Retrospective cone-beam computed tomography evaluation of temporary anchorage devices

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Introduction: Miniscrew implants as temporary anchorage devices (TADs) are becoming more popular in orthodontic treatment. Their ease of use allows orthodontists to place them in locations in the mouth that are convenient for orthodontic treatment mechanics. The aims of this study were to evaluate the location of TADs placed during orthodontic treatment and to relate the placement to the surrounding dentoalveolar structures.

Methods: Three-dimensional cone-beam computed tomography scans were taken before and after placement of the TADs over a 6-month period as part of routine clinical protocol. The following parameters were recorded: placement site, length of the TAD in the alveolar bone, amount of contact with the periodontal ligament, and interroot distance between TADs.

Results: Thirty-five TADs (19 in the maxilla, 16 in the mandible) were evaluated. The mean lengths of the TADs in alveolar bone were 5.29 ± 1.39 mm in the maxilla and 4.60 ± 0.86 mm in the mandible. The amounts of contact with the periodontal ligaments were 2.54 ± 0.81 mm (n = 13) in the maxilla and 2.72 ± 0.49 mm (n = 10) in the mandible. The interroot distance measurements were 2.78 ± 0.76 mm (n = 15) and 5.19 ± 4.42 mm (n = 16) in the maxilla and the mandible, respectively. Paired t tests indicated a significant difference in the interroot distance for mandibular teeth.

Conclusions: Three-dimensional cone-beam computed tomography technology allows better visualization of TAD placement. Clinicians can expect 71.2% of the length of the screw section of the TAD to be embedded in the alveolar bone; the percentage is often higher in the maxilla than in the mandible. Of the 35 TADs, 65.2% were in contact with the periodontal ligament. There appears to be more space for TAD placement in the mandible than in the maxilla.

Read the full text online at: www.ajodo.org, pages 166.e1-166.e5.

EDITOR’S SUMMARY

Miniscrew implants can be used to provide temporary anchorage to facilitate tooth movement. But how accurately are these implants placed by clinicians who are relatively new to this approach? How much of the implant is actually imbedded in alveolar bone? Is there a difference in available space when placing them in the maxilla vs the mandible? Does cone-beam computed tomography (CBCT) technology allow for better visualization when placing a miniscrew implant? The aim of this study from the University of Texas was to evaluate the location of TADs placed during orthodontic treatment.

CBCT images were obtained in this teaching clinic on all patients requiring an implant for temporary anchorage over a 6-month period. The implants were self-drilling, self-tapping, polished titanium screws with a tube slot on the head to allow for 3-dimensional control. Thirty-five TADs were placed and evaluated in 18 patients, most in the posterior regions of the jaws. Some were observed to have contact with the periodontal ligament (PDL) in both the maxilla and the mandible. Additional details are described in the online version of the article.

This study has some weaknesses. The sample used to assess differences in the scores of variables between the maxilla and the mandible was small. It is easy to see in Table I the imbalance in the numbers of miniscrew implants by region; however, data from different regions were pooled for the tests, and this probably affected the results. The small number of implants limited the use of paired sites for analysis.

The authors noted that 65.2% of miniscrew implants were in contact with the PDL. There appears to be more space for placement in the mandible than in the maxilla. Clinicians can expect 71.2% of the length of the screw section be embedded in alveolar bone and perhaps a bit more in the maxilla. CBCT technology has allowed for better visualization of the effects of miniscrew implants on the surrounding dentoalveolar structures.
Q & A

Turpin: Was it possible to be objective in evaluating the locations of all miniscrews in this interesting study?

Kau: Yes, it was. Although there was scatter, it was possible to trace and extrapolate the outline of the PDL and hence the location of the implant.

Turpin: Is the learning curve for residents similar to those in practice when it comes to placing miniscrew implants?

Kau: I believe that residents benefit from an experienced operator readily at chair side. For a private practitioner, it might be a longer learning curve.

Table I. Placement site of TADs according to location in the dentoalveolus

<table>
<thead>
<tr>
<th>Region</th>
<th>Region I</th>
<th>Region II</th>
<th>Region III</th>
<th>Region IV</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maxilla</td>
<td>0</td>
<td>0</td>
<td>14</td>
<td>5</td>
<td>19</td>
</tr>
<tr>
<td>Mandible</td>
<td>1</td>
<td>6</td>
<td>8</td>
<td>1</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>1</td>
<td>6</td>
<td>22</td>
<td>6</td>
<td>35</td>
</tr>
</tbody>
</table>

Regions: I, anterior incisal; II, distal from the canine; III, premolar (between 2 premolars and distal of the second premolar; IV, molar.

Fig 1. Diagrammatic representation of TAD placement in region III and the parameters measured.

Fig 2. CBCT images showing TADs placed in the maxilla and the mandible (the views are shown from the axial slices).