CEPHALOMETRIC FLOATING NORMS FOR THE BET A ANGLE, MAXILLARY-MANDIBULAR PLANE ANGLE BISECTOR-WITS AND YEN-LINEAR AMONG THE CHENNAI POPULATION: A RETROSPECTIVE - IN-VITRO STUDY

Dr. Vineeth Kumar1, Dr. Dhivya Dilipkumar MDS2, Dr. Deepak. C MDS, PhD3,
Dr. Akshay Tandon MDS4,

1 PG Student, 2 Associate Professor, 3 Professor and Head, 4 Senior lecturer

Department of Orthodontics, SRM Dental college, Kattankulathur, SRM Institute of science and technology SRM Nagar, Kattankulathur, Kanchipuram Chennai, TN, India
1vineeth.kumar93@gmail.com, 2dhiv2000@yahoo.com, 3deepakc@srmist.edu.in, 4aks226mpl@gmail.com

ABSTRACT:

Aim: The aim of the study was to provide floating norms for the Beta angle, MMBP-Wits and YEN-Linear in adult Chennai population that can help in proper diagnosis and treatment planning of different cases.

Materials and methodology: Lateral cephalometric radiographs of 100 subjects (50 males and 50 females; mean age, 18-25 years) were taken from the record room of the college (Department of Orthodontics and Dentofacial Orthopedics, SRM Kattankulathur Dental College and Hospital). The lateral cephalograms were traced for the Beta angle, MMBP-Wits and YEN-Linear. Lateral cephalometric head film was obtained with the patient positioned in Natural Head Position, seated condyle and with passive lips. The cephalograms were further traced by the same operator; this comprised the cephalometric database for the study. The final results obtained were compared between Males and Females of the study to verify the acceptable standards of them.

Results: The outcomes of the current study presented there to be no statistically significant difference between gender in the YEN-Linear, Beta angle and MMBP-Wits for the Chennai population. Hence a common normative range applicable for both the genders was proposed.

Conclusion: "There was no Statistically Significant gender wise difference among the subjects of the Chennai population. Hence a common normative range applicable for both the genders can be proposed. Floating norms have been provided to individualize the reference values for The Beta angle, MMBP-Wits and YEN-Linear."

Keywords: Beta angle, Floating norms, MMBP-wits, YEN-Linear.

I. INTRODUCTION

Lateral cephalometric radiography was introduced by Holly Broadbent (USA) and Herbert Hofrath (Germany) in 1931. Since the introduction of lateral cephalometric radiography, it is considered as the ‘Gold’ standard tool in orthodontic diagnosis and the treatment planning. Transverse, sagittal and vertical are the three most commonly used planes of divergences in orthodontics. Among them, the sagittal discrepancies are most frequently encountered in day-to-day practice1.

ANB angle, introduced by Riedel was used to express the apical base relationship3. Jacobson in 1975 revealed that the ANB angle did not give a correct evaluation of the changes in the Skeletal relationship since the mandible’s growth rotation as well as antero-posterior location of the Nasion in relation to the points A and B could in turn result in alteration of the ANB angle.

Jacobson had introduced The Wits Appraisal with an intention to solve the issues associated with ANB angle4. Nevertheless, Wits Appraisal suffers limits associated with the identification and the cant of the occlusal plane.
since it relates point A and point B on this occlusal plane\textsuperscript{5}. To overcome these limitations, newer measurements had been regularly that include Beta angle\textsuperscript{7}, MMBP-Wits\textsuperscript{8} and YEN-Linear\textsuperscript{9}.

Baik and Ververidou in 2004 introduced the Beta angle\textsuperscript{7} that made use of 3 Skeletal Landmarks namely: “Point A”, “Point B”, and “Apparent Axis of Condyle C”. These landmarks had been primarily used to measure, in the Sagittal Dimension, the type and severity of the Skeletal Dysplasia.

The MMBP-Wits were defined as “the distance between the perpendicular projection of point A and point B (Ap and Bp, resp.) on the bisector of the palatal plane and mandibular plane”\textsuperscript{8}.

YEN-Linear, another unique measurement has been constructed using the landmarks such as “M” which is said to be the midpoint of the anterior maxilla, “G” being the centre at the bottom of the symphysis and lastly, a “perpendicular” starting from the points mentioned, onto the “functional occlusal plane” which was measured in millimeters\textsuperscript{9}.

Currently, no cephalometric norm of the MMBP-Wits and YEN-Linear is available for the population of the Chennai district. Thus, the purpose of the present study was to deliver “Cephalometric Floating norms” for MMBP-Wits, YEN-Linear as well as for the Beta Angle among the Chennai population and to assess if there was any statistically significant gender wise difference in order to provide a common normative range applicable for both the genders.

