Assessment of Anteroposterior apical jaw base relationship using Mount Vernon Index (MVI)

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Abstract
Objectives: To check the predictability and variability of Mount Vernon Index (MVI) with other four sagittal discrepancy parameter and to examine and discuss the correlation existing between. Methods: Lateral Cephalograms of 100 Class I Indian subjects with the age range of 17-24 years were obtained. Cephalograms were traced using sharp 3H pencil on lead acetate paper for four different AP parameters like ANB, Wits appraisal, Facial convexity and Beta angle. For all Cephalograms, Mount Vernon Index was calculated. Results: The measurements with most homogenous distribution in group was BETA angle (C.V=5.63) followed by MVI (C.V.=13.6), ANB, Rickett’s analysis and Wit’s analysis. Among all five analyses, statistically significant highest positive correlation was found between Mount Vernon Index and BETA angle. Other angles like, Rickett’s facial convexity angle and ANB angle showed significant positive correlation with Mount Vernon Index. Conclusions: MVI is a quick and reliable method for evaluation of a patient’s AP skeletal patterns. It can be one of the useful diagnostic tools to identify the skeletal pattern of an individual.

Key words: Class I malocclusion; A-P relationship; Mount Vernon Index

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Introduction

Till now, various methods of assessing the sagittal jaw base relationship have been formulated. Earlier, the skeletal pattern used to be analyzed clinically by an overall profile view of the patient and by palpation of the anterior surfaces of the basal part of the jaws with the teeth in occlusion. However, after the introduction of the cephalometrics, better and more accurate method of recording, measuring and quantifying skeletal morphology became possible. To determine the sagittal jaw base relationship various angular and linear parameters were studied and documented.

This article describes a simple cephalometrics analysis; Mount Vernon Index (MVI) that provides a quick assessment of the AP (Anterio-Posterior) skeletal pattern (1). In this article, Mount Vernon Index was compared with four accepted methods of cephalometrics analysis to determine the reliability of this technique (2-5).

Material and Methods

The study was carried out using Lateral cephalograms of 100 Indian subjects with the age range of 17-24 years. This work has been approved by the ethical committee related to the institution in which it was performed and all the subjects gave informed consent to the work. Clinical examination of 100 subjects was performed to select the subjects having Class I dentoalveolar malocclusion with acceptable profile.

Lateral cephalometric radiographs for each patient were taken in natural head posture. The wire plumb line and suspended weight recorded the true vertical on each radiograph, the subject was then asked to determine the self-balanced position of the head, and asked to look into his/her own eyes in the mirror. While holding the teeth in centric occlusion, a lateral Cephalogram was taken in the standard manner (6).

Figure 1: Mount Vernon Index: perpendicular distance in mm (d) between B point and line from nasion through A point.

Figure 2: Steiner analysis to determine ANB angle, Ricketts analysis used to determine facial convexity.
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Tracing was made by hand using a sharp 3H pencil on acetate tracing paper in a dark room using X-ray viewer. For each radiograph, the Mount Vernon Index was determined by measuring the distance (d) between B point and a line extending from nasion through A point (1). (figure 1) The AP skeletal pattern was also evaluated by using four accepted cephalometric methods, like, ANB angle, Facial convexity, Wits appraisal and Beta angle (2-5). (fig 2-4)

Figure 3: Wits Appraisal

The data was statistically analyzed using the Statistical Package for Social Sciences (SPSS) 10.0 software. Statistical methods that were employed in the present investigations were,
- To determine the reliability and reproducibility associated with radiographic measurements, 20 radiographs were selected at random from the observational group. Their tracing and measurements were repeated and compared with first measurements by using Independent ‘t’ test.
- Mean, Standard Deviation, Variance, Minimum and Maximum value and Range were calculated for each analysis.
- To find out any significant differences for the measurements between male and female sample, Independent ‘t’ test was applied.
- Coefficients of variability and correlation tests were used to determine accuracy of Mount Vernon Index and correlation between the MVI and the other four methods of analysis.

