2023

Questionnaire Survey on Pain & Mini-implant Failure in Class II Female Patients after Extraction of Maxillary Second Molars Using Infra Zygomatic Mini Implants

Hosam Abdullah Zaza  
*Future University in Egypt*, hosam.zaazaa@fue.edu.eg

Nagwa El Mangoury  
*Future University in Egypt*

Amr El Dakrory  
*Cairo University*, amrdakroury61@yahoo.com

Mostafa El Dawlatly  
*Cairo University*, mostafaeldawlatly@gmail.com

Follow this and additional works at: [https://digitalcommons.aaru.edu.jo/fdj](https://digitalcommons.aaru.edu.jo/fdj)

Part of the Orthodontics and Orthodontology Commons

**Recommended Citation**  

This Article is brought to you for free and open access by Arab Journals Platform. It has been accepted for inclusion in Future Dental Journal by an authorized editor. The journal is hosted on Digital Commons, an Elsevier platform. For more information, please contact rakan@aaru.edu.jo, marah@aaru.edu.jo, u.murad@aaru.edu.jo.
Questionnaire Survey on Pain and Mini-implant Failure in Class II Female Patients after extraction of Maxillary Second Molars Using Infra-Zygomatic Mini Implants

Hosam Abdullah Zaza,*, Nagwa El Mangoury, Amr El Dakrory and Mostafa El Dawlatly

a. Teaching Assistant of Orthodontics and Dentofacial Orthopedics, Future University in Egypt
b. Professor of Orthodontics and Dentofacial Orthopedics, Future University in Egypt
c. Department of Orthodontics and Dentofacial Orthopedics, Cairo University, Egypt
d. Associate Professor, Department of Orthodontics and Dentofacial Orthopedics, Cairo University, Egypt

ARTICLE INFO

Discipline:
Orthodontics

Keywords:
Pain, Infra-zygomatic mini-implant failure, Distalization, Skeletal anchorage.

* Corresponding author.
E-mail address: hosam.zaazaa@fue.edu.eg
(Hosam Abdullah Zaza).

ABSTRACT

Background: Skeletal anchorage devices have been developed for case requiring absolute anchorage during orthodontic treatment. One of these anchorage devices is the Infra-zygomatic mini-implant type. However, the pain associated with this type of appliance have not been sufficiently evaluated from the patient’s point of view. Aim: The aim of this study was to survey patients for one week after insertion of the infra-zygomatic mini-implants and 1 week following every reactivation in order to evaluate their pain and discomfort as well as the percentage of mini-screw failure. Materials and methods: 10 patients requiring infra-zygomatic mini-implants were selected. All participants completed questionnaires for 7 days after insertion and after every reactivation. The patients responded to questions by placing a mark along a 10-cm-long visual analog scale (VAS). Results: The mean of the pain score of all activations showed a normal decreasing pattern with the pain being at its highest at the day of the activation and decreasing gradually by the end of the week. As for mini-implant failure, the overall failure rate of mini-implants was 30% throughout the trial period. With an immediate failure rate of 15% following mini-implant insertion. Conclusions: Putting into perspective patient comfort and success rate of the mini-implants these results suggest that infra-zygomatic mini-implants with an 85% immediate success rate are effective as skeletal anchorage devices and are a valid option in cases requiring distalization in the maxillary arch.

1. INTRODUCTION

Since the introduction of mini-implants as a skeletal anchorage device, different types of mini-implant devices and techniques of application have been introduced, as mentioned by several authors such as Creekmore et al.1. The use of mini-implants as skeletal anchorage in orthodontic practice is changing not only how far orthodontists can move a tooth without the use of extra-oral devices such as headgear, but also their approach in managing different orofacial discrepancies, malocclusions, or space problems. Such as, case reports published by Ercanar et al.2 and Kircelli et al.3 described how mini-implants could be used as anchorage for facemask protraction in adolescent patients with maxillary hypoplasia and oligodontia. Other studies have also been conducted by El-Dawlatly et al.4 and Alfify et al.5 to test the potential of using a mini-implant to achieve zygomatic anchorage in order to distalize maxillary first molars in a class II adolescents. In addition, Bae et al.6 attempted intrusion of over-erupted teeth before prosthetic replacement of missing teeth in the opposing arch can be achieved using skeletal anchorage. The use of skeletal anchorage didn’t only change how far teeth can be moved, but also offered more treatment options to both orthodontists and patients. However, there is a scarcity in the current literature regarding pain and discomfort experienced by patients through the distalization process as well as infra-zygomatic mini-implant failure rate. Therefore, we conducted patient questionnaire surveys for 1 week after mini-implant insertion as well as following every activation until the end of the trial period.

