SAGITTAL DISCREPANCY ASSESSMENT WITH DIFFERENT PARAMETERS IN MANDI GOBINDGARH POPULATION: A CEPHALOMETRIC STUDY

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Abstract

Aims: The aim of this study was to calculate mean value of ANB angle, Wits appraisal, beta angle, Yen angle, W angle and MKG angle for Mandi Gobindgarh population and also to find difference among these parameters.

Materials and methods: Total 80 cephalometric radiographs were taken from the department of Orthodontics & Dentofacial Orthopaedics. All radiographs were traced and values for each parameter were calculated. Statistical analysis was applied on data.

Results: Values of ANB angle, Wits appraisal, Beta angle, W angle, YEN angle, and MKG angle calculated for studied population were 4.4±2.02, 3.8±2.3, 28.5±4.8, 53.3±3.91, 120.5±5.09, and 56.6±6.69 respectively.

Conclusion: This study reported that the values of ANB angle and wits were towards class II malocclusion, but other parameters' value fall in class I value.

Keywords: Beta angle, dysplasia, YEN angle, Wits appraisal.

Introduction

The dentofacial abnormalities in orthodontics exist in Sagittal, Transverse and Vertical planes. Cephalometric techniques are routinely used for assessment of skeletal and dental discrepancies. Various cepahalometric parameters have appeared in literature as a diagnostic tool for treatment planning, as communication tool, for studying dentofacial growth and development and for evaluating treatment results. The basic purpose of cephalometric analysis is to characterize the features of individual and to establish a classification system.[1]

For orthodontic diagnosis and treatment planning of skeletal discrepancies, evaluation of anteroposterior jaw relationship has prime importance.[2]

Generally used parameters for anteroposterior dysplasia assessment are ANB angle and Wits appraisal. Various studies have been done which concluded that there are number of distorting factors. Various studies have raised question for stability of nasion.The validity of ANB angle is questionable due various factors such as jaw rotation, variable position of nasion, cranial base length, vertical distance of points A and B from the cranial base and rotation of patient's head side wards or upwards.[3-5] Wits appraisal, overcomes some of these limitations, but it is influenced by eruption of teeth, Curve of Spee, open bite and its identification is not so easy or reproducible. Due to shortcomings of theses parameters, new parameters were introduced such as beta angle, Yen angle, W angle and MKG angle.

Chong yolbaik Maira[6] introduced beta angle. It does not depend on cranial reference planes and dentition. Beta angle is traced by using three landmarks - point A, point B, and point C that is the apparent axis of the condyle. It is the angle formed between A-B line and point A perpendicular to C-B line. Beta angle still have some limitations. So Yen angle and W angle were introduced. Yen angle value is also affected by jaw rotation due to growth or treatment. W angle is independent of jaw rotation, but its value depends on point S (midpoint of Sella). It was observed in various studies that

Sella point is also unstable landmark. So the more stable point is needed for determining anteroposterior dysplasia accurately. Thus, the MKG angle was introduced. The aim of present study was to calculate mean value for ANB angle, Wits appraisal, Beta angle, Yen angle, W angle and MKG angle in Mandi Gobindgarh population and find co relation among these parameters.

Materials and Methods

80 pre-treatment cephalograms were taken from Department of Orthodontics and Dentofacial Orthopedics, based on following criteria:

- Patients who have not undergone orthodontic treatment
- Age Group- 17 years to 28 years
- No Mixed Dentition
- Patient not having any dentofacial anomaly
- Cephalograms with high magnification without any artifacts

Sample size was calculated using statistical analysis based on pilot study.

ANB Angle (Fig. 1 A)

To construct ANB angle, points A, B, and N (Nasion) were located. Then angle is measured between the N–A line and the N–B line at point N. Value of ANB angle for different classes is as follows:

- Class I – 1° to 4° Angle
- Class II – Angle > 4°
- Class III – Angle < 1

Wits appraisal (Fig.1 A)

Wits appraisal is a linear distance between point A and point B projected perpendicularly on the functional occlusal plane. Value of Wits appraisal for different malocclusions is as follows:

- Class I - Female: 0mm Male: -1mm
- Class II - BO was positioned well behind point AO (positive reading)
- Class III - BO is ahead of point AO (negative reading).

Beta angle (Fig. 1 B)

Three points, point A, point B and point C (center of condyle) were located. Three lines were drawn that were C-B line, line connecting point A and point B, and perpendicular from point A to C-B line . Beta angle was measured between perpendicular line and A-B line. Standard values for Beta angle are:

- Class I – 270 to 350 angle.
- Class II- beta angle < 270
- Class III – Beta angle > 340

W Angle (Fig.2 A)

This angle was measured by locating three points: Point S, Point M, Point G. Angle between the perpendicular line from Point M to S-G line and the M-G line is measured.

