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# DETERMINING THE SAGITTAL RELATIONSHIP BETWEEN THE MAXILLA AND THE MANDIBLE BY CANNONS ANALYSIS IN CHHATTISGARH POPULATION

Akhilesh Belchandan[A], Deepti Dwivedi[B], Vinay Dwivedi[C]

[A] - *Senior lecturer, Department of orthodontic, Maitri college of Dentistry & research centre Anjora Durg Chhattisgarh*

[B] - *Consultant, Department of Pedodontics, Oro Care Dental Clinic, Shahdol*

[C] - *Consultant, Department of Orthodontics, Oro Care Dental Clinic, Shahdol*

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**Corresponding Author**

**Dr Deepti Awasthi**
**C/o- Dr Vinay Dwivedi**
**Opposite Cental Academy School**
**Near Police Line, Shahdol (M.P.)**
**Mobile: 9179058510**

**Abstract:**

**Introduction:** In orthodontic diagnosis and treatment planning, great important has been attached to evaluating the sagittal apical base relationship. The study was aimed to determining the anterioposterior relationship of maxilla and mandible by using cannons analysis in Chhattisgarh population.

**Material and method:** All the 100 patient had class I occlusion, well skeletal balance, and orthognathic profile, in Chhattisgarh population were selected and their lateral cephalogramwere tracedwith 4 skeletal landmark- point N, point A, Point B, and Porion(po) for linear measurement that indicates the severity and types of skeletal dysplasia in anterioposteriordimension. The age of subjects ranged from (8-11, 12-18, 19 and over years).

**Results:** Difference between porion (po) to point A and porion (po) to point B was found to be 10mm and this value remained relatively constant through life. So this value considered to have normal class I skeletal pattern.

**Conclusion:** The cannons analysis is an effective way to establish the sagittal jaw relationship since it is not affected by the other landmark.

**Keywords:** Cannons analysiss, sagittal relationship, cephalometric analysis

## Introduction

Advent of cephalometric has greatly influenced science and practice of orthodontics. Cephalometric analysis is mostly uses for diagnosis and making better treatment planning for orthodontic treatment. The cephalogram were measure for height, length and proportions of the craniofacial and dentofacial structures. the understanding facial growth , racial variation of dentofacial structures and understanding the location severity and etiology of malocclusion has enabled better treatment option, helped to design appropriate interceptiveorthodontic / orthopaedic procedure and predict prognosis and evaluate treatment outcome and results.[1]

Since the introduction of lateral cephalometric radiography (LCR) by Broadbent in 1931, it has been widely used in orthodontic assessment and treatment planning. The evaluation of the anterio-posterior jaw relationship is an indispensable step, and it is generally determined by the lateral cephalometric analysis. There are numerous angular and

linear measurements to assess the sagittal discrepancy between maxilla and mandible, which is of prim important in diagnosis and treatment planning. After introduction of the cephalometry, various angular and linear measurements were studied and documented.[2]

In (1948)**Downs** was the first to introduce a method of recording the skeletal and denture pattern to measure facial form on a cephalograms. They evaluate the sagittal relationship between maxilla and mandible by measuring the angle formed by AB and N-Pog line. This analysis was not presented as the basis for a treatment goal rather it is a method for examining and quantifying the relationship of the skeletal component of the face.[3]

**Steiner** (1953) is proposed using SNA and SNB angle which described the anterioposterior position of maxilla and mandible. The reference plane here is the S-N plane which can be subjected to discrepancies due to the points constructing the plane. The sella and the nasion are both situated in the interiors of the skull and cannot be visualized clinically and therefore cannot be utilized as a tool for actual direct clinical communications.[4,5]

**Richard Riedel**(1952) came up with the ANB angle. This angle widely accepted as a principle method of evaluating sagittal relation of maxilla and mandible.steiner was more interested in the ANB angle because it described the relationship between maxilla and mandible. However further research would discover that there are limitation to using ANB angle. Jacobson pointed out mainly two factors that can affects the ANB angle. The first was anterior or posterior position of Nasion and other was the rotation of mandible.these two factors must be kept in mind and adjusted for as needed when using the ANB angle.[6]

Taylor in 1969 pointed out that ANB angle did not always indicate the sagittal relationship of maxilla and mandible. Varied horizontal discrepancies of point A and B could give the same ANB measurement because variation in the vertical distance from nasion could compensate for other variation. [7]

Jacobson (1975) suggested the Wits appraisal as way to determine jaw disharmony. Using functional occlusal plane and drawing perpendicular lines from point A and Point B to the functional occlusion plane. There is any discrepancy between those two vertical lines determine if there is disharmony. This analysis is accurate to determine skeletal discrepancy but it is unable to determine which jaw discrepant jaw. [8]