\section*{II. MATERIALS AND METHOD:}

This is a Retrospective study, conducted in The Department of Orthodontics and Dentofacial Orthopedics, SRM Kattankulathur Dental College and Hospital, Potheri, Chennai, Tamil Nadu. The inclusion criteria was: Age range: 18-25 years, Patient with Skeletal Class I with an ANB angle of 1 to 3 degrees, Patient with Class I Molar Relationship having less than \(\frac{1}{2}\) cusp displacement as well as Class I canine relationships having less than \(\frac{1}{4}\) cusp displacement, Normal Overjet and Normal Overbite. The exclusion criteria were: Severe irregularities of the incisors, No missing teeth, any craniofacial anomaly.

The materials used in the study were: 100 pre-treatment Class I lateral cephalograms (50 males and 50 females), X-ray viewer, Matt acetate cephalometric tracing sheets, 3H pencil. The lateral cephalograms used in the study were taken from the department record room which consisted of the pre-treatment x-rays of the patients that were exposed with jaws held in Centric relation, Lips placed in a Relaxed position, and the Head which was held in The Natural Head Position (NHP). The Lateral Cephalograms were taken with X-Mind Pano D+ X-ray machine (Figure 1). All the radiographs were recorded with the equivalent exposure parameters by the same machine. (Figure 2)
Digital Panoramic and Cephalometric X-ray Unit

The radiographs tracings were done, and the Beta angle, MMBP-Wits and YEN-Linear were measured in order to find the Sagittal Dysplasia. The Beta angle was formed between the A-B line and the last perpendicular line (Figure 3). MMBP-Wits was performed by measuring the Distance between the perpendicular projections of Point A and Point B (Ap and Bp, resp.) on the bisector of the Palatal Plane and Mandibular Plane (Figure 4). The Yen-Linear was formed by the perpendicular lines drawn on the Functional Occlusal Plane from both the points and were named as GO and MO. The distance between the points GO and MO was also measured (Figure 5).

Figure 3- Line from the Point A is drawn perpendicular to the C-B line

Figure 4- MMBP-Wits

Figure 5- Yen-Linear

III. STATISTICAL ANALYSIS

The data obtained were documented in an excel spread sheet and the analysis had been performed with the S.P.S.S (Statistical Package for Social Sciences) 23.0 software. The Mean and Standard Deviation were calculated from the collected Data. The confidence interval had been set at 95% and the p-value had been set for 0.05. Any value equal found to be equal to or less than that was considered to be significant.

IV. DISCUSSION:

Lateral cephalometric radiographs have been a useful diagnostic tool in regular orthodontic practice and were introduced by Broadbent in 1931 

Cephalometric studies/analyses tend to make use of linear as well as angular variables that had been proposed in order to analyse the jaw position and also the sagittal jaw relationship.
They have obvious shortcomings due to factors such as unstable landmarks chosen as reference planes or due to environmental factors affecting the growth of jaws. Similarly, alterations in the jaw inclination, total jaw prognathism and also changes in the facial height would affect the angular variables, while the inclination of the reference line would affect the linear variables.

A variety of analyses have been introduced in literature, for instance, the ANB angle, W angle, YEN angle, Wits appraisal, Beta angle and Pi analysis in order to identify a consistent index of sagittal jaw relationship. On the other hand, these indexes were based on anatomical landmarks and geometric relationships. These angles have been said to be influenced chiefly by different “Morphological Localization” of these landmarks and also by “Facial Divergence”.

The ANB angle, introduced by Riedel was used to express the “dental apical base relationship” and is the angle that is formed in-between the planes that cross the points Nasion-A and Nasion-B. Although very popular and useful, it was frequently affected by a variety of factors and was often misleading.

The Wits Appraisal as introduced by Jacobson was done to overcome the problems related to the ANB angle. He had put forth the fact that the vertical and antero-posterior position of the nasion as well as the rotational changes of the jaw tend to affect the consistency of ANB angle and therefore the utilization of Wits Appraisal had been recommended. In contrary to the other parameters, this analysis was neither associated with the Nasion point nor the Skull base.

To overcome these limitations, newer measurements have been regularly devised and compared with one another. The newly found measurements include Beta angle, MMBP-Wits and YEN-Linear.

It has been documented that various ethnic groups are said to represent significant variations in soft tissues as well as Craniofacial Morphology. This validates the necessity to conduct more research and formulate norms for population which have unique facial morphology. Currently, no cephalometric norm of the MMBP-Wits and YEN-Linear is available for the population of the Chennai district.

In the present study 100 pre-treatment lateral cephalograms (50 males & 50 females) of patients with Class I malocclusion were taken from the department record room. All the x-rays of the patients were exposed with jaws held in “centric relation”, “lips placed in a relaxed position” and “the head which was held in the Natural Head Position (NHP)”. The Cephalograms were taken with X-Mind Pano D+ X -ray machine. All the radiographs were recorded with the same exposure parameters by the same machine. The radiographic tracings were done, after which the MMBP-Wits, YEN-Linear and Beta angle had been measured in order to find the Sagittal Dysplasia.

