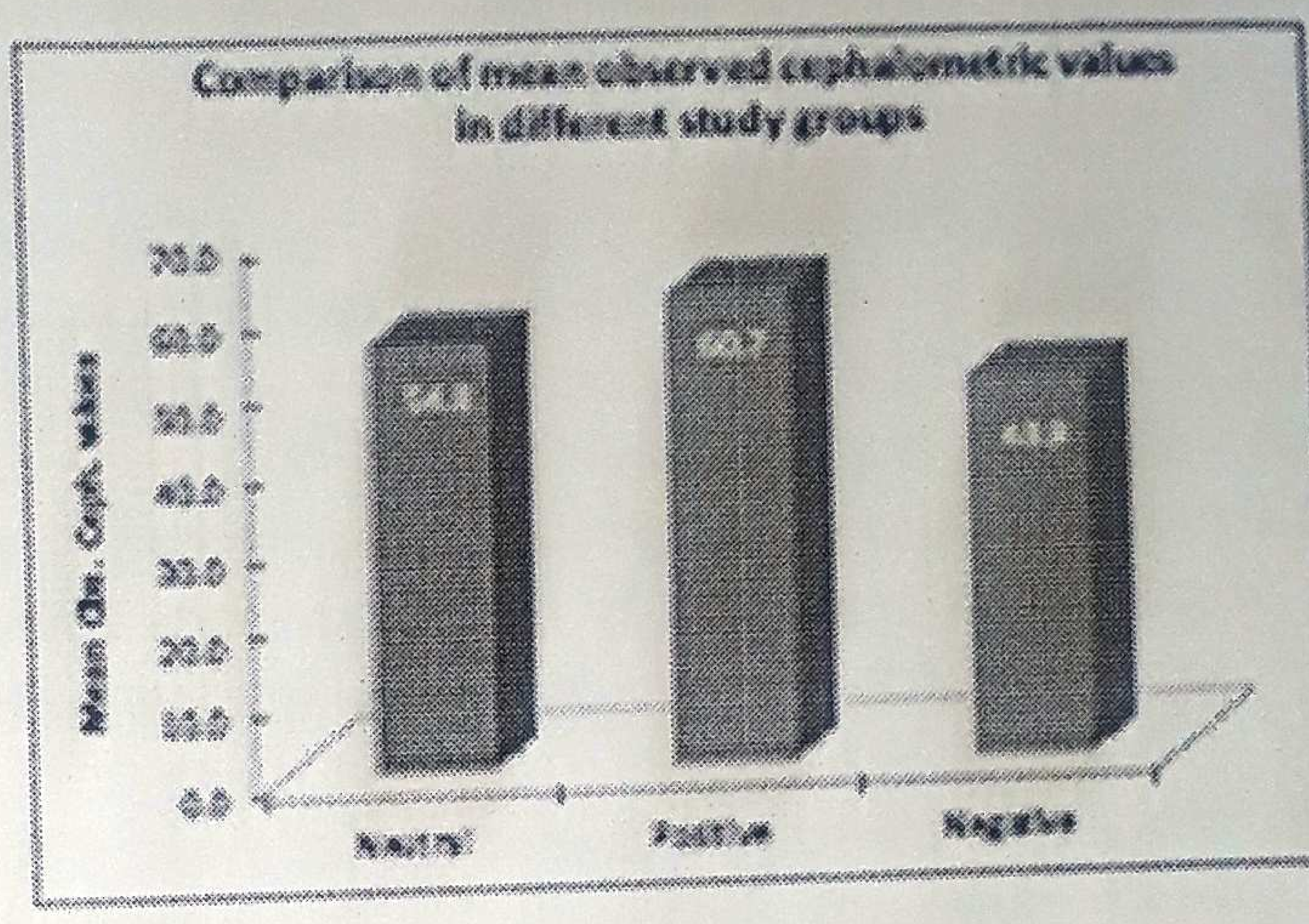
SR. NO	NAME	GENDER	OBSERVED CEPHALOMETRIC VALUE	NORMAL CEPHALOMETRIC VALUE	VISUAL ASSESSMENT
1.	F+1	FEMALE	63.5	54	POSITIVE VECTOR
2.	F+2	FEMALE	61.6	54	POSITIVE VECTOR
3.	F+3	FEMALE	60.6	54	POSITIVE VECTOR
4.	F+4	FEMALE	60.8	54	POSITIVE VECTOR
5.	F+5	FEMALE	60.7	54	POSITIVE VECTOR
6.	F+6	FEMALE	59.6	54	POSITIVE VECTOR
7.	F+7	FEMALE	63.8	54	POSITIVE VECTOR
8.	F+8	FEMALE	62.9	54	POSITIVE VECTOR
9.	F+9	FEMALE	59.4	54	POSITIVE VECTOR
10.	F+10	FEMALE	60.8	54	POSITIVE VECTOR