2. MATERIALS AND METHODS

Patient selection

The sample included 10 female nongrowing Class II patients who required orthodontic molar distalization using infra-zygomatic mini-implants at Future University’s Orthodontic Clinic, Cairo, Egypt. Sample size calculation was done based on a paper published by Nur et al.7. A single clinician treated all patients. All subjects had to meet the following inclusion criteria: (1) Female Patients with CVMI 5 & 6. (2) Full Set of permanent teeth. (3) Bilateral ¾ to ¾ units Class II molar relationship. (4) Overjet with an average of 3-6 mm. (5) proper oral hygiene and periodontal condition. (6) Maxillary 3rd molars must have a favorable path of eruption. The age of the patients ranged from 17 to 25 years with mean age of 20 years. The 2nd molars were bilaterally extracted
in all 10 patients. The treatment was continued until Class I molar relationship was achieved. The appliance was manufactured from a 1.1 mm diameter stainless steel wire that passed along the labial and buccal surfaces, away from the labial surface by about 3 to 4 mm. The appliance was constructed using 2 soldered hooks opposite to the distal surface of the maxillary lateral incisors directed gingivally, a U-shaped loop at the 1st premolar region, and two bends that served as a mesial stop in front of the maxillary first molars. **Figure 1** shows the design of the appliance that was developed and used for distalization of the maxillary 1st molars.

**Mini-implant insertion**

An infra-zygomatic mini-implant (Tomas-pin EP, Dentaurum, Germany), 10 mm in length and 1.6 mm in diameter, was inserted into the infra-zygomatic area. First a sterile probe was used at the infra-zygomatic crest area in order to induce a bleeding point opposite to the long axis of the mesio-buccal cusp tip and 3-4 mm above the muco-gingival junction. This was done in order to serve as a guide for the mini-implants subsequent insertion. After determination of the bleeding point, the mini-implant was directed perpendicular to the occlusal surface until reaching 1 mm into the bony cortex and then redirected to a 55-70° angle until final insertion of the mini-implant. One week following the insertion of the mini-implants, the patients were recalled and extraction of the maxillary 2nd molars was carried out in an atraumatic manner. Cementation of the bands on the maxillary 1st molars was carried out and the wire framework was fitted into the extra-oral tube of the cemented bands. A Niti coil spring (Tomas closed coil spring, Dentaurum, Germany) was then inserted into the Infra-zygomatic mini-implant head on one end, while the other end extended to the soldered hook with a distalization force of 300 gm.per side, measured using a force guage (Morelli orthodontic force gauge, Brazil). Patients were recalled every 4 weeks to check for mini-implant stability and force recalibration.

After infra-zygomatic mini-implant placement and activation of the appliance, all patients were given a 7 day follow up questionnaire with the following questions (**Figure 3**). Visual analogue scale (VAS) was used in order to evaluate the intensity of pain. Each patient was given the questionnaire after every reactivation, and every subsequent activation until the end of Molar distalization period.
Infra-zygomatic mini-implants were evaluated during every reactivation visit. A Mini-implant was considered failed if there was evident movement of the mini-implant head or displacement, as well as in cases with full mucosal coverage where the mini-implant head was fully submerged under the alveolar mucosa.

Statistical Analysis:

Data was statistically described in terms of mean ± standard deviation (±SD), or frequencies (number of cases) and percentages when appropriate. Numerical data were tested for the normal assumption using Shapiro Wilk test. Internal consistency was tested using Cronbach alfa statistic. Comparison between more than 2 time points was done using Freidman’s test. Two-sided p values less than 0.05 was considered statistically significant. IBM SPSS (Statistical Package for the Social Science; IBM Corp, Armonk, NY, USA) release 22 for Microsoft Windows was used for all statistical analyses.