- Class I – 51° to 56° Angle
- Class II – Angle < 51°
- Class III – Angle > 56°

Yen Angle (Fig.2B)

Points used for measuring Yen angle are: 1. Point S 2. Point M 3. Point G. The angle between lines SM and MG was measured. Value of Yen angle for different classes is as follows:

- Class I – 117° to 123° Angle
- Class II – Angle <117°
- Class III – Angle >123°

MKG angle (fig.3)

For measuring this angle, three points are taken which are: point KR (lowest point on outline of KR), point M (midpoint of premaxilla), point G (center of largest circle which is tangent to internal, inferior, anterior and posterior surfaces of mandibular symphysis). Angle is measured between lines drawn from point M to point KR and second line is from point KR to point G.

- Class I – 51° to 59° Angle
- Class II – Angle >59°
- Class III – Angle <51°

Anatomic landmarks were traced on a tracing paper and values of all parameters were recorded (Fig. 4).

These measurements obtained were used to check for significant variance using one way ANOVA analysis and Newman-Keuls Test for Co-Relation of ANB angle, WITS Appraisal and Beta Angle with W angle, YEN Angle and MKG Angle.
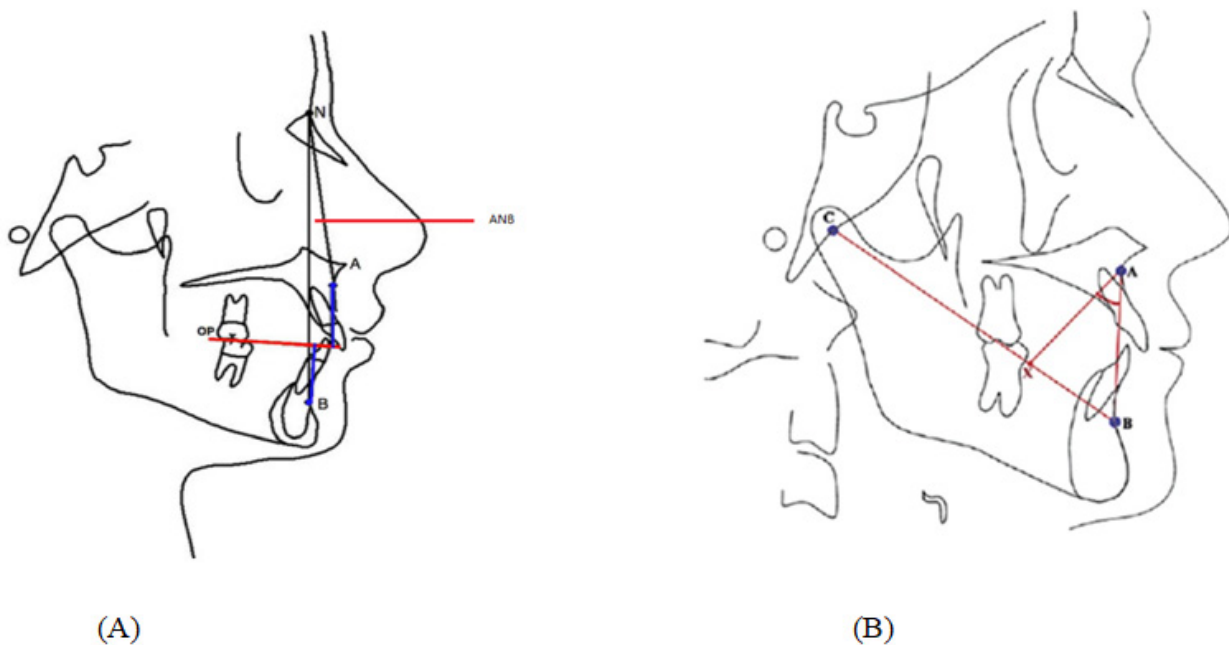

(A)   (B)

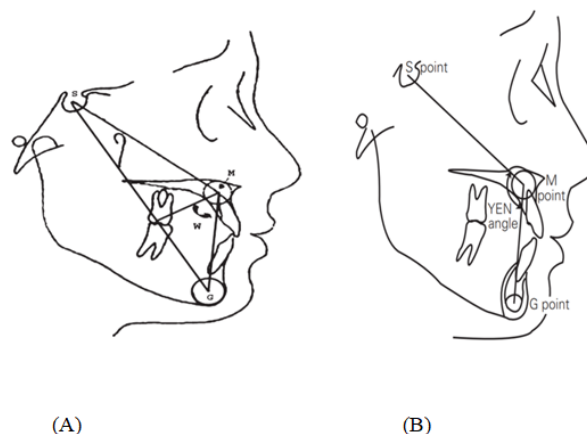*Figure 1: (A) Landmarks for ANB angle and Wits appraisal. (B) Landmarks for Beta angle*

(A)   (B)

