# **ORIGINAL ARTICLE**

# TO CHECK THE RELIABILITY OF VARIOUS CEPHALOMETRIC PARAMETERS USED FOR PREDICTING THE TYPES OF MALOCCLUSION AND GROWTH PATTERN

Lipika Vashisht<sup>1</sup>, Sushil Negi<sup>1</sup>, Mahak Aggarwal<sup>2</sup>, Gurinder Pal Singh Sandhu<sup>1</sup>, Babita Kaushal<sup>1</sup>

<sup>1</sup>Department of Orthodontics, <sup>2</sup>Department of Pediatric and Preventive Dentistry Bhojia Dental College and

Hospital, Baddi, H.P

#### **ABSTRACT:**

**Objective:** To check the reliability of various horizontal parameters for predicting the Class I, Class III, Class III malocclusion and the reliability of various vertical parameters for predicting the normodivergent, hypodivergent and hyperdivergent growth patterns. Material and methods: The study was carried out in the Department of Orthodontics and Dentofacial Orthopedics, Bhojia Dental College and Hospital, Baddi, (H.P). Ethical clearance from institutional ethical committee was taken for conducting study. A complete history and examination of all the subjects was done at the ESI hospital, Baddi, prior to their inclusion in the study. A total of 80 subjects with age group of 16-28 years were selected for the study. Sample size of 80 subjects were divided into three groups based on Angle's classification:- Group 1: Angle's class I Malocclusion Group 2: Angle's classII Malocclusion Group 3: Angle's classIII Malocclusion . The same subjects were divided into 3 groups based on the values obtained by measuring the clinical FMA with modified facial goniometer Group I:FMA (18-26degree) Normodivergent Group II: FMA(<18 degree) Hypodivergent Group III: FMA(>26degree) Hyperdivergent . Lateral cephalograms of all the 80 subjects were taken in standardized manner in the same cephalostat machine and were traced for various vertical and sagittal parameters and the readings were evaluated and compared for results. Results: After the statistical analysis of factor analysis and ANOVA of the data it was found that out of the vertical parameters with a sample size of 80 patients 53 patients fall under horizontal growth pattern and 27 under vertical growth pattern and none in normodivergent and in sagittal parameters 28 fall under Class-I, 49 under Class-II, and 1 under Class-III. Conclusion: In short statistically significant parameters reliable for finalizing the type of growth pattern are Bjork sum, Y-axis, Mandibular plane angle, J-ratio. The reliable parameters for finalizing the type of malocclusion are ANB, Yen angle, APP-BPP. Key words: Cephalometrics, Growth pattern, Malocclusion.

Corresponding author: Dr. Lipika Vashisht, Post graduate student, Department of Orthodontics, Bhojia Dental College and Hospital, Baddi, H.P, E mail: lipikavashisht@rocketmail.com

This article may be cited as: Vashisht L, Negi S, Aggarwal M, Sandhu GPS, Kaushal B. To check the reliability of various cephalometric parameters used for predicting the types of Malocclusion and Growth Pattern. J Adv Med Dent Scie Res 2016;4(1):15-20.

# NTRODUCTION

The anterioposterior relationship of maxillary and mandibular apical bases is an important parameter evaluated during orthodontic diagnosis<sup>1</sup>. The vertical disharmonies are often combined with a saggital discrepancy in the relationship of jaws<sup>2</sup>. A careful

analysis of linear and angular measurements is of practical value in recognizing an abnormal growth pattern , and also helps to determine the prognosis of the case<sup>3</sup>. A method of appraising faces permits one to say that a person has a certain type of face and to describe it in degrees of the facial angle<sup>4</sup>.

#### AIMS AND OBJECTIVES

- To check the reliability of various horizontal parameters for predicting the Class I, Class II, Class III malocclusion.
- To check the reliability of various vertical parameters for predicting the normodivergent, hypodivergent and hyperdivergent growth patterns.

#### **MATERIAL AND METHOD**

The study was carried out in the Department of Orthodontics and Dentofacial Orthopedics, Bhojia Dental College and Hospital, Baddi, (H.P). Ethical clearance from institutional ethical committee was taken for conducting study. A complete history and examination of all the subjects was done at the ESI hospital, Baddi, prior to their inclusion in the study. A total of 80 subjects were selected for the study

#### **INCLUSION CRITERIA**

- Patients with fully erupted permanent dentition.
- Subjects aged between 16-28 years.
- No history of any craniofacial disorders.

