Factors affecting the success rate of orthodontic anchorage with mini implants

SZUHANEK CAMELIA, SITARU PATRICIA, BÂLDEA BOGDAN
2nd Department, Faculty of Dental Medicine
University of Medicine and Pharmacy VICTOR BABES Timisoara
Eftimie Murgu Square no.2, Timisoara
ROMANIA
e-mail: camelia.szuhanek@yahoo.com

Abstract:-Anchorage is an important parameter of the successful outcome of orthodontic treatment. Miniscrews have been utilized for this purpose because of the absolute anchorage they provide, easy insertion and removal, all for a low price. Success rate has been intensively studied. The goal of our study was to identify factors linked to success rate, including to reveal the importance of different dimensions of mini implants. Mini screws were used for anchorage in order to obtain orthodontic movement for the malposition treatment or as preliminary stage before prosthetic treatment. We evaluated the amount of variables on sex, age, oral hygiene, required orthodontic movement, dimensions of mini screws, maxilla/mandible, insertion site, angulation and orthodontic success. Our success rate was 85%. Failure of anchorage occurred mostly in the first 2 months of use.

Keywords: mini implant, mini screw, orthodontic anchorage, success rate, failure, angulation.

1. Introduction

The control of orthodontic anchorage is an important parameter for successful outcome of orthodontic treatment. In order to find the most suitable methods of anchorage, a lot of research has been conducted, including both intraoral and external devices. Success rate has been intensively studied [1,2,3,4,5,6,7]. Mini screws used in orthodontic anchorage have to be immediately loaded in order to reduce duration of treatment and have to be removed when the treatment is over. They have to be inserted between the roots of the teeth or in the area distal to the last molars. Patients for this type of mini screws anchorage are generally younger than those who benefit from dental implants. These facts are responsible for the difference between factors which influence the success rate in dental implants and those responsible for success rate of orthodontic anchorage by mini screws. Vices require patient’s determination and will in order to assure the proper anchorage [3,4,5](Figure 1).

When skeletal anchorage is involved, as the one provided by mini screws, the clinician can rely on trustful anchorage without the need of patient collaboration. Often and often, mini screws have been utilized for this purpose because of the absolute anchorage they provide, easy insertion and removal, all for a low price. Small dimensions assure placement into the interdental bone, increasing the clinical applicability.

Fig.1. Orthodontic implants used in the intrusion of overerupted upper molars.

Most studies regard those factors affecting the stability of mini implants, but there are also many others which influence clinical success and they have been remained unknown. The goal of this study was to identify factors linked to success rate, including to reveal the importance of different dimensions of mini implants.

2. Materials and methods

The study has been conducted in the Faculty of Dentistry, University of Medicine and Pharmacy “Victor Babeș”, Timişoara, between January-December 2012. The group consisted of 10 patients
(2 male patients and 8 female patients) with the average age of 30.1. Mini implants were inserted in order to achieve orthodontic anchorage. The patients were informed about the advantages and disadvantages of this procedure and the mini-implants were inserted after obtaining each patient’s written consent.

There were inserted 20 Leone mini screws, having the following dimensions: 6 of them had 8mm length and 1.75mm diameter; 2 of 8mm length and 1.5 mm diameter; 2 of 6mm length and 1.5mm diameter; 10 of 6mm length and 1.5mm diameter. The surgical procedure included local anesthesia and flapless technique.

Depending on local topography, the mini screws were inserted either oblique, at 45° with the teeth implantation axe, or 90°, or parallel with the teeth vertical axe. The reason for angulation was not to interfere with the roots, maintaining the proper length of mini implants. Right after insertion the primary stability was checked and no sign of mobility was found.

3. Clinical variables
The 10 variables have been divided in 2 categories; patient-linked factors and implant-linked factors, as showed in the table 1.

4 Results
After centralizing data, we evaluated the amount of variables depending on sex, age, oral hygiene, the required orthodontic movement, the mini screws used, maxilla/mandible, insertion site, angulation and orthodontic success. Data was introduced in Microsoft Excel and we obtained the following results:

The group consisting of 10 patients, 8 female and 2 male, were between 23-43 years old. Furthermore, 20% of patients were 23; 10%-26; 20%-28; 10%-30; 20%-31; 10%-38, 10%-43. All patients were trained to perform and maintain an optimal oral hygiene. After the periodical control 80% had good oral hygiene and 20% showed a medium level.

