REVIEW ARTICLE

EFFICIENCY IN CONTROLLING SAGITTAL SKELETAL ANCHORAGE OF II / I ANOMALY

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ABSTRACT

The aim of this research is to systematically analyze clinical trials involving the use of mini-implants in the sagittal control of II / I anomaly. Published articles were considered over a period of seven years, in the AJO-DO and “The Angle Orthodontist”. There were sought all articles which reported the use of mini-implants in the sagittal control for the treatment of II/I anomaly. By establishing a search strategy and a criterion for inclusion / exclusion, seven articles have been selected for this analysis. In two studies there have been made comparisons with functional mobile devices such as head-gear and in one study with fixed functional appliances; the results are far more rapid for functional fixed appliance, but more efficient for the mini-implant group and without undesired effects. Molar distalization was achieved on a distance between 2.9 to 6 mm with mini-implants, with a success rate of over 90%. The results obtained with mini-implants should be seen taking into consideration the quality of the studies that was mean and low, due to predominantly retrospective studies, and, in addition, it should be noted that the lot size is quite small, which shows the need for more qualitative studies and larger sets of subjects. The efficiency of skeletal anchorage in the sagittal control of anomaly II / I is superior to traditional means of anchorage. The methodology of the analyzed studies was poor and the results should be interpreted with caution.

KEYWORDS: mini-implant, II/I anomaly, distalization, “en masse” retraction, skeletal anchorage, sagittal control

In the past 10 years, mini-implants have become increasingly popular in our country, distalization using these devices being a viable alternative in Class II division 1 treatment [1,2]. They are also very often used for “en masse” retraction of the front teeth, taking advantage of the vertical effect of overjet reduction [3,4]. Our current research goal is to achieve a systematic analysis of prospective and retrospective clinical studies, involving mini-implants for skeletal anchorage to increase efficiency in the sagittal control of class II division I anomaly, so that, based on this retrospective analysis it would be possible to outline several points of discussion concerning treatment methods used for this anomaly [5,6,7].

In this study we have considered articles published over a period of seven years, since 2005, in AJO-DO and ”The Angle Orthodontist”. We have selected all the articles that have reported the use of mini-implants in the sagittal control of the class II
division 1 treatment. The selection criterion used in this research is described in Table I.

Based on the data gathered from the titles and the abstracts of the studies, the two authors independently have selected the articles that met the following criteria:
- studies conducted on human subjects published in English;
- studies clearly describing the technique used in the sagittal control of II / 1 anomaly;
- retrospective studies or prospective were included;
- studies with a sample of at least 10 subjects.

Exclusion criteria for articles in this study were the following:
- case reports;
- studies review;
- control studies concerning only transverse or vertical control;
- in vitro studies.

Searching for articles in AJO-DO had 314 results, while searching The Angle Orthodontist magazines gathered 257 results. Application criteria for inclusion / exclusion allowed the identification of seven relevant publications (Table II) for this study.

Table I. Search strategy

<table>
<thead>
<tr>
<th>No.</th>
<th>Keywords</th>
<th>Associated keywords</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Mini-implant</td>
<td>Mini (/micro/ortho) - implant + sagittal control</td>
</tr>
<tr>
<td>2.</td>
<td>Micro-implant</td>
<td>Mini (/micro/ortho) - implant +anomaly II/1</td>
</tr>
<tr>
<td>3.</td>
<td>Ortho-implant</td>
<td>Mini (/micro/ortho) - implant +distalization</td>
</tr>
<tr>
<td>4.</td>
<td>Skeletal anchorage</td>
<td>Skeletal anchorage + sagittal control</td>
</tr>
<tr>
<td>5.</td>
<td>Sagittal control</td>
<td>Skeletal anchorage+ anomaly II/1</td>
</tr>
<tr>
<td>6.</td>
<td>Anomaly II/1</td>
<td>Skeletal anchorage + distalization</td>
</tr>
<tr>
<td>7.</td>
<td>Distalization</td>
<td>Mini (/micro/ortho) - implant + retraction</td>
</tr>
</tbody>
</table>

Table II. Application criteria for inclusion / exclusion allowed the identification of seven relevant publications

<table>
<thead>
<tr>
<th>No.</th>
<th>Study</th>
<th>Type of study</th>
<th>Sample size</th>
<th>Place and size of TAD</th>
<th>Treatment mechanics</th>
<th>Studies results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kuroda [8] et al 2009</td>
<td>Retrospective compared to Head-gear</td>
<td>22</td>
<td>1,3/8 mm between PM2 and M1 vestibular</td>
<td>en masse retraction using coil-spring Ni-Ti</td>
<td>Incisors retracted 3mm more in the mini-implant group</td>
</tr>
<tr>
<td>2</td>
<td>Yao[9] et al 2008</td>
<td>Retrospective cephalometric, compared to HG</td>
<td>47</td>
<td>2/9-11 mm between PM2 and M1 vestibular</td>
<td>en masse retraction using coil-spring Ni-Ti and TPA</td>
<td>Retrudare more and less loss of mini-implants for anchorage, but in the incivilor hiperdivergenti tipping percentage is comparable to the two groups</td>
</tr>
<tr>
<td>3</td>
<td>Upadhyay [10] et al 2012</td>
<td>Prospective, compared to fixed functional appliance</td>
<td>34</td>
<td>1,3/8 mm between PM2 and M1 vestibular</td>
<td>en masse retraction using coil-spring Ni-Ti</td>
<td>Overjet treated more rapidly by fixed functional app, but with lower inc.flaring</td>
</tr>
<tr>
<td>4</td>
<td>Upadhyay [11] et</td>
<td>Prospective,</td>
<td>23</td>
<td>1,3/8 mm</td>
<td>en masse</td>
<td>Very good treatment for medium</td>
</tr>
</tbody>
</table>
In 5 of the 7 articles included in the study, the treatment mechanics was based on the use of NiTi coil springs [8,9,10,12] (in one survey they have used elastic strands) for the retraction of the front teeth, while for molar distalization both this method and a modified pendulum type were used. In only one study out of 7 there were auxiliary means used to maintain anchorage, such as the transpalatal arch.