Figure 2: (A) Landmarks for W angle. (B) Landmarks for YEN angle.
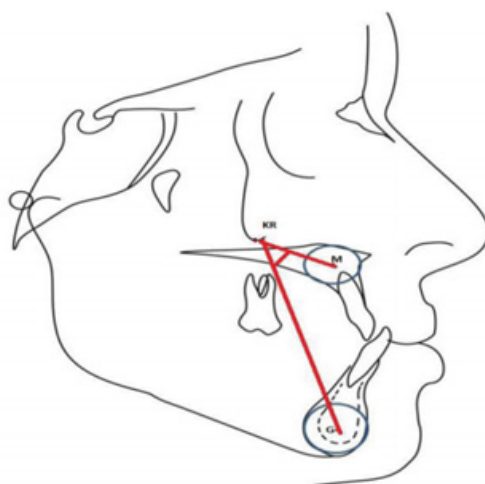
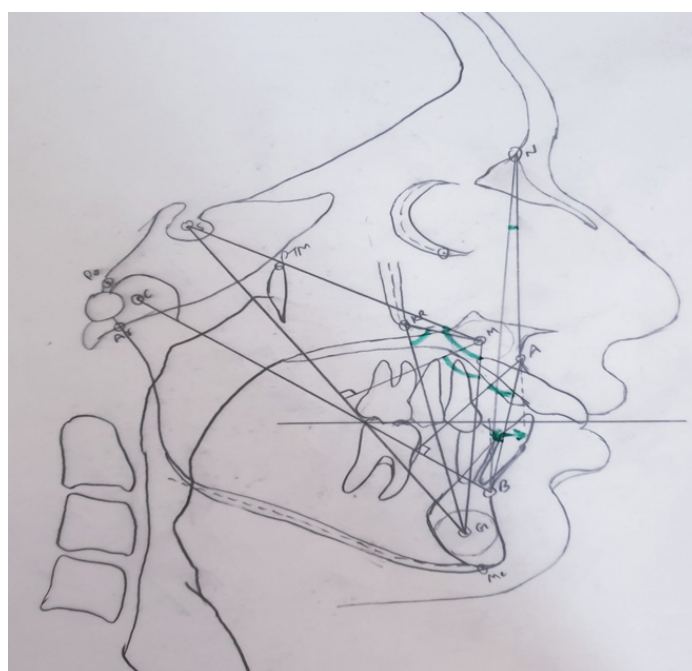*Figure 3: Landmarks for MKG angle.*

Figure 4: All the angles traced on tracing paper for measurements.

Results

Following tracing and evaluating all the angles and measurements, results were obtained.
Obtained values are used for one way ANOVA and NEWMAN KEULS test

