Evaluation of Distances between the Mandibular Teeth and the Alveolar Process in Himachali Population with Normal Occlusion

Vikrant Bhandari, Anil Singla, Vivek Mahajan, Harupinder Singh Jaj, Vishal Seth

ABSTRACT

Introduction: The aim of this study was to evaluate the distances between the mandibular permanent teeth and the alveolar process in Himachali population with normal occlusion.

Materials and methods: Fifty mandibular casts from untreated subjects of Himachal population were selected who had permanent dentition. A computer program was used to calculate the distances between the dental reference points and the alveolar process for each tooth. The mean values were then compared to the normal values by applying the Student t-test at a significance level of 0.05.

Results: The results showed a progressive increase of these distances from the anterior region (incisors) to the posterior region (molars), from 0.00 to 2.46 mm.

Conclusion: Himachali population with normal occlusion have more lingual crown positions for the incisors, premolars and molars compared with Americans with normal occlusion.

Keywords: WALA ridge, FA point, Glass beads.


INTRODUCTION

The form of the mandibular dental arch is considered one of the main references during treatment, as it is an important factor for the stability of orthodontic treatment. Andrews and Andrews described an anatomic ridge on the mandibular alveolar process that delimited the soft tissue band immediately superior to the mucogingival junction. This structure was called the WALA ridge, so that the teeth must be aligned according to the appropriate distance between the dental crowns (FA point) and WALA ridge. Thus, preservation of the form and dimensions of the dental arches must be one of the first object of orthodontic treatment.

MATERIALS AND METHODS

Fifty mandibular dental casts of Himachal population with age group from 13 to 21 years. were selected with teeth in occlusion except for third molars as the following inclusion criteria:
1. All the patients had the permanent dentition.
2. All the patients had the natural occlusion.
3. All the patients had no previous history of orthodontic treatment.

According to the method used by Trivino et al a red glass bead was glued to the buccal aspect of each tooth, simulating the FA point at the center of the clinical crowns of the incisors, canines, and premolars and at the buccal groove of the molars (Fig. 1). Then, a black glass bead was glued and positioned on the anatomic line of the WALA ridge (Will Andrews and Larry Andrews), adjacent to the FA point.

After bonding the glass beads, the dental casts were digitized on a scanner (Scanjet 6100C, Hewlett-Packard, Palo Alto, Calif), and images with 300-dpi resolution in TIFF (Tagged Image File Format) format were obtained (Fig. 2). The correct position of the dental cast on the scanner was established with millimeter paper. The dental cast was placed in the rectangle’s center, so that the posterior edge of the models would be parallel to the horizontal lines and the middle dental line parallel to the vertical lines. The arch images of the 50 mandibular dental casts were divided into right and left sides, obtaining 100 semiarches that were projected on a flat computer screen with the software Image J (Java, Sun Microsystems, Palo Alto, California). With this software, the distances between the red and black glass beads could be calculated, indicating the linear measurements between the FA points and the WALA ridge, and establishing the horizontal
The relationship of the clinical crowns to the alveolar bone. This distance was measured from a point determined on the inner border of the red glass bead (the border nearest to the buccal aspect of the tooth) to a specific point of the black bead, which was the next glass bead border to the alveolar ridge for the first and second molars and the second premolar. For the first premolars, canines and incisors, the most external border of the black bead was selected. After obtaining these measurements for the first premolars, canines and incisors, 2 mm was subtracted from these values, since the measurements included the black glass bead image on these teeth.

RESULTS

The mean values of the distance between the FA point of the mandibular teeth and the WALA ridge progressively increased from the central incisor to the second permanent molar, from 0.00 to 2.46 mm respectively (Fig. 3).

No statistically significant difference was found between the mean values of our sample and Andrews’ values for the distance of first permanent molar (Table 1).

DISCUSSION

Discovering the nature of equilibrium of the natural dentition is of primary importance to orthodontists whose concern is achieving ideal and stable dental arches. Considering the relative stability observed in dental arch form, even during growth, the anatomic position of the dental arch stabilized between the tongue and the circumoral musculature, and the experiences encountered in moving teeth and stabilizing them following such movement, all strongly supporting the concept that the teeth reside in equilibrium in the undisturbed state. After eruption, the crowns of the permanent teeth are subject

Table 1: Comparison of mean values of distance between the FA point of mandibular teeth and WALA ridge (mm) with Andrew’s values by the student t-test

<table>
<thead>
<tr>
<th>Tooth</th>
<th>Mean (n = 50)</th>
<th>SD</th>
<th>Andrews (n = 50)</th>
<th>Difference</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>2.46</td>
<td>±0.52</td>
<td>2.20</td>
<td>0.26</td>
<td>3.585</td>
<td>0.001*</td>
</tr>
<tr>
<td>6</td>
<td>2.04</td>
<td>±0.64</td>
<td>2.00</td>
<td>0.04</td>
<td>0.465</td>
<td>0.644 NS</td>
</tr>
<tr>
<td>5</td>
<td>1.53</td>
<td>±0.50</td>
<td>1.30</td>
<td>0.23</td>
<td>3.233</td>
<td>0.002*</td>
</tr>
<tr>
<td>4</td>
<td>1.17</td>
<td>±0.47</td>
<td>0.80</td>
<td>0.37</td>
<td>5.585</td>
<td>0.000*</td>
</tr>
<tr>
<td>3</td>
<td>0.95</td>
<td>±0.43</td>
<td>0.60</td>
<td>0.35</td>
<td>5.831</td>
<td>0.000*</td>
</tr>
<tr>
<td>2</td>
<td>0.19</td>
<td>±0.29</td>
<td>0.30</td>
<td>0.11</td>
<td>−2.430</td>
<td>0.019*</td>
</tr>
<tr>
<td>1</td>
<td>0.00</td>
<td>±0.00</td>
<td>0.10</td>
<td>0.10</td>
<td>0.000</td>
<td>0.000*</td>
</tr>
</tbody>
</table>