Most studies included (5 out of 7) were retrospective, only two were prospective, very recent studies, the oldest being from 2005 and most recent from 2012. Two studies [8,9] have examined the compared results obtained with extraoral devices (head-gear), the results being very conclusive: the incisors were retracted with more than 3mm than the group with mini-implant and with less loss of anchorage for mini-implants, but for the hiperdivergent patients the percentage of inclined lower incisors was comparable in the two groups.

In all studies where retraction of the front group was desired, mini-implants were placed bilaterally labially between PM2 and M1; mini-implant dimensions were 1.3 mm in diameter in two studies (and 2mm in one), and a length of 8 mm for two studies (and 9-11 mm in the other). Also, in all cases requiring retraction of the front group, 126 cases, spiral springs were connected between the mini-implant and a crimpable (or welded) hook placed on the archwire.

In terms of molar distalization, it was done on a distance between 2.9 to 6 mm with mini-implants [13-15], with a success rate of over 90% in various ways of traction: elastic fixed jaw attached equipment, modified pendulum appliance type, or coil springs and elastic chains. The location and the size of the mini-implants vary for molar distalization: the infrazygomatic ridge [6], 2 mini-implants anterior in the palate of 2 / 11 mm and different sizes distal to the upper second molar.

The present study examined articles that have evaluated the effectiveness of skeletal anchorage in the sagittal control of II/1 anomaly. A systematic review of these articles was the most suitable method for the existent evidence[16,17]. Depending on the quality of the included studies, a systematic review can detect different levels of quality, from the highest, if clinical trials include random studies only, to the lowest, when using retrospective studies only. In this manner it is possible to summarize the well known information and to indicate the weak parts of the studies and emphasize field studies that require further investigation [18].

The present research included both random prospective studies and retrospective studies, the methodology of these investigations are of a
generally low and medium quality. Moreover, our results should be interpreted with caution, and conclusions drawn should be viewed in the light of subsequent more detailed investigations[19,20].

The study results suggest that mini-implants used as anchorage for achieving retraction of the front group or molar distalization reduce unwanted side effects on other teeth. Also, compared to other devices used for distalization (head-gear), the use of mini-implants proved to be 3–4 months faster [12-14], which was expected, given the increased time action of the forces for mini-implants. In both studies that investigated treatment with mini-implants, compared results obtained with head-gear[8,9] (a total of 69 subjects), there was a greater retraction distance of 3mm in favor of mini-implants.

In a comparative prospective study results obtained with fixed functional appliances, Upadhyay [10] et al 2012 found that it reduces the sagittal incoclusion faster, but it presents the disadvantage of flaring lower incisors too much, compared to the mini-implants group. In another prospective cephalometric study, Upadhyay [11] et al 2009 believes that the use of mini-implants in therapy of class II, division 1 anomaly is a viable alternative to surgery for the most severe malocclusions.

Molar distalization with mini-implants is performed with an average of 4 mm, obtained with a mean success rate of 95%, without side effects on the incisors, while Kiliaridis and Antonarakis[4] calculated in their study a distance of 2.9 mm for the classical ways of distalization, associated with unwanted mesial movement of 1.8 mm of the incisors. These results imply superior effects produced by mini-implants compared to conventional equipment used for distalization.

Apparently, these spectacular results obtained with mini-implants should also be considered through the quality of the studies, which was medium and low, and also the sample size should be taken into consideration, [6,10] quite low in some cases, which shows the need for better studies in terms of quality and larger groups of subjects.

Generally, the retraction of the front group and molar distalization represent stages in the complex treatment of II/1 anomaly, followed by other stages of treatment. The obtained position of the front group, or molars may be affected in the following steps of treatment. Considering these aspects, before concluding the efficiency of controlling sagittal skeletal anchorage in II/1 anomaly, should we considered two issues: first, it should be identified and analyzed the results at the end of treatment compared to other methods – are mini-implants really better? Secondly, is the result obtained with mini-implants stable? Unfortunately, the studies included in this systematic review did not raise these issues. All studies were focused on short-term effects of distalization and retraction. Therefore, due to these shortcomings, the quality of the findings decreases.

Following the systematic review carried out, the following conclusions were drawn:

1. Front group retraction and upper molar distalization are more rapidly performed on a greater distance and without side effects on other groups when using mini dental implants.
2. The studies methodology was relatively low.
3. The efficiency of using mini-implants should be compared with the final results and long-term stability.

References

5. Antonarakis GS, Kiliaridis S. Maxillary molar distalization with non compliance intermaxillary appliances in Class II