| Parameter	Mean Value
ANB angle	4.4±2.02
Wits Appraisal	3.8±2.3
Beta Angle	28.5±4.8
W angle	53.3±3.91
YEN angle	120.5±5.09
MKG angle	56.6±6.69
Table No. 1: The mean value of studied parameters in given population.	
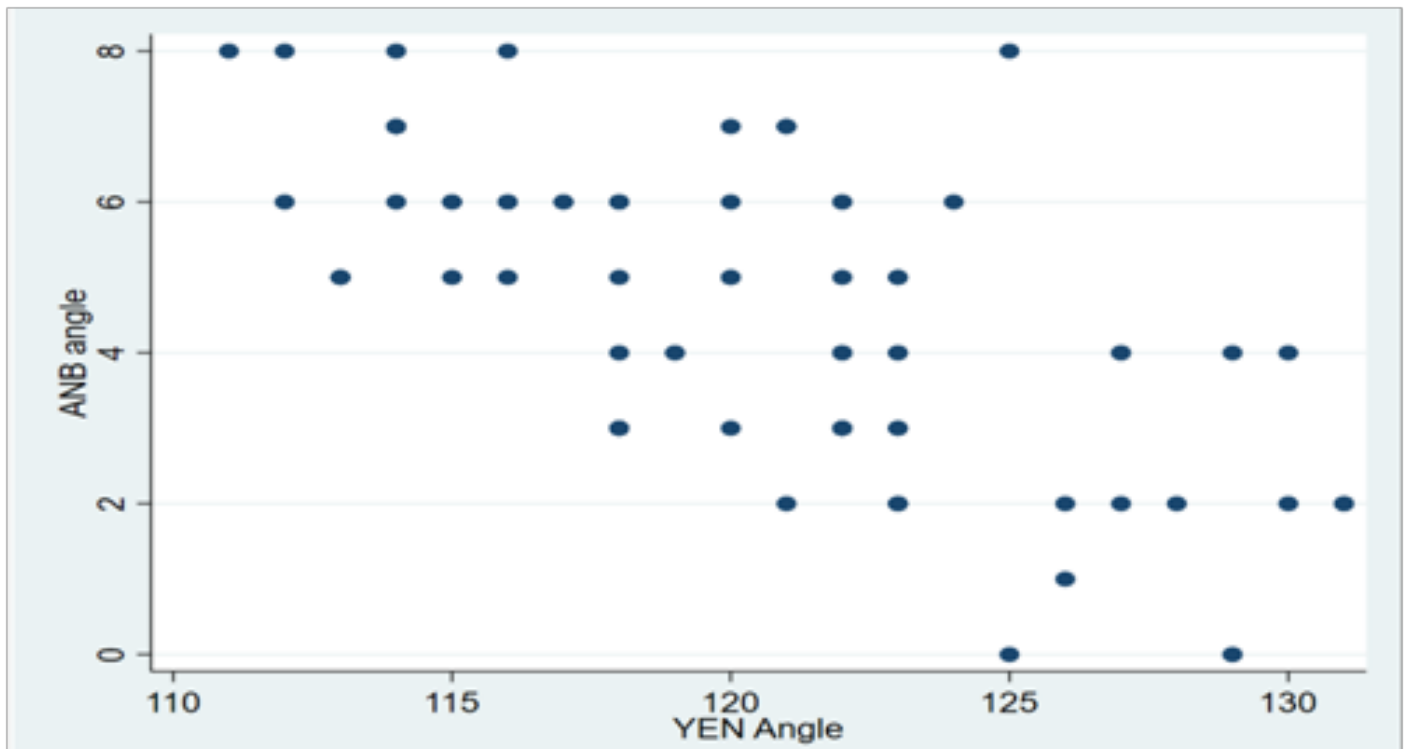
Graph No.1: On running oneway ANOVA using ANB angle and Yen angle there was a statistical difference of the means (F (20,59)= 4.50, p value <0.001) followed by insignificant post hoc test Newman- Keuls test
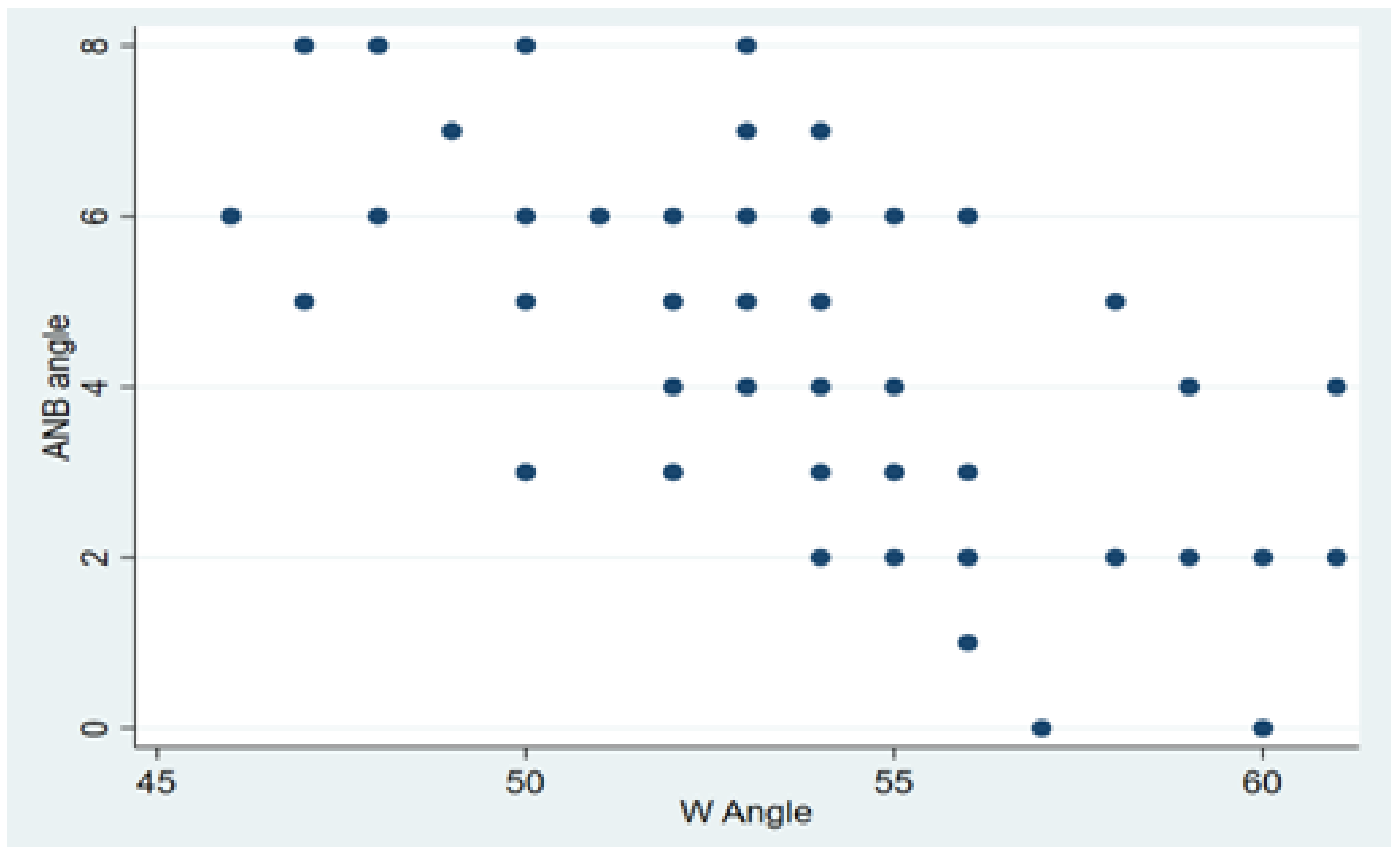