On measuring the Beta angle by using three skeletal landmarks, the landmarks being: “Point A”, “Point B”, and “Apparent Axis of Condyle C”, those present between the values of 27° and 35° were considered to have a Class I skeletal pattern. Those having values less than 27° (acute beta) were considered to have a Class II Skeletal pattern, and those having values more than 34° (obtuse beta) were considered to have a Class III Skeletal pattern.

MMBP-Wits was calculated by measuring the distance between the perpendicular projections of the two points namely point A and B (Ap and Bp, resp.) that were present on the bisector of the Palatal Plane and Mandibular Plane.

It is easier to define than the Functional Occlusal Plane or the Bisecting Occlusal Plane as it more accurate with less variation. The Mean Values were found to be -4 mm for the children’s group.

The YEN-Linear used the following Landmarks - M which is said to be the midpoint of Anterior Maxilla, “G” being the centre at the bottom of the symphysis and lastly, a perpendicular starting from the points mentioned, onto the functional occlusal plane (measured in millimeters). The normal values were Class I: -1 - 2.5 millimeter; Class II: >2.5 millimeter and Class III: < -1 millimeter.

Statistical Test used was Independent Sample ‘t’ test. The p value for Beta Angle, MMBP-Wits and YEN-Linear are 0.937, 0.939 and 0.929 respectively. All the p values are greater than 0.05, which shows that the study is not significant. That is, there is no significant difference between the mean values of the variables based on gender (Table 1). There was no statistically significant gender-wise difference (Table 1).
Table – I: Comparison of normative range of different study parameters for males and females in the study population

<table>
<thead>
<tr>
<th>Variables</th>
<th>Sex</th>
<th>N</th>
<th>Mean</th>
<th>Std.Deviation</th>
<th>Normative Range (Mean±1.96 SE)</th>
<th>Independent Sample t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower Limit</td>
<td>Upper Limit</td>
</tr>
<tr>
<td>BetaAngle</td>
<td>Male</td>
<td>50</td>
<td>31.1</td>
<td>2.98</td>
<td>24</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>50</td>
<td>31.06</td>
<td>1.91</td>
<td>28</td>
<td>37</td>
</tr>
<tr>
<td>MMBP-Wits</td>
<td>Male</td>
<td>50</td>
<td>-2.34</td>
<td>3.54</td>
<td>-9</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>50</td>
<td>-2.4</td>
<td>4.22</td>
<td>-9</td>
<td>4</td>
</tr>
<tr>
<td>YEN-Linear</td>
<td>Male</td>
<td>50</td>
<td>1.42</td>
<td>1.23</td>
<td>-1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>50</td>
<td>1.44</td>
<td>0.99</td>
<td>-1</td>
<td>3</td>
</tr>
</tbody>
</table>

Hence a common normative range applicable for both the genders can be proposed (Table II).

Table – II Common normative range applicable for both the gender

<table>
<thead>
<tr>
<th>Variables</th>
<th>N</th>
<th>Mean</th>
<th>Std.Deviation</th>
<th>Normative Range(Mean±1.96 SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower Limit</td>
</tr>
<tr>
<td>BetaAngle</td>
<td>100</td>
<td>31.08</td>
<td>2.49</td>
<td>24</td>
</tr>
<tr>
<td>MMBP</td>
<td>100</td>
<td>-2.37</td>
<td>3.88</td>
<td>-9</td>
</tr>
<tr>
<td>YENLinear</td>
<td>100</td>
<td>1.43</td>
<td>1.11</td>
<td>-1</td>
</tr>
</tbody>
</table>

The outcomes of the current study presented there to be no statistically significant difference between gender in the YEN-Linear, Beta angle and MMBP-Wits for the Chennai population. Hence a common normative range applicable for both the genders was proposed. The obtained mean value of Beta angle were 31.08° ± 2.49, with maximum number of subjects within a range of 28° – 33° (68%). The mean value of MMBP-Wits was -2.37mm ± 3.88 with maximum number of subjects within a range of 0 mm – 5 mm (35%). The mean value of YEN-Linear was 1.43mm ± 1.11, with maximum number of subjects within a range of 2mm (38%) (Chart I, II, III). Any value obtained outside this interval would be suggestive of either skeletal Class II malocclusion or skeletal Class III malocclusion.

CHART I
If any value thus obtained is said to belong to the interval that was provided by the mean value as well as standard deviation then the subject could be diagnosed to have a normal sagittal jaw relationship, which means a Skeletal Class I malocclusion. Any value obtained outside such an interval was suggestive of having either a skeletal Class II malocclusion or skeletal Class III Malocclusion.

V. CONCLUSION:
Within the confines of the study thus performed, we can arrive at the conclusion that, there was no statistically significant gender wise difference among the subjects of the Chennai population. Hence a common normative range applicable for both the genders can be proposed. Floating norms have been provided to individualize the reference values for The Betaangle, MMBP-Wits and YEN-Linear

REFERENCES