#### **EXCLUSION CRITERIA**

- Prior orthodontic treatment.
- History of trauma
- Tooth agenesis or extraction

# METHODOLOGY (5-16)

Sample size of 80 subjects were divided into three groups based on Angle's classification:-Group 1: Angle's class I Malocclusion Group 2: Angle's classII Malocclusion

Group 3: Angle's classIII Malocclusion

The same subjects were divided into 3 groups based on the values obtained by measuring the clinical FMA with modified facial goniometer  $^{7}$ . Group I: FMA (18-26degree) Normodivergent Group II: FMA (<18 degree) Hypodivergent GroupIII: FMA (>26degree) Hyperdivergent

Lateral cephalograms of all the 80 subjects were taken in standardized manner in the same cephalostat machine (Advapex, OPG-TMJ-CEPH, Flat cassette model) with similar exposure parameters and standardized settings. During the exposure of cephalograms, the subjects were guided to stand still to ensure that no strain or change in head posture occurred while the head is fixed in the cephalostat. Lateral cephalograms of the subjects were traced and investigated by single investigator. The modified facial goniometer is fabricated to check the FMA of the subject and assigning them respective growth pattern. The planes used for measuring the FMA are the -a)upper point of tragus joining with lowest point of orbitale. b) line tangent to the inferior border of the mandible passing through menton.. The angle is measured between these two planes. These subjects are then cephalometrically analysed by using various parameters.

#### **A) VERTICAL PARAMETERS Angular** measurements

J.

1. Articular angle: The angle between the lines joining sella to articulare and articulare to  $\sim$  gonion.normal range(143<sup>0</sup>+/\_6)

<sup>M</sup> 2. Gonial angle: The angle between the lines joining

articulare to gonion and gonion to menton. Normal  $range(128^{0}+/7)$ 

3. Bjork sum: The sum of saddle, Articulare and gonial angle.normal range $(396^{\circ}+/_{6})$ 

4. Y-Axis: angle between FH plane and line joining sella to gnathion. This angle determines the direction of growth of the mandible relative to cranial base.normal value( $66^{\circ}$ )

5. Basal plane angle: This defines the angle of inclination of mandible to maxillary base, the latter being represented by palatal plane. normal  $(25^{\circ})$ 6. Down's mandibular plane angle: This angle is formed between frankfort horizontal plane and mandibular plane. (Go-Me)  $normal(21.9^{\circ})$ 

7. FMA (Tweed): It is the angle formed between FH plane and mandibular plane(tangent to the lower border of mandible passing through menton)normal  $range(22-28^{\circ})$ 

8. Mandibular plane angle (Steiner): It is the angle formed between the sella- nasion plane and the line joining the gonion and gnathion. normal  $(32^{\circ})$ 

### LINEAR MEASUREMENTS

1. Jarabak ratio: Posterior facial height (Sgo)X 100/anterior facial height(Nme)normal range 62-65%

# B) SAGITTAL PARAMETERS ANGULAR MEASURMENTS

1. ANB: It is difference between SNA and SNB angles.normal  $(2^0)$ 

2. Beta angle: It is the angle between perpendicualr line from point A on C-B line and the A-B line. normal range( $27-35^{0}$ )

3. Yen angle: When point S, point M, point G are connected they form yen angle which is measured at M. normal range( $117-123^{0}$ )

4. W angle: It is measured between the perpendicular from point M on S-G line and the M-G line.normal range( $51-56^{\circ}$ )

5. FABA: formed by the FH plane and the line connecting point A and point B. normal  $(81^{\circ})$ 

### LINEAR MEASURMENTS

1. Wits appraisal (AO-BO):linear distance between more projections of point A and point B on the bisecting cocclusal plane. Normal (-1.0-0)

2.MM Bisector: linear distance between the pojection of point A and point B on the bisector of the angle between the palatal plane and the mandibular plane. Normal (4mm)

3. APP-BPP: Distance between the projections from point A and point B on the palatal plane. Normal (5 mm)

4. Maxillo mandibular differential (Mcnamara): The effective mid facial length is subtracted from mandibular length. Normal range (25-27 mm).

# **RESULT:**

To achieve the objective of my study which was performed on a sample size of 80 patients with age group ranging from 16- 28 years. On sample size of 80 patients different analysis of vertical and saggital parameters were performed. The different parameters for assigning a particular growth pattern in a patient are-

- 1. Articular angle
- 2. Gonial angle

- 3. Bjork sum
- 4. Y-axis
- 5. Basal plane angle
- 6. Down's mandibular plane angle
- 7. FMA
- 8. Mandibular plane angle
- 9. J-ratio

J.

A

On the total number of sample size statistical analysis was performed the test conducted on the sample size are factor analysis and ANOVA. Based on which out of 80 patients 53 fall under horizontal growth pattern and 27 under vertical growth pattern and none in normodivergent growth pattern.and out of various vertical parameters Bjork sum ,Y- axis, Mandibular plane angle, J- ratio are most reliable parameters and gonial angle and Basal plane angle is least reliable. Same sample size of 80 was also analysed for sagittal parameters which were

ANB
Beta angle
Yen angle
Wangle
FABA
Wits
MM Bisector
APP-BPP
Maxillomandibular differential

Out of 80 patients 28 fall under Class I, 49 fall under Class II, 1 fall under Class III. Most reliable parameter to assign the malocclusion type are ANB, Yen angle, APP-BPP and least are maxillomandibular differential and wits.