Table V

MALE POSITIVE VECTOR

SR. NO	NAME	GENDER	OBSERVED CEPHALOMETRIC VALUE	NORMAL CEPHALOMETRIC VALUE	VISUAL ASSESSMENT
1.	M+1	MALE	63.7	54	POSITIVE VECTOR
2.	M+2	MALE	57.9	54	POSITIVE VECTOR
3.	M+3	MALE	57.1	54	POSITIVE VECTOR
4.	M+4	MALE	63.8	54	POSITIVE VECTOR
5.	M+5	MALE	57.7	54	POSITIVE VECTOR
6.	M+6	MALE	57.7	54	POSITIVE VECTOR
7.	M+7	MALE	62.1	54	POSITIVE VECTOR
8.	M+8	MALE	62	54	POSITIVE VECTOR
9.	M+9	MALE	59.7	54	POSITIVE VECTOR
10.	M+10	MALE	58	54	POSITIVE VECTOR

A comparison of mean observed values in different study vector groups using ANOVA test was conducted. The test showed that there was a statistical significance between the three groups ($P < 0.001$ %) with mean values of 54.1 for the neutral group, 60.7 for the positive and 48.9 for the negative group.



Discussion:

One of the primary goals of orthodontic treatment is to attain and preserve optimal facial attractiveness. To accomplish this, it is important that the orthodontist conduct a thorough facial examination so that the orthodontic correction will not adversely affect the normal facial traits.Treatment planning of facial attractiveness is difficult, especially when the 2 goals of attractiveness and bite correction are combined. Unfortunately, bite correction does not always lead to correction, or even maintenance, of facial traits. Sometimes the orthodontist"s zeal to correct the bite may even result in a decrease of facial attractiveness. This result, when it occurs, may be due to a lack of attention to facial esthetics or simply a lack of understanding of what is desirable as an esthetic goal.[2,3,4]

What really determines a person"s attractiveness is the skeletal mass of the face. Three promontories determine facial features: the nose, the two malar eminences, and the chin. The strength of the mass and the volume that are characteristic of each promontory affects their relative balance with each other. Balance in bone structure is what gives the form of the face its maximum attractiveness called "beauty".[18,31]

The cheekbone contour is characterized by a curved line that starts at a point just anterior to the ear and extends anterior-inferiorly, ending adjacent to the alar base of the nose. For descriptive purposes, it is divided into three areas: 1) the zygomatic arch, 2) the middle contour area, and 3) the subpupillary area. In normoskeletal patients, the cheek bone - nasal base - lip contour complex forms a smooth continuous, anteriorly facing curved line.31 Augmentation has been proposed to improve the appearance of patients with a flat malar eminence, to create a more youthful-looking face, to make the face more oval, and to deemphasize prominent nasal or mental profiles.[18]

Cephalometrics has concerned itself with the study of the relationship of the maxilla to the cranial base (SNA angle) as well as the relationship of the mandible to the cranial base (SNB angle), and the relation of the mandible to the maxilla (ANB angle).[21] The malar eminence not only affords protection to the orbit laterally but cosmetically is the "highpoint" of the face, high "cheekbones" being regarded as esthetically pleasing. The lateral cephalometric radiograph does not show the malar eminence but it is, in fact, always lateral and inferior to the orbitale.[29] Thus, if the position of orbitale was known in relation to nasion and A point, this would, in effect, tell us the relationship of the malar eminence to these latter positions.[14]

Relying on cephalometric dentoskeletal analysis for treatment planning can sometimes lead to esthetic problems, especially when the orthodontist tries to predict soft tissue outcome using only hard tissue normal values. To accurately predict soft tissue response to hard-tissue changes, the orthodontist must understand soft tissue behavior in relation to orthopedic and orthodontic changes and must also take into consideration growth and development of soft tissue traits.[2]

This study sought to evaluate the validity of vector relationships as a means of diagnosing and describing anterior malar projection and esthetics. The visual classification co-relates with the cephalometric findings. These findings suggest that vector relationships are an effective means of classifying anterior malar support during macro-esthetic evaluation of the patient. Wide variation in landmark identification of orbitale has been observed in the past; however, using the protocols outlined in this study, excellent intraobserver agreement was attained for SNO measurements.[5]

A positive vector relationship has been identified in anthropometric studies as an important element of the youthful face and malar complex, and should be considered the esthetic ideal.[8] 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. Youthful, esthetic facial contours require sufficient maturation and growth of both hard and soft tissues, and although orbital and malar retrusion are often associated with craniofacial syndromes[33], less severe hypoplasia of the mid-face is a common facial skeletal variant.[8]

Consequently, greater attention must be paid to regional hypoplasias within the maxilla, including those presenting in the absence of malocclusion. Deficient malar and mid-facial projection leaves the soft tissues poorly supported, resulting in premature lower lid and cheekdescent as well as visible bags, scleral show, and a more aged appearance.8

In this study, it was found that there was a statistically significant gender difference in the neutral group. This proves that the normal mean value of SNO angle which is 54° would change according to the gender.