This analysis takes into consideration the occlusal plane to determine the anterioposteriror relationship of the jaws. This plane can vary with malpositioning teeth, beside this it is not a diagnostic aid and is only useful to understand the anteriorposterior jaw relationship when the angle ANB does not provide a very clear image. [5]

In 1974 Harvold developed a precursor of cannons analysis to describe the jaws discrepancy.he proposed radial measurement between center of the condyle (TM) to ANS for maxillary length and TM to prognathions for mandibular length measurement. he also compare the difference between those measurement and generated chart to determine the jaws discrepancy. In the cannons analysis using anatomic porion, nasion, point A and point B. anatomic porion is the superior point of the external auditory meatus.[9]

Anatomic Porion is the superior point of the temporal bone. In 2004 **Greiner** checked how to Porionchanges relative to sella. This study would indicate that Porion is relative stable point N the cranial base and not dependent on the growth of the displacement seen with mandibular growth.In the cannons analysis uses measurement on a comparison of value to determine the sagittal relationship of maxilla and mandible.The purposes of the study was determine norms of class I occlusion using Cannons analysis in Chhattisgarh population.

## Material and methods

The entire subjects were randomly selected for this study. Initially 150 subjects were selected from Chhattisgarh population. The entire subject was clinically examined for dental status. Those who had class I occlusion, orthognathic profile and good skeletal balance were selected. steiner and wits analysis are used to determine the sagittal relationship of maxilla and mandible and examine potential causes for the differences among analysis. Finally 100 subjects were selected. Subjects were divided in three groups according to age and sex Table I.

**Table I – Sample Demographic**

| Age group | Number of subjects |
|---|---|
| 12-18 years | 45 |
| 19 and over | 30 |

| Sex | Numbers of subjects |
|---|---|
| Male | 49 subjects |
| Female | 51 subjects |

In the first phase of the study the cephalogram were traced and analysed. The cephalometric landmarks were located and planes were drawn for following linear measurement by tracing of the lateral cephalometric (Fig.1). The component of cannons analysis showed in the Table 2.

**TABLE 2**

| Component Of Cannons Analysis |
|---|
| Wits appraisal |
| ANB ($^0$) |
| Porion – Nasion (mm) |
| Porion – A Point (mm) |
| Porion – B Point (mm) |
| Po-B minus Po-A (mm) |
| Palatal plane – occlusal plane ($^0$) |
| Palatal plane – mandibular plane ($^0$) |

In second phase of study included an analysis of linear and angular measurement. To determine the linear distance from Porion to Point N, Porion to Point A, Porion to Point B, and difference between the PorionB and Porion A. and angulation between palatal plane to occlusal plane and palatal plane to mandibular plane were also measured.

## Results

The total sample composed of 100 subjects including 49 male and 51 female they were selected from Chhattisgarh population at Rajnandgaon city. Distribution of subject according to their age and sex shows Table 1.

Tables IIIshown normal value of all subjects where Wits Appraisal was -1.3mm (SD= 1.545), ANB angle was 2.5° (SD=1.473), Porion-Nasion (Po-N) was 93.8mm (SD=5.736) ,Porion-A Point (Po-A) was 94.7mm B (SD=6.164), Porion-B Point (Po-B) was 106.4 mm (SD=1.264 )(Anova test : statistical analysis )

Table III shown normal linear and angular values, according age group there is no significantly changes in Wits Appraisal and ANB values with age increases but there was some changes seen in length of cranium, maxilla and mandibular length with age.

**TABLE III**

| Age | | Wits | ANB | PO-N | PO-A | PO-B | POB-POA | PP-OP | PP-MP |
|---|---|---|---|---|---|---|---|---|---|
| 8-11 | Mean | -1.23mm | 3 | 92.2 | 93.28 | 103.3 | 10.1 | 13.5 | 25.3 |
| | N | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| | Stdev. | 1.202 | 1.720 | 5.640 | 6.354 | 6.816 | 1.214 | 4.243 | 1.453 |
| 12-18 | Mean | -1.52 | 2 | 95.4 | 96.2 | 106.4 | 10.2 | 11.5 | 25.8 |
| | N | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 |
| | Stdev. | 2.019 | 1.593 | 6.353 | 6.143 | 6.295 | 1.267 | 3.34 | 1.177 |
| 19 over | Mean | -1.4 | 2.7 | 98.7 | 100.1 | 111 | 11.2 | 9.33 | 25.2 |
| | N | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 |
| | Stdev. | 1.6765 | 1.435 | 5.352 | 6.984 | 7.947 | 1.432 | 3.84 | 1.424 |
| Total | Mean | -1.3 | 2.5 | 93.8 | 94.7 | 106.4 | 10.1 | 9.92 | 25.5 |
| | N | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | Stdev. | 1.545 | 1.473 | 5.736 | 6.296 | 6.164 | 1.264 | 2.546 | 1.463 |

## Discussion

The purposes of the study was determine norms of class I occlusion using Cannons analysis in Chhattisgarh population. According to our study the mean value of wits appraisal was -1.3mm (sd= 1.45) for all Chhattisgarh subjects. The mean value increased with age, and the mean value slightly less negative in female than male. According to Jacobsen normal wits appraisal value is -1mm which is the same with the mean value obtained in our study. **Glen S. Davis** found wits appraisal mean value was -1.412mm.