During data analysis of 80 sample size we found 16 are vertical growth pattern, 59 are horizontal growth pattern and 5 are normodivergent growth pattern. Hence the most common growth pattern seen is horizontal type which was confirmed and supported by various statistically significant parameters. Similarly mapping the data for class type we found that out of 80 sample size class I are 26, class II are 38 and class III are 15. Hence the most common malocclusion type is class II and least common is class III.

Details are given in below tables and graphs.

Horizontal/Vertical / Normo	Gonial Angle	Bjork Sum	Y- Axis	Basal Plane Angle	Down's Mandibular Plane Angle	FMA	Mandibular Plane Angle	J- Ratio
53	47	61	73	43	49	49	58	56
27	27	15	3	27	21	14	16	10
0	6	4	1	8	10	16	5	9





# SAMPLE DATA FOR 80 PATIENTS: MALOCCLUSION TYPE

ANB	Beta Angle	Yen Angle	W Angle	Faba	Wits Appraisal	MM Bisector	App- Bpp	Maxilomandibular Differential
28	47	14	26	22	53	51	12	22
49	31	61	31	36	22	24	38	4
1	2	5	22	22	5	5	30	54



#### SAMPLE DATA FOR 80 PATIENTS: GROWTH PATTERN/MALOCCLUSION

	Jaw Type	Class Type	
Horizontal/CL I	59		26
Vertical/CL II	16		38
Normal/ CL III	5		15



#### **CONCLUSION:**

During the study the data collected was cephalometrically analysed for the various vertical and sagittal parameters and then statistically evaluated .Based upon the result it was confirmed that the vertical parameters Bjork sum , Y- axis, Mandibular plane angle, J - ratio are the most reliable parameters and in sagittal parameters ANB, Yen angle, APP-BPP are most reliable parameters for assigning a growth pattern and type of malocclusion.

#### **REFERENCES:**

- 1. Bishara, Fahl, and Peterson.Longitudinal changes in the ANB angle and Wits appraisal:Clinical implications.Am J Orthod Dentofacial Orthod1983;84:2;133-139
- 2. Bock JJ,Fuhrmann RA.Evaluation of vertical parameters in cephalometry.J Orofac Orthop 2007;.68(3):210-22.
- 3. NegerM.The facial goniometer:An instrument for the direct measurement of Frankfort –Mandibular plane angle and the gonion angle.Angle orthod 1951;21: 4.
- 4. DownsW B .Analysis of dentofacial profile. Angle orthod1956;26:4.

- 5. Tweed Charles H. The Frankfort-Mandibular IncisorAngle in orthodontic diagnosis, Treatment planning and prognosis. Angle orthod 1954;24:3.
- 6. Baik C Y, Ververidou M.2004.A new approach of assessing sagittal discrepancies: The Beta angle. Am J Orthod Dentofacial Orthop 2004;126:100-5.
- 7. Athansiou A E, Droschi H, Bosch C.Data and patterns of transverse dentofacial structure of 6-to 15 year-old children:a Posteroanterior cephalometric study.Am J Orthod Dentofacial Orthop 1992;101:465-71.
- 8. Scott J H.The maxillary- mandibular planes angle (MM)bisector:A new reference plane for anteroposterior measurement of the dental bases.Am J Orthod Dentofacial Orthop 1994;105:583-91.
- Foley T F, Stirling D L, Scott J H.The reliability of three sagittal reference planes in the assessment of class II treatment.Am J Orthod Dentofacial Orthop 1997;112:320-9.
- 10. Brezniak N, Arad A, Heller M et al. Pathognomonic cephalometric characteristics of Angle classII Division 2 malocclusion. Angle orthod 2002;72:251-257.
- 11. Yang S D,Suhr C H. F-H to AB plane angle (FABA) for assessment of anteroposterior jaw relationships. Angle orthod 1995;65:3.
- 12. Rakosi An atlas and manual of cephalometric radiography. (Wolfe:London)1982.

- 13. Jacobson A, Caufield PW .Introduction to radiographic cephalometry (Lea and Febiger:Philadelphia)1985.
- 14. Yen P. Identification of landmarks in cephalometric radiography. Angle Orthod 1960;30-35.
- 15. Neela P K, Mascarenhas R, Husain A.A new sagittal dysplasia indicator:t he yen angle. WJ 2009;10:147-151.
- Bhad W A, Nayak S, Doshi U H.A new approach of assessing sagittal dysplasia:the W angle.Eur J Orthod 2011;1-5.

#### Source of support: Nil

**Conflict of interest:** None declared