Graph No.2: On running oneway ANOVA using ANB angle and W angle there was a statistical difference of the means (F (15,64)=6.04, p value <0.001) followed by insignificant post hoc test Newman- Keuls test
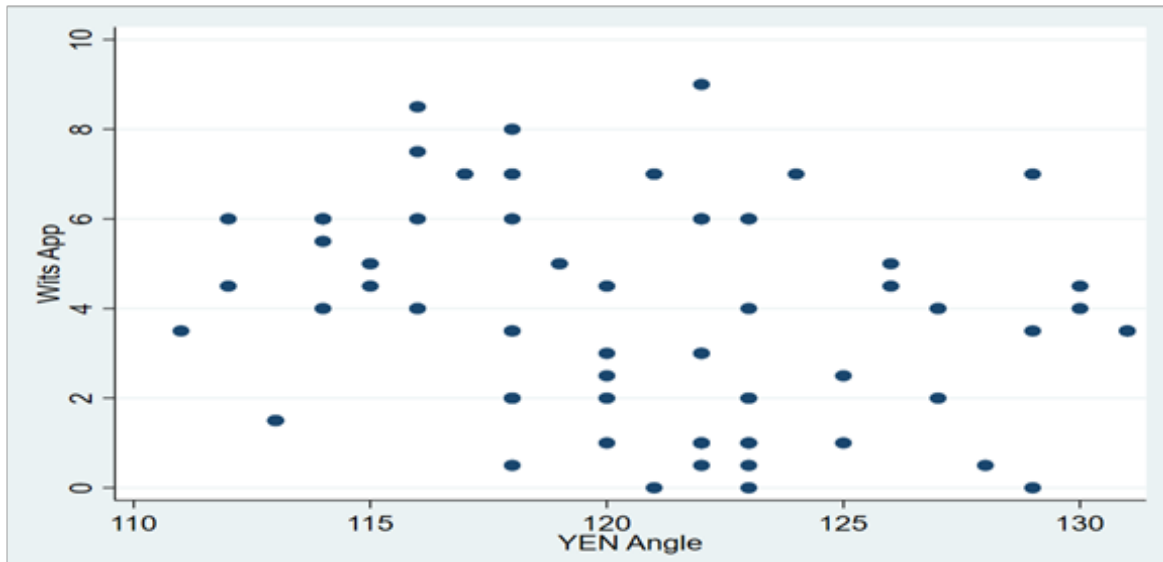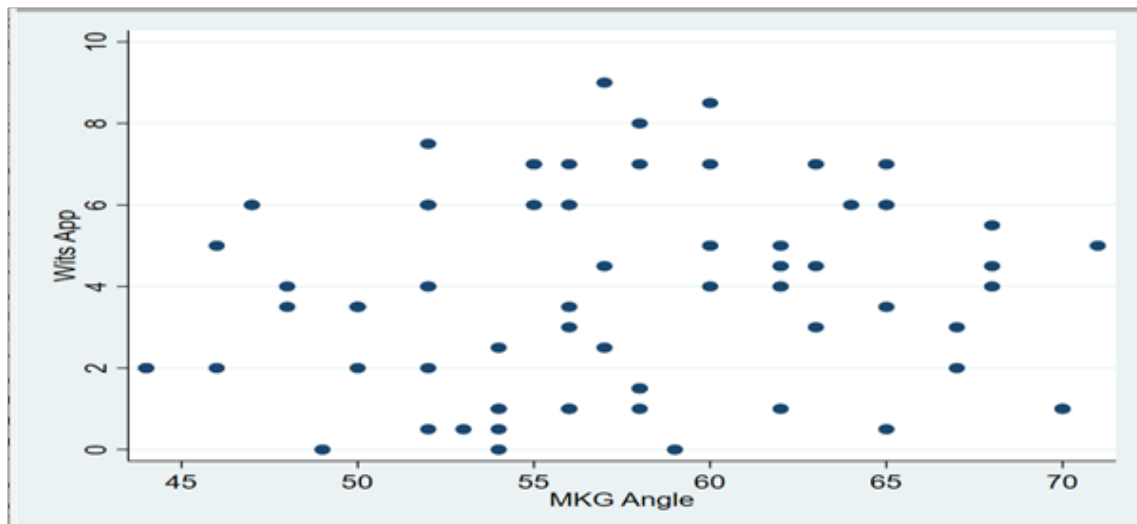
Graph No.3: On running oneway ANOVA using ANB angle and MKG angle there was a statistical difference (F(22,57)= 2.72 , p value= 0.0013) followed by a post hoc Newman- keuls test which gave an insignificant result
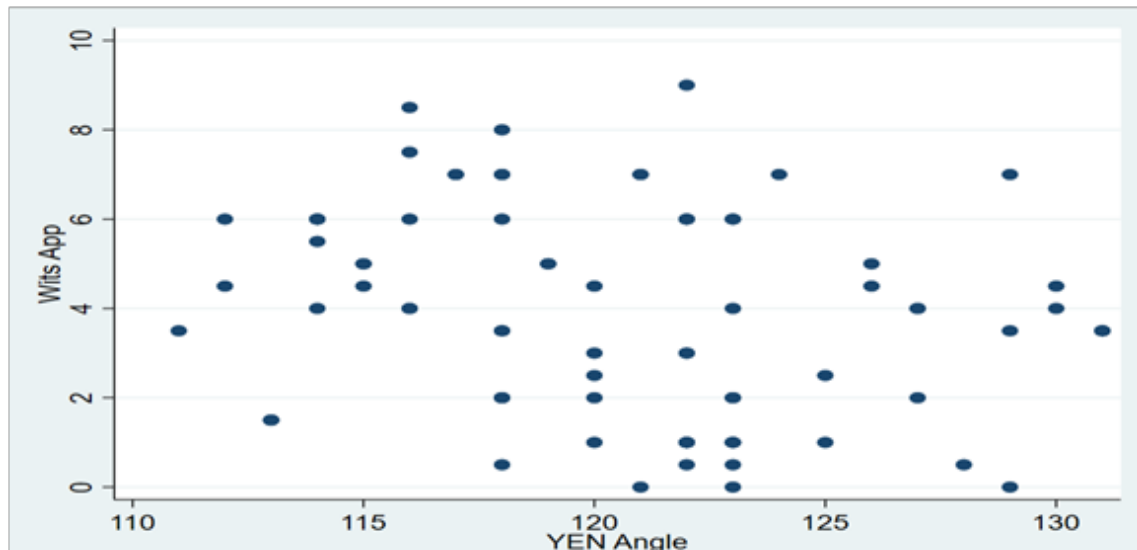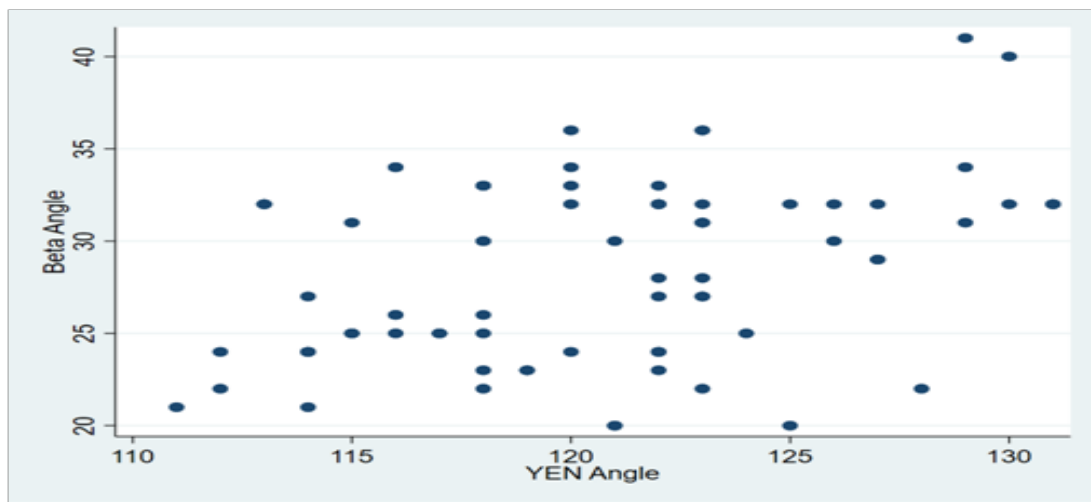

