THE EFFECT OF MANDIBULAR TONGUE CRIBS ON DENTOSKELETAL CHANGES IN PATIENTS WITH CLASS II DIVISION 1 MALOCCLUSION

Aim: To investigate the effect of a modified tongue crib appliance in Class II Division 1 patients with anterior tongue thrust and mandibular deficiency. Methods: Twenty-three patients (14 females, 9 males) with a mean age of 10.09 ± 1.02 years, a moderate Class II Division 1 occlusion due to a mandibular deficiency, and a mean overbite of –1.1 ± 0.8 mm were treated with a mandibular tongue crib device. Pre- and posttreatment lateral cephalograms were obtained and traced, and various angular and linear variables were measured. These measurements were compared using the paired t-test. Results: The statistical assessment indicated that SNB, facial angle, B-VL, Pog-VL, and interincisal angle increased significantly. IMPA, 1-SN, ANB, and Wits appraisal were significantly decreased (P < .05). The changes of Jarabak Index, SN-MP, SNA, and Y-axis were not significant. In addition, the overjet was reduced. Conclusion: During the mixed dentition phase, a tongue crib appliance in the mandible is helpful to impede tongue thrust and stimulate mandibular growth. World J Orthod 2010;11:23–26.

Key words: Class II Division 1, anterior open bite, tongue thrust, mandibular tongue crib, functional appliance

Anterior open bites are among the most problematic malocclusions to treat. It has been reported that tongue thrust swallowing is an adaptation of an anterior open bite to achieve an anterior seal.1,2 A Class II Division 1 relationship is one of the most prevalent disorders in antero-posterior dimension and found in 12% to 49% of all patients.3,4 Tongue thrust frequently accompanies these two malocclusions.2,5 One treatment modality for tongue thrust is the insertion of a tongue crib,6,7 which is usually applied to the maxillary arch.7,8 It has been shown that this appliance could have some protrusive effect on the premaxilla, which would be beneficial in patients with a Class III occlusion9 and cleft lips and palates.10 In patients with a skeletal Class II relationship, however, such a protrusion would be unfavorable. On the other hand, it could be of great value if applied to a retrusive mandible. This study was carried out considering that mandibular deficiency is one of the most common characteristics of Class II Division 1 malocclusions,11 and redirection of mandibular growth is therefore an important objective of functional therapy.12,13 Specifically, the dentoskeletal effect of a mandibular removable tongue crib in patients with a Class II Division 1 relationship due to a mandibular deficiency who, at the same time, a tongue thrust was to be evaluated.
PATIENTS AND METHODS

The sample consisted of 23 patients (14 females and 9 males) with a mean age of 10.09 ± 1.02 years. All patients were in the mixed-dentition period, had a Class II Division 1 malocclusion due to a mandibular deficiency, a tongue thrust, and an anterior open bite (mean overbite –1.1 mm ± 0.8 mm measured between the incisal edges of the most erupted maxillary and mandibular central incisors). The cephalometric findings of these patients were ANB > 4 degrees, SNB < 78 degrees, and MP-SN > 32 degrees.

Tooth alignment in the mandibular arch was acceptable, and none of the patients had any teeth extracted or any form of orthodontic therapy. All were treated with a mandibular removable tongue crib in which the spurs were positioned immediately behind the mandibular incisors and neither touched the teeth nor disturbed the occlusion (Fig 1). Patients were advised to wear this appliance at least 18 hours per day and remove it only while eating or toothbrushing.

The minimum therapy duration was 14 months and 6 days. Pre- and posttreatment lateral cephalograms were traced on acetate sheets with a fine-tipped pencil. In all tracings, the following dental and skeletal parameters were measured: interincisal angle, IMPA, 1-SN, facial angle, ANB, SNB, SNA, distance of B and Pog from VL (a vertical line drawn through S perpendicular to a line at an angle of 7 degrees to SN), Y-axis, Jarabak Index, MP-SN, and Wits appraisal. The linear and angular measurements were obtained with an accuracy of 0.5 mm and 0.5 degrees, respectively. Two weeks later, the same operator remeasured all parameters. Because the correlation between the two sets of measurements was 0.88, the first measurements were considered. The data were analyzed by paired t test.

RESULTS

The pre- and posttreatment cephalometric tracing of a patient is shown in Fig 2. The statistical comparison of the pre- and posttreatment data are listed in Table 1. The SNB, facial angle, PtB-VL, and Pog-VL increased significantly. Conversely, there was no noticeable skeletal effect on the maxilla. The ANB and Wits appraisal decreased significantly (P < .05).

As for the vertical skeletal parameters, there was not a significant decrease in the MP-SN angle and the Y-axis and an increase in the Jarabak Index.

Regarding the dental parameters, the IMPA and 1-SN decreased, whereas the interincisal angle increased (P < .05).
DISCUSSION

Some controversy exists in the literature regarding whether tongue thrusting is the cause or result of an anterior open bite. However, most authors agree that tongue thrust is a secondary phenomenon of anterior open bite and that the affected patients place their tongue forward during deglutition to create an anterior seal.1,2,13–15 In any case, insertion of a tongue crib can prevent the forward positioning of the tongue and allows the anterior open bite to decrease.7, 8

Tongue cribs are usually part of maxillary appliances.7,8 The effect of this type of device is a protrusion of the premaxilla, thus increasing the overjet as was shown especially in early mixed dentition patients with Class III occlusions9 and cleft lip and palates.10 In Class II patients, such an effect would be unfavorable. Tongue cribs in the mandible can overcome this disadvantage as shown in the present study because they will not result in an increase in SNA.