According to Richard Reidlethe mean value of ANB angle was $2^0$. In our study the mean value for ANB angle was $2.5^0$ (sd=1.473). The mean value was relatively constant with increasing age but female displayed a slightly more ANB angle. Glen S. Davis found same result as our study. The new parameter of cannons analysis was used for established average cannons value in Chhattisgarh population.

Porion- Nasion (Po-N): 93.8mm (sd=5.736)
Porion –A (Po-A): 94.7mm (sd= 6.269)
Porion-B (Po-B): 106.4 (sd= 6.164)

The mean valueof PO-N, PO-A, PO-B were change to growth, and therefore when diagnosing a case, but differences between maxillary and mandibular length were relatively constant throughout life. When differences between maxillary and mandibular length evaluated, mean value is 10.1(sd=1.264). according to 8-11 year of age the mean value of (PO-A)-(PO-B) is 10.1mm while 12-18 years of age had a mean of 10.2 and 19 over age the mean value is 11.2.

The new parameter of cannons analysis for well related maxilla and mandible is:

PO-N= 93.8
PO-A= 94.7mm
PO-B= 106.4mm
PO-B minus PO-A= 10.1mm

This case is an 10 year old female her chief complaint was proclination of upper front teeth. She had class II molar relationship on both side and excessive over jet. She had clinically normal maxilla and retrognathic mandible.Figure 1 and 2 Showingpretreatement photographs. Table IV is showing cephalometric parameters.

**Fig 1. Pretreatment Extraoral photograph**

**fig 2. pretreatment intraoral photograph**

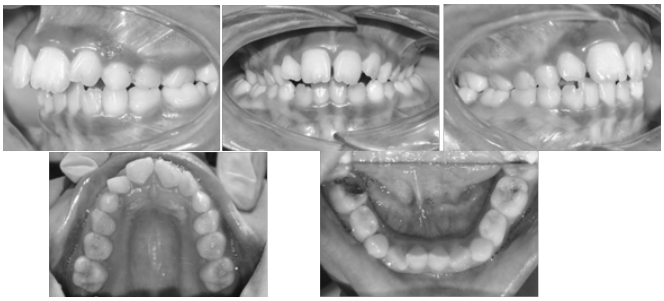

**fig 3. Pretreatment panoramic x-ray and lateral cephalometric x- ray**

**Table IV Cephalometric Measurement**

| | |
|---|---|
| Wits appraisal | 5 |
| ANB(0) | 7 |
| PO-(mm) | 98 |
| PO-Am(m) | 97 |
| PO-B(mm) | 102 |
| POB-POA | 8 |
| PP-OP(0) | 9 |
| PP-MP(0) | 27 |

Now use cannons analysis orderly to evaluate skeletal discrepancy. First step is to evaluate the differences between PO-B and PO-A, the difference is 8mm. according to Chhattisgarh population mean value is 10. In this case 8mm difference indicate jaw discrepancy either maxillary

or mandibular jaw.

Next step is determine jaws discrepancy by compare the values of PO-N to PO-A. According to Chhattisgarh population mean value is 93.8 mm and 94.7 mm simultaneously. In this case measurement is 98mm and 97mm and the differenceis only 1 mm which indicate there is no problem in maxillary jaw but value of PO-B value is 102mm isshowing 4mm discrepancy which indicate the mandibular jaw discrepancy, means patient having class II skeletal pattern due to normal maxilla and retrognathic mandible.

ANB and wits appraisal analysis are included in cannons analysis. Bothanalysis are mainly used to determine the jaw discrepancy but both measurement give us false diagnosis in select cases. ANB angle is most widely used cephalometric analysis that attempt to establish the relationship between jaws but it relies on a well position Nasion and mandibular plane angle. If PO-b and PO-A difference is 10mm and wits appraisal is showing small this may be explained by either false occlusal plane or PP-OP value. If the occlusal plane is correct check the PP-OP value. it should $11^0$ but If it is increased a falsely low wits appraisal can generated.

## Conclusion

The cannons analysis is very effective for orthodontic diagnosis and treatment planning. Its variance between linear measurements helps us to determine the actual jaws discrepancy. Cannon analysis norms for Chhattisgarh population are:

PO-N= 93.8
PO-A= 94.7mm
PO-B= 106.4mm
PO-B minus PO-A= 10.1mm

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