Graph No.4: On running oneway ANOVA between Wits and Yen angle there was a insignificant difference of means (F (20,59)= 1.65, p value=0.07)
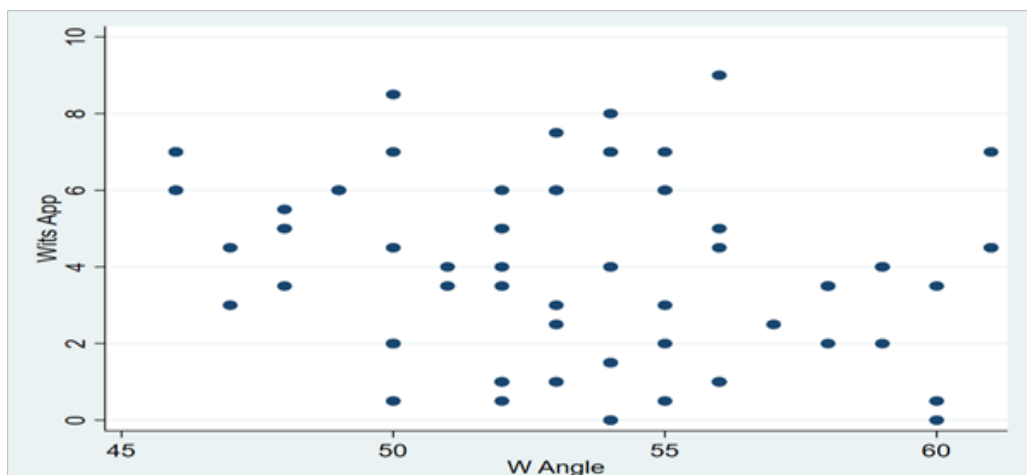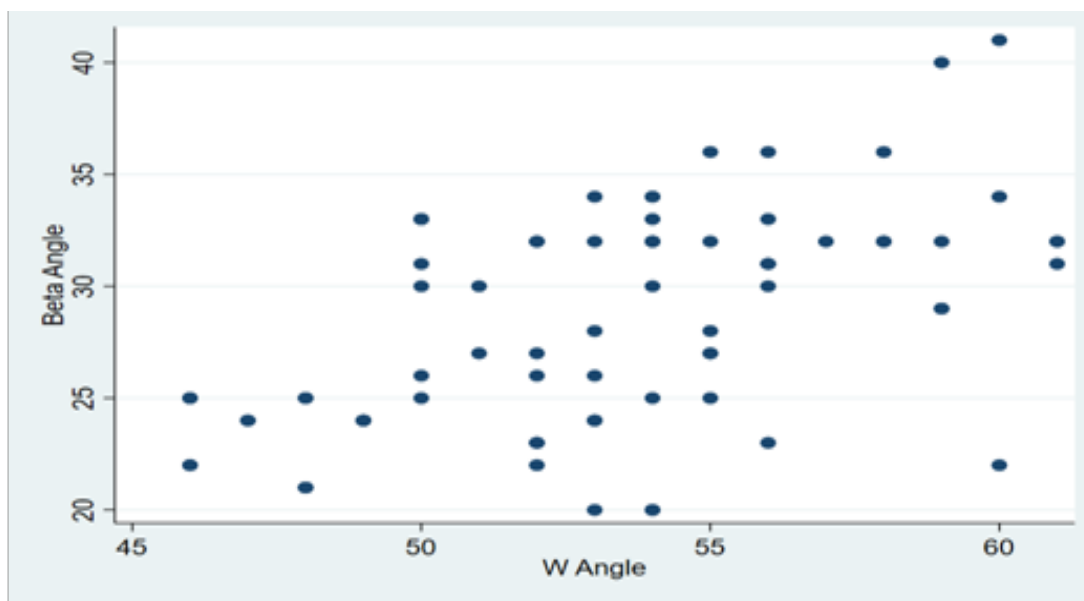