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 therapy in the adolescent patient. Further investigation is indicated.[16,17]

In the young age group, we can identify malar retrusion regarding the vector selections S, N and O. Comparison of angular measurements for SNO from positive vector group and negative vector group showed retrusion of malar eminence by 12° in subjects with negative vector group.

In negative vector group, on clinical examination along with the other classical features such as scleral show, dished-in appearance and aged appearance, this vector relationship can be used as an indication of maxillary hypoplasia.[8]

Using vector relationships as part of a dento-facial analysis provides the orthodontist with a convenient means of classifying malar support to the mid-face and will help to better inform treatment decisions.

Conclusion:

The following conclusions were drawn from the study:

- Visual vector relationship is an effective clinical assessment of anterior malar projection and it is supported by cephalometric analysis.
- There was a statistically significant gender difference in the neutral group and hence the normal mean value of SNO would change according to gender.

- There was no statistically significant sexual dimorphism between the positive or negative vector groups.

But further radiographic examinations are required to evaluate the extent of malar deficiency mainly when surgical correction of the defect is planned. Visual vector relationship can only be used as a clinical diagnostic tool for gross assessment of malar deficiency.

References

1. Arnett G W, Jelic JS, Kim J, Cummings DR, Beress A, Worley M, Chung B, Bergman R. Soft tissue cephalometric analysis: Diagnosis and treatment planning of Dentofac deformity: Am J Orthod Dentofac Orthop 1999;116:239-53.

Bergman RT. Cephalometric soft tissue facial analysis: Am J Orthod Dentofac Orthop 1999;116:373-89.

Arnett GW, Bregman RT. Facial keys to orthodontic diagnosis and treatment planning, Part I. Am J Orthod Dentofac Orthop. 1993;103: 299–312.

Arnett G W, Bregman RT. Facial keys to orthodontic diagnosis and treatment planning, part II. Am J Orthod Dentofac Orthop. 1993;103:395–411.

Baumrind S, Frantz RC. The reliability of head film measurements. 1. Landmark identification. Am J Orthod Dentofacial Orthop. 1971;60:111–127.

Cecil Steiner: Cephalometrics for you and me :Am J Orthod Dentofacial Orthop 1953:39:10: 729-755

Frey S T. New diagnostic tenet of the esthetic midface for clinical assessment of anterior malar projection: Angle Orthod. 2013;83:790–794.

Michael J. Yaremchuk. Making Concave Faces Convex: Aesth. Plast. Surg. 29:141– 147, 2005.

Hinderer UT. Malar implants for improvement of the facial appearance. Plast Reconstr Surg. 1975 ;56(2):157–65.

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

Whitaker LA. Aesthetic augmentation of the malar-midface structures. Plast Reconstr Surg. 1987;80(3):337–46.

Sung S J, Baik HS. Assessment of skeletal and dental changes by maxillary protraction: Am J Orthod Dentofac Orthop 1998;114:492-502

Ryan K. Hinckley: Characterization Of Malar Deficiency In Class I And Class Iii Individuals Using Cbct:S.L.U 2012.

14. Leonard MS, 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.
15. Ismail SFH, Moss JP, Hennessy R. Three-dimensional assessment of the effects of extraction and nonextraction orthodontic treatment on the face. Am J Orthod Dentofacial Orthop. 2002;121:244–256.
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. Nguyen T, Cevidanes L, Cornelis M. Three-dimensional assessment of maxillary changes associated with bone anchored maxillary protraction. Am J Orthod Dentofacial Orthop. 2011;140:790–798
18. Robiony M, Costa F, Demtri V, Politi M. Simultaneous Malaroplasty with porous polyethylene implants and orthognathic surgery for correction of malar deficiency: J Oral Maxillofac Surg 1998:56: 734-741.
19. Reidel :An analysis of dentofacial relationships ; Am J Orthod Dentofacial Orthop ;1957;43;2;103-119
20. Walker GF. A new approach to the analysis of craniofacialmorphology and growth. Am J Orthod Dentofacial Orthop.1972;61:221–230
21. Mouakeh M. Cephalometric evaluation of craniofacial pattern of Syrian children with Class III malocclusion: Am J Orthod Dentofac Orthop 2001;119:640-9.
22. Sanyinsu K, Isik F, Trakyali G, Arun T: An evaluation of the errors in cephalometric measurements on scanned cephalometric images and conventional tracings. European Journal of Orthodontics 29 (2007) 105–108
23. Mariane P, Costa MS, Vogel CJ, Martins T: Comparative study between manual and digital cephalometric tracing using Dolphin Imaging software with lateral radiographs. Dental Press J Orthod 2010 Nov-Dec;15(6):123-30
24. Erkan M, Gurel H, Nur M and Demirel B : Reliability of four different computerized cephalometric analysis programs. European Journal of Orthodontics 34 (2012) 318–321
25. William J. Binder,Babak Azizzadeh : Malar and Submalar Augmentation facial plast surg clin n am : 16 (2008) : 11 32