Mini screws were used for orthodontic anchorage in order to obtain orthodontic movement for the malposition treatment or as preliminary stage before prosthetic treatment. The main goal for 10% of the mini screws was the intrusion of frontal teeth; 10% were used to intrude the superior first molar; 25% were used to intrude the first and second superior molar; 10% for intrusion in order to obtain the correct occlusal design; 10% for correction of the occlusal design with molar intrusion, 5% for molar movement distally; 10% for premolar movement distally, were premolars were the last remained posterior teeth; 5% for the traction of an impacted superior left canine and 5% for the second lower inferior molar.

The 20 mini screws had the following dimensions: 6 of them were 8 mm long and had 1,75 mm diameter; 2 of them had 8 mm length and 1,5 mm diameter; 10 were 6 mm long and 1,75 mm diameter and 2 were 6 mm long and 1,5 mm diameter.

75% of the mini implants were placed in mandible, while 25% were placed in the maxilla.

The orthodontic therapy had different purposes, consequently, different sites and angulations were necessary for the mini screw insertion. Consequently, 10% were inserted palatal, between 1.5-1.6; 11% were placed buccal, between 1.6-1.7, 11% buccal mesial to 1.6; 11% palatal, between 1.6-1.7; 11% buccal, between 1.5-1.6; 5% buccal between 1.3-1.4; 5% palatal, between 1.3-1.4; 11% on the right side, distal to molar; 5% on the left side, distal to the last molar; 5% buccal, between 3.3-4.3; 5% distal to 4.7; 5% between 1.3-1.2; 5% between 2.3-2.2.

The orthodontic treatment was intended to gain various dental movements, which needed insertion in various positions, considering local anatomy and purpose. Therefore, 4 mini implants were inserted at 45°, 8 were obliquely inserted, 5 horizontally and 3 vertically.

The inserted mini screws were used for different periods of time, depending either on the necessary duration to achieve orthodontic success, or because of their loss during treatment. Only one implant was used for 12 month, until the achievement of the goal; 4 were used for 10 months, 3 for 9 months, 3 for 8 months, 2 for 7 months, 4 for 5 months, 1 for 2 months and 1 for one month.

85% of the mini screws maintained and achieved successfully their goal in orthodontic anchorage, while 15% were lost during treatment.

5 Discussions
The study showed that mini implants which failed (15%) were inserted to female patients, while those who succeeded (85%) were placed to both female and male patients. As shown in previous studies [1,2], we also found out that success rate is higher in male patients.
Table 1. The patient-linked and mini implant-linked variables evaluated in this study.

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Patient</th>
<th>Sex</th>
<th>Age</th>
<th>O.H.</th>
<th>Required orthodontic movement</th>
<th>L</th>
<th>D</th>
<th>Arch</th>
<th>Insertion site</th>
<th>Insertion angle</th>
<th>Duration of use</th>
<th>Success</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>A.P.</td>
<td>F</td>
<td>23</td>
<td>good</td>
<td>Molar intrusion 1.6</td>
<td>8</td>
<td>1.75</td>
<td>S</td>
<td>Palatal 1.5/1.6</td>
<td>Oblique 45°</td>
<td>10 months</td>
<td>YES</td>
</tr>
<tr>
<td>2.</td>
<td>A.P.</td>
<td>F</td>
<td>23</td>
<td>good</td>
<td>Molar intrusion 1.6</td>
<td>8</td>
<td>1.75</td>
<td>S</td>
<td>Buccal (M1-M2)</td>
<td>Oblique 45°</td>
<td>10 months</td>
<td>YES</td>
</tr>
<tr>
<td>3.</td>
<td>L.N.</td>
<td>F</td>
<td>28</td>
<td>good</td>
<td>Molar intrusion 1.6, 1.7</td>
<td>8</td>
<td>1.75</td>
<td>S</td>
<td>Palatal (M1-M2)</td>
<td>Oblique 45°</td>
<td>8 months</td>
<td>YES</td>
</tr>
<tr>
<td>4.</td>
<td>L.N.</td>
<td>F</td>
<td>28</td>
<td>good</td>
<td>Molar intrusion 1.6, 1.7</td>
<td>8</td>
<td>1.75</td>
<td>S</td>
<td>Buccal (M1-M2)</td>
<td>Oblique 45°</td>
<td>8 months</td>
<td>YES</td>
</tr>
<tr>
<td>5.</td>
<td>V.Z.</td>
<td>M</td>
<td>30</td>
<td>medium</td>
<td>Anchorage for mandible retraction</td>
<td>8</td>
<td>1.5</td>
<td>S</td>
<td>Buccal Mesial to 1.6</td>
<td>Oblique 45°</td>
<td>8 months</td>
<td>YES</td>
</tr>
<tr>
<td>6.</td>
<td>V.Z.</td>
<td>M</td>
<td>30</td>
<td>medium</td>
<td>Anchorage for mandible retraction</td>
<td>8</td>
<td>1.5</td>
<td>S</td>
<td>Buccal Mesial to 1.6</td>
<td>Oblique 45°</td>
<td>8 months</td>
<td>YES</td>
</tr>
<tr>
<td>7.</td>
<td>U.S.</td>
<td>M</td>
<td>43</td>
<td>good</td>
<td>Correction of Occlusal Design - Molar Intrusion</td>
<td>6</td>
<td>1.5</td>
<td>S</td>
<td>V 1.5/1.6</td>
<td>Oblique</td>
<td>5 months</td>
<td>YES</td>
</tr>
<tr>
<td>8.</td>
<td>U.S.</td>
<td>M</td>
<td>43</td>
<td>good</td>
<td>Correction of Occlusal Design - Molar Intrusion</td>
<td>6</td>
<td>1.5</td>
<td>S</td>
<td>Buccal 1.3/1.4</td>
<td>Oblique</td>
<td>5 months</td>
<td>YES</td>
</tr>
<tr>
<td>9.</td>
<td>U.S.</td>
<td>M</td>
<td>43</td>
<td>good</td>
<td>Correction of Occlusal Design - Molar Intrusion</td>
<td>6</td>
<td>1.5</td>
<td>S</td>
<td>Palatal 1.3/1.4</td>
<td>Oblique</td>
<td>5 months</td>
<td>YES</td>
</tr>
<tr>
<td>10.</td>
<td>U.S.</td>
<td>M</td>
<td>43</td>
<td>good</td>
<td>Correction of Occlusal Design - Molar Intrusion</td>
<td>6</td>
<td>1.5</td>
<td>S</td>
<td>Palatal 1.5/1.6</td>
<td>Oblique</td>
<td>5 months</td>
<td>YES</td>
</tr>
</tbody>
</table>