Graph No.5: On running oneway ANOVA between Wits and W angle there was a insignificant difference of means (F (15,64)= 1.13, p value=0.35)

Graph No. 6: On running oneway ANOVA between Wits and MKG angle there was a significant difference of means ($F_{(22,57)}$= 2.26, p value=0.007) and after getting an insignificant post hoc Newman-Keul test.

Graph No. 7: On running oneway ANOVA between Beta angle and Yen angle there was a significant difference of means ($F_{(20,59)}$= 16.62, p value= <0.001) and an insignificant post hoc Newman Keul test

Graph No.8: On running oneway ANOVA between Beta angle and W angle there was a significant difference of means ($F_{(15,64)}$= 2.68, p value=0.032) and an insignificant post hoc Newman Keul test
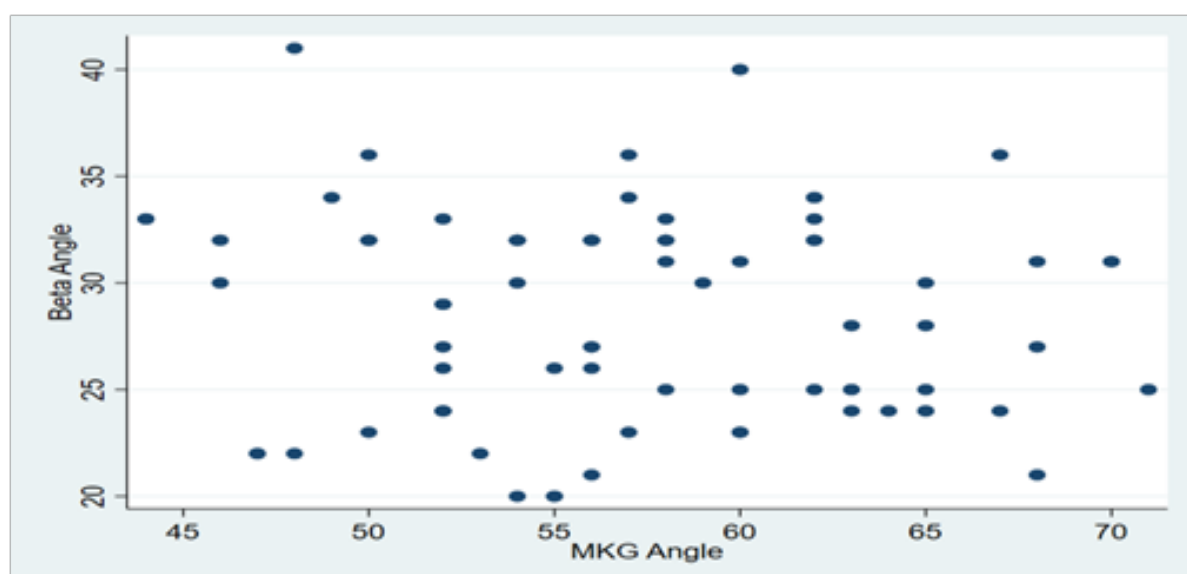
Graph No.9: On running oneway ANOVA between Beta angle and MKG angle there was an insignificant difference of means (F (22,57)= 1.50, p value= 1.117)

Discussion

ANB angle is still widely used to assess sagittal discrepancy. Jacobsson noted that this angle is affected by age of patient, vertical growth pattern of patient and anterior cranial base length. Wits appraisal was considered to overcome some shortcomings of ANB angle. Occlusal plane is used for calculating its value, so change in cant of occlusal plane will result in different Wits value. The identification of points is also difficult, especially in mixed dentition stage after shedding of primary molars. Present study reported that studied population showed the values of ANB angle and Wits were towards class II malocclusion, but other parameters' value fall in class I value.