Stahl et al16 studied longitudinal growth changes in untreated individuals with a Class II Division 1 occlusion based on cervical vertebral maturation stages (CS). They found that between CS1 (mean age 10.2 years) and CS3 (mean age 12.1 years), SNB showed a mean increase of 0.4 degrees and Pog-N perpendicular a mean decrease of 0.9 mm. In contrast, SNB and Pog-VL increased in this study 1.7 degrees and 2.5 mm, respectively. Subtracting the natural occurring growth during this time span from the results found here provides a hint about the therapeutic effect of the presented appliance.

The growth difference can be explained by the fact that the mandibular tongue crib forces the mandible into a forward position. Muscles such as the palatoglossus, styloglossus, chondroglossus, and hyoglossus have a protrusive force that can be transferred via the tongue tip to the tongue cribs to the mandible. It should be mentioned, however, that the increase in the abovementioned parameters was not clinically significant and that a mandibular tongue crib is not primarily a functional appliance.

In the vertical dimension, the appliance did not have any considerable effect. Dental changes observed were a decrease in IMPA and 1-SN. This can be explained by the fact that by omitting the tongue force with a tongue crib, the lips retracted the incisors. This decreased the open bite. Another explanation for the decrease of the open bite is that the suppressing effect of the tongue on incisor eruption was eliminated by the tongue crib.

The mandibular tongue crib improved the profile favorably as the maxillary incisors retruded, the upper lip moved back, and the lower lip was no longer trapped behind the maxillary incisors. Lip tension decreased positively because of the maxillary incisor retraction and mandibular protrusion.

Table 1 Values of various dentoskeletal parameters before and after treatment with a mandibular tongue crib appliance

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Pretreatment</th>
<th>Posttreatment</th>
<th>Difference</th>
<th>Paired t test (P)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNA (degrees)</td>
<td>79.5 ± 5.0</td>
<td>79.9 ± 4.8</td>
<td>0.4 ± 1.2</td>
<td>&lt; .2</td>
</tr>
<tr>
<td>SNB (degrees)</td>
<td>71.4 ± 2.1</td>
<td>73.0 ± 2.3</td>
<td>1.7 ± 0.9</td>
<td>&lt; .05</td>
</tr>
<tr>
<td>ANB (degrees)</td>
<td>7.3 ± 2.7</td>
<td>6.2 ± 2.8</td>
<td>−1.1 ± 1.3</td>
<td>&lt; .05</td>
</tr>
<tr>
<td>Wits (degrees)</td>
<td>3.9 ± 2.1</td>
<td>3.0 ± 2.0</td>
<td>−0.9 ± 1.0</td>
<td>&lt; .05</td>
</tr>
<tr>
<td>Y-axis (degrees)</td>
<td>74.2 ± 5.0</td>
<td>73.8 ± 6.1</td>
<td>−0.4 ± 1.9</td>
<td>.4</td>
</tr>
<tr>
<td>MP-SN (degrees)</td>
<td>37.8 ± 4.1</td>
<td>37.2 ± 5.0</td>
<td>−0.6 ± 3.4</td>
<td>&lt; .4</td>
</tr>
<tr>
<td>Jarabak Index (%)</td>
<td>58.0 ± 3.9</td>
<td>58.5 ± 4.2</td>
<td>0.5 ± 1.2</td>
<td>&lt; .1</td>
</tr>
<tr>
<td>B-VL (mm)</td>
<td>33.3 ± 2.7</td>
<td>33.0 ± 3.3</td>
<td>1.8 ± 1.9</td>
<td>&lt; .05</td>
</tr>
<tr>
<td>Pog-VL (mm)</td>
<td>27.2 ± 2.5</td>
<td>29.7 ± 2.4</td>
<td>2.5 ± 1.2</td>
<td>&lt; .05</td>
</tr>
<tr>
<td>Facial angle (degrees)</td>
<td>76.8 ± 3.2</td>
<td>79.3 ± 3.4</td>
<td>2.5 ± 3.4</td>
<td>&lt; .05</td>
</tr>
<tr>
<td>IMPA (degrees)</td>
<td>98.3 ± 5.8</td>
<td>96.5 ± 5.5</td>
<td>−1.8 ± 3.4</td>
<td>&lt; .05</td>
</tr>
<tr>
<td>1-SN (degrees)</td>
<td>102.2 ± 4.6</td>
<td>100.8 ± 5.0</td>
<td>−1.3 ± 1.9</td>
<td>&lt; .05</td>
</tr>
<tr>
<td>Interincisal (degrees)</td>
<td>121.8 ± 6.1</td>
<td>124.5 ± 6.0</td>
<td>2.8 ± 3.7</td>
<td>&lt; .05</td>
</tr>
</tbody>
</table>
CONCLUSION

In Class II Division 1 patients with a mandibular deficiency combined with an anterior open bite and tongue thrust, it can be recommended to use a tongue crib on a mandibular appliance. Thus, adverse effects on the maxilla (protrusion) can be avoided. In addition, the open bite is reduced and mandibular growth increased.

REFERENCES