NS: Statistically nonsignificant, *Statistically significant
to alterations as a result of ‘environmental’ forces. These forces may tip the teeth around their centers of rotation. Even though most patients with a malocclusion have an altered dental arch form, the alterations achieved with mechanics during orthodontic treatment should not affect the balance between bone, dental and muscular structures. The arrangement of these structures adjacent to teeth and jaws should be considered the limit for orthodontic movement.\(^4,5\) Hypothetically, when this occurs, the centers of rotation of the mandibular teeth, which remain in the center of the basal bone, do not alter, however, the crowns and root apex may be altered.\(^3\)

According to some authors,\(^8-15\) the dental arch can be described by diagrams constructed from patients. Measurements or diagrams that describe mean curves are determined by mathematical equations. Other studies have shown wide variations in dental arch shapes between subjects; this caused author to search for universal landmarks that might establish an individualized shape for each patient.\(^16-19\)

Andrews and Andrews\(^2\) suggested the use of an anatomic reference, such as a parameter with the object of centralizing the roots of teeth in the basal bone, which they denominated via the WALA ridge (named after Will Andrews and Larry Andrews). The WALA ridge is the strip of soft tissue immediately above the mucogingival junction of the mandible, at the level of the line that passes through the centers of rotation of the teeth or close to it, and is exclusive to the mandible. Therefore, the center line of rotation (hypothetical line that passes through the horizontal center of rotation of each tooth) would be the line that best conserves the original and ideal form of the dental arch. Thus, the ideal form of the maxillary and mandibular dental arches would be dictated by the form of the basal bone of the mandible. When the form of the mandibular dental arch is correct, the wire that unites the bracket slots of ‘straightwire’ brackets should have the same shape as that of the WALA ridge.\(^3\) The mandibular alveolar process is selected because its shape would be minimally effected by faciolingual tipping of the teeth, this would happen because of the shape of the underlying basal bone.\(^3\) By taking it as a base of the study, i.e. relation between teeth and the WALA ridge, standard distances were established between FA points and the WALA ridge which would influence the treatment plan.

In this study, dental casts with normal occlusion of Himachali patient were taken and distance between FA point and WALA ridge were calculated. The mean values of the distance between FA point and WALA ridge were 0.00 mm for central incisors, 0.19 mm for lateral incisors, 0.95 mm for canines, 1.17 mm for first premolar, 1.53 mm for second premolar, 2.04 mm for first molar and 2.46 mm for second molar. A gradual increase was observed from anterior to posterior region. So it was concluded that the mandibular teeth were more lingually placed in Himachali population as compared to study conducted by Andrews and Andrews\(^2\) on Caucasians except for central and lateral incisors (Table 1). No statistically significant difference was observed at first molars after applying the Student t-test to compare our numbers to the values of Andrews and Andrews.\(^2\) The results of our study are in concordance with the study conducted by Tarcila Trivino, Danilo Furquim\(^3\) in Brazilian with normal occlusion.

Ronay et al\(^20\) conducted a study which shows the distal to the mandibular canines, the average distance between FA and WALA points describing the same tooth changes buccolingually. In this posterior area, the FA points are more lingually located than the WALA points. They also reported only positive values between FA and WALA points and projected that the points at the mucogingival junction were always more buccally positioned than the most prominent part of the tooth crown.

The results of our study disagree with the results of study conducted by Kanashiro and Vigorio\(^21\) who found lower mean values for the central incisors (−0.38 mm), lateral incisors (−0.12 mm) and canines (0.24 mm), and higher mean values for first premolars (1.49 mm), second premolars (2.67 mm), first molars (3.00 mm) and second molars (3.51 mm), indicating more lingually placed posterior teeth as compared to Himachali population.

The discrepancy between the mean values of the FA points and the WALA ridge distances in this study and the results of other authors can be attributed to the different methodologies and the differences in their samples. In our study, we chose to bond glass beads because of the difficulty in visualizing the distances between the FA points and the WALA ridge in the mandibular incisor region. Evaluation of the method error showed no systematic and casual error, demonstrating the accuracy of this methodology.\(^3\)

On the contrary, this study suggests that all basal and dental arches should be individually derived. Furthermore, the basal arch, represented by WALA points, can be used as a clinical guide in fabricating individualized archwire templates.\(^20\)

CONCLUSION

It was concluded from our study that Himachali population with normal occlusion, there are standardized distances between the FA points and the WALA ridge, decreasing from the posterior to the anterior regions of the dental arch, indicating a progressively lingual position of the mandibular teeth.

REFERENCES

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The Journal of Indian Orthodontic Society, October-December 2012;46(4):300-303