After that beta angle was introduced to eliminate above mentioned limitations of ANB angle and Wits appraisal. Beta angle also depends on point A and point B. According to Holdaway, these points show changes in their location due to growth and treatment. Center of condyle is also used to measure this angle, which is difficult to locate. On running oneway ANOVA between Beta angle and W angle there was a significant difference of means (p value=0.032) and insignificant post hoc Newman Keul test. Similar results were found for beta angle and YEN angle. No significant difference was reported between beta angle and MKG angle (Graph no.7,8,9). Kapadia RM et al[7] reported significant correlation between Yen angle, W angle, ANB angle, Wits appraisal and Beta angle. Similar results were observed by Mittal et al[8], Doshi et al[9] and Trivedi et al.[10] Another study reported significant positive correlation of Beta angle with Yen angle and W angle and negative correlation with ANB angle.[11] Katti et al found that Yen angle and Beta angle are positively correlated with each other. Yen angle is a better class II sagittal dysplasia indicator than Beta angle and it was homogenously distributed as compared to Beta angle.[12]

Neela et al[13] in 2009, introduced Yen angle, which can be used easily in mixed dentition stage. Mean value of Yen angle in present study population is 120 degrees, showing prominence of class I skeletal malocclusion according to Yen angle.

As rotation of jaw caused by growth and treatment can mask true dysplasia when using this angle to assess the sagittal discrepancy. ANB angle has been shown to be affected by vertical facial growth as well as by jaw rotations. To avoid this problem another new parameter was developed, the W angle. This angle measurement is not based on unstable landmarks or functional occlusal plane. Points used for this angle are point S, point M and point G. The geometry of the W angle remains stable even when jaws are rotated or growing vertically. It is measured between a perpendicular line from point M to line joining point S and point G and M-G line. W angle value between 51 to 56 degrees represent class I skeletal pattern, for class II, its value is less than 51 degrees and value greater than 56 degrees indicates class III skeletal pattern. Present study observed calculated value of W angle in Mandi Gobindgarh population that was 53.3 degrees. It indicates most common skeletal pattern in this population is class I according to W angle.

ANOVA test showed significant difference (p value

<0.001) between ANB angle when compared with Yen angle and W angle, but a post hoc Newman- keuls test which gave an insignificant result. ANOVA test gave no significant difference between Wits appraisal, Yen angle and W angle. (Graph no.1,2, 4 and 5). Mittal et al found strong correlation of Yen angle and W angle with Wits appraisal but better correlation of Yen angle with ANB angle was seen.[8] Kapadia RM et al[7] reported high correlation of Yen angle and W angle with ANB angle whereas these angles showed least correlation with Wits appraisal. Sachdeva[14] reported insignificant difference in values of ANB angle and Wits appraisal among skeletal class I, II and III, however these classes were significantly different in values of Beta angle, W angle and Yen angle. Surendra Maharjan, Che Lili[15] observed significant differences in ANB angle, Yen angle and W angle. They also found strong correlation between Yen angle and W angle. Soni G[16] et al reported correlation among Yen angle, ANB angle, W angle and Wits appraisal and they also suggested that all these angles can be used for assessment of anteroposterior jaw discrepancy. These results were similar to study done by Alam et al[17]. Yen angle and W angle showed high correlation with ANB angle ((r- -808,-622) and least correlation with Wits appraisal ((r- -652, -497).This happened because common reference point 'S' is used for measuring ANB angle, Yen angle and W angle.

Due to limitations of above parameters, a new angle was introduced that is MKG angle. Points G and M are not influenced by bone remodeling caused due to dental movements[18]. Bein[19] stated the KR point is constant point in relation to cranium bones throughout the life of an individual. Value of this angle ranging from 51 to 59 degrees indicates class I skeletal pattern. Value more than 59 degrees indicates class II and value less than 51 degrees denotes class III skeletal pattern of individual. In present study value observed is 56 degrees, denoting class I skeletal pattern of studied population. ANOVA test showed significant difference between ANB angle and MKG angle but a post hoc Newman- keuls test which gave an insignificant result. ANOVA test showed significant difference between Wits and MKG angle but a post hoc Newman-keuls test which gave an insignificant result (Graph no.3 and 6).

Conclusion

Values of ANB angle, Wits appraisal, Beta angle, W angle, YEN angle, and MKG angle calculated for studied population were 4.4±2.02, 3.8±2.3, 28.5±4.8, 53.3±3.91, 120.5±5.09, and 56.6±6.69 respectively.

ANOVA test showed significant difference when ANB angle was compared with Yen angle, W angle and MKG angle but post hoc Newman- keuls test gave insignificant results for these differences.

When Wits appraisal was compared with W angel and Yen angle, no difference was observed. But significant difference between Wits and MKG angle was seen. Post hoc Newman- keuls test gave insignificant results.

No significant difference was reported between beta angle, W angle, Yen angle and MKG angle.

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