Figure 4: Beta angle

Results

The statistical analysis to check the error between repeated measurements suggested no significant difference between them (p>0.05). Statistical data relating to measurements such as mean, standard deviation, standard error of mean and t test for males and females are presented in table 1. The results of the study suggest no statistical significant differences between the genders (P>0.05), so all the measurements belonging to both the sexes were pooled and a correlation analysis was performed among them.
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Table 1: Range of Measurements of Pooled Group (n=100) with coefficient of Variability and measurements in the study population with normal occlusion (n = 100)

<table>
<thead>
<tr>
<th></th>
<th>Male (n=60)</th>
<th>Female (n=40)</th>
<th>‘t’ value</th>
<th>p value</th>
<th>Pooled group (n=100)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Range</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>ANB</td>
<td>2.59</td>
<td>0.60</td>
<td>2.5</td>
<td>2.6</td>
<td>0.56</td>
</tr>
<tr>
<td>Rickett’s Analysis</td>
<td>1.20</td>
<td>1.14</td>
<td>5</td>
<td>1.37</td>
<td>1.11</td>
</tr>
<tr>
<td>BETA</td>
<td>30.87</td>
<td>1.72</td>
<td>7</td>
<td>31.28</td>
<td>1.78</td>
</tr>
<tr>
<td>MVI</td>
<td>4.35</td>
<td>0.59</td>
<td>5</td>
<td>4.30</td>
<td>0.58</td>
</tr>
<tr>
<td>WITS</td>
<td>0.73</td>
<td>0.79</td>
<td>3</td>
<td>0.6</td>
<td>0.83</td>
</tr>
</tbody>
</table>

Independent ‘t’ test

The Coefficient of Variability of all parameters is also represented in table 1. The measurements with most homogenous distribution in group was BETA angle (C.V=5.63) followed by MVI (C.V.=13.6), ANB, Rickett’s analysis and Wit’s analysis.

Table 2: Coefficient Correlation between measurements of Class I group

<table>
<thead>
<tr>
<th></th>
<th>ANB</th>
<th>Wits</th>
<th>Ricketts</th>
<th>MVI</th>
<th>Beta angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANB</td>
<td>r</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>p</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wits</td>
<td>r</td>
<td>-0.21</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>p</td>
<td></td>
<td></td>
<td>0.840</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ricketts</td>
<td>r</td>
<td>0.686</td>
<td>0.065</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>p</td>
<td></td>
<td>0.000</td>
<td>0.523</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MVI</td>
<td>r</td>
<td>0.698</td>
<td>0.029</td>
<td>0.696</td>
<td>1</td>
</tr>
<tr>
<td>p</td>
<td></td>
<td>0.000</td>
<td>0.776</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Beta angle</td>
<td>r</td>
<td>1</td>
<td>0.072</td>
<td>1</td>
<td>-0.244</td>
</tr>
<tr>
<td>p</td>
<td></td>
<td>0.006</td>
<td>0.478</td>
<td>0.014</td>
<td>0.000</td>
</tr>
</tbody>
</table>

r = Pearson correlation coefficient; p = Significance (2-tailed)

Table 2 depicts coefficient correlation among various parameters of the study population. Among all five analyses, significantly higher positive correlation was found between Mount Vernon Index and BETA angle. Other angles like, Rickett’s facial convexity angle and ANB angle showed significant positive correlation with Mount Vernon Index.

Discussion

From the orthodontic view point, a patient’s facial profile is best described by the relative A-P jaw relationship with respect to the cranial anatomy. An accurate measurement of A-P jaw relationships is critically important in orthodontic treatment planning. In cephalometrics, both angular and linear variables have been proposed to analyze sagittal jaw relationship. Angular measurements can be erroneous as a result of changes in facial height, jaw inclination, and total jaw prognathism; linear variables can be affected by the inclination of the reference line (5).

The most popular parameter for assessing the sagittal jaw relationship remains the ANB angle, which is based on a craniofacial reference plane. Many studies describe the factors that affect ANB angle and it will make this approach problematic (7-15). Severity of a skeletal discrepancy depends on the relationship of the jaws to each other rather than on their relationship to cranial or extracranial landmarks. So, at least, two methods of analysis may be needed to support the orthodontist’s clinical findings. When comparing the coefficient of variability of all five analyses, BETA angle is highly reliable and more homogeneously distributed parameter followed by Mount Vernon Index. Beta angle showed highest positive correlation with the Mount Vernon Index, which means, if value of the beta angle increases, Mount Vernon Index will also increase or vice versa. Other parameters like Rickett’s facial convexity angle and ANB angle showed 2nd highest correlation with Mount Vernon Index which is in agreement with the orthodontist’s clinical findings.
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with an earlier study (1). Wit’s appraisal showed no statistical significant correlation with the other parameters analyzed in this study. This is however in contrast to the finding of the previous study (1). Wit’s appraisal also showed highest level of variability than other parameters of this study indicating that it is the least reliable parameter; this is in agreement with the previous studies (7-15).

Conclusions

BETA angle is highly reliable and more homogenously distributed angular parameter and Mount Vernon Index is the second most reliable parameter used to assess antero posterior sagittal discrepancy. Although the Mount Vernon Index will not replace more complex evaluation systems, it can be a useful clinical diagnostic tool.

References