Next variable was age. The age of the group was between 23-43, with an average age of 27.33. As previous studies[4] shown, age seems not to interfere with the outcome of the orthodontic anchorage with mini screws. Regarding oral hygiene, 80% of the group showed a good level, while 20% had a medium level; those 15% of implants that failed, were inserted to patients with a medium level of oral hygiene. In contrast to other studies which evaluated the factors of success
rate [6], where hygiene is a major factor of the final outcome, our study could not proof the importance of this factor while our group presented only a good or a medium level of hygiene. Orthodontic anchorage had to obtain various orthodontic movements. Failure was shown in 3 cases, which required either molar intrusion (1.6, 1.7), or premolar movement to distal, where premolars were the last remained distal teeth on the arch, or the repositioning of 4.7. Most probable there were other factors incriminated than those evaluated in our study.

The dimensions of the mini screws that failed were 8mm-1.5mm; 6mm-1.75mm; 6mm-1.5mm. As shown in the study the longer the mini screw and smaller the diameter, the bigger sensitivity to failure, because of the risk of bending or breaking. Neither shorter length in association with smaller diameter is a good choice. Consequently, it is important that the mini screw has the proper dimensions for the clinical case.

Arch was another parameter of our study. Most mini implants which failed were placed in the mandible. As shown in previous studies [1,2] the failure rate was higher in lower arch, which is the same for our study.

The insertion site of failed implants varied each time: buccal mesial to 1.6; distal to the last molar on the right side; distal to 4.7. Nevertheless, it becomes obvious the tendency to failure on the right side of the mandible, which was noticed in other studies [6,7], too.

Our study revealed that all oblique-inserted mini screws succeeded, while 40% of those inserted horizontally failed. Those placed vertically, failed in 33.3% of the cases, similar to other previous studies [1,2].

Failure of the mini screws and the consecutive loss of orthodontic anchorage (15%) appeared in the first 2 months of treatment, as shown in similar studies [2,5] while the rest of 85%, being a success, remained in the oral cavity until the achievement of the insertion goal, meaning 5 to 12 months.

6. Conclusions
This study shows that the success rate of orthodontic anchorage with mini implants is higher in male patients. Age seems not to interfere with the final outcome of the treatment. Our group presented good or medium level of oral hygiene, therefore, we could not determine the importance of this factor. All types of orthodontic movements were different, consequently we could not find a specific link either to success or to failure. Dimensions of mini screws interfere with the success rate and it is important to be adequate to clinical case: a longer mini implant with a shorter diameter is exposed to failure because of the risk of bending or breaking. Neither the short length in association to small diameter is a good choice. Failure rate is higher in mandible than in maxilla, especially on the right side of the lower arch. The oblique insertion is the most adequate. Failure of orthodontic anchorage with mini implants occurred in the first 2 months of use.

References