3. RESULTS

Figure 4 shows the pre-treatment and post-treatment records of a Class II ½ unit case. The average treatment duration of all cases was 6.4 months.
After collection and analysis of all questionnaires, the results of the mean pain score of the 7 days’ activation was obtained and compared. It was found that the highest score of pain was found in the first activation with a VAS score of 7.79. Following the first activation, gradual decrease in the average pain intensity was noted and reached its lowest at the 7th activation with only a score of 4.36 according to the VAS score Figure 5.

Overall, the infra-zygomatic mini-implants failure rate was 30% in total. A 15% failure rate was observed during the 1st activation with a total of 3 mini-implants failing. After replacement of the failing mini-implants, one of the replaced implants failed again during the 2nd activation. After the 2nd activation, a 10% mini-implant failure was seen, with a total of 2 mini-implants failing. One of these 2 mini-implants was among the previously failing mini-implants. During the 3rd activation period 5% mini-implant failure was recorded. Finally, at the 5th activation, 1 mini-implant had failed. However, the patient recorded receiving an injury on the area below to the zygomatic arch region on the side of the failed mini-implant which resulted in bruising and swelling. This was believed to be the cause for the failed mini-implant as it got totally submerged under the mucosa following the injury (Figure 7).

### Table (1)

<table>
<thead>
<tr>
<th>All activations</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>7.94</td>
<td>1.15</td>
</tr>
<tr>
<td>Day 2</td>
<td>7.00</td>
<td>1.46</td>
</tr>
<tr>
<td>Day 3</td>
<td>6.09</td>
<td>1.57</td>
</tr>
<tr>
<td>Day 4</td>
<td>5.25</td>
<td>1.75</td>
</tr>
<tr>
<td>Day 5</td>
<td>4.63</td>
<td>1.96</td>
</tr>
<tr>
<td>Day 6</td>
<td>3.47</td>
<td>2.09</td>
</tr>
<tr>
<td>Day 7</td>
<td>2.53</td>
<td>2.18</td>
</tr>
</tbody>
</table>

### Figure (5) — Line graph for the mean pain score between every activation

As for the mean pain within the week the same pattern was noticed with the highest average pain score being 7.94 during the first day (Table 1). A gradual decrease in the mean pain level was noticed reaching its lowest score at the 7th day with a VAS score of 2.53 (Figure 6).

### Figure (6) — Line graph for the mean pain score of all activations in each day

### 4. DISCUSSION

Pain is a subjective phenomenon and is often tedious to assess and depends on many variables. It tends to vary according to many factors such as gender, age, the site of mini-implant placement, and the subject’s previous experience of pain. In our study, only female subjects were selected within the same age group in order to reduce such variables.

Similar to Miresmaeili et al., a screw head which is 2 mm away from the mucosal surface is recommended for attachment of the retraction device (Closed Coil Spring). This matches the design of the self-drilling titanium mini-screws (Tomas-pin EP, Dentaurum, Germany) which was highly characterized by a 3mm in height mushroom head that eliminated the risk of gingival overgrowth. The mini–implants were 10 mm in length and 1.6 mm diameter which was considered adequate through a study conducted by Lin et al.

There are almost no studies in the available literature regarding pain follow up during re-activation visits. Almost all pain studies regarding mini-implant post insertion pain focuses only on the first week following mini-implant placement. In our study the average initial pain reported during only the first activation was 9.52 during the first day and decreased to 3.40 at the 7th day. A study conducted by Kawaguchi et al. reported that pain reported following buccal mini-screw insertion was 7.29 during the 1st day and 1.34 at the 7th day following mini-implant insertion which is slightly lower than pain reported in our study. Another clinical trial conducted by Kuroda et al. reported an average pain of 4 at the 1st day which decreased to less than 1 during the 7th day. However, both of these studies were regarding inter-radicular mini-implants and not infra-zygomatic region which might explain the difference in the pain intensity between both groups.
The findings of our study show that infra-zygomatic mini-implants had an initial success rate of 85%. A meta-analysis reported that the average overall success rate of mini-implants to be approximately 86%\(^3\). This analysis included studies for mini-implants placed in different regions. However, the vast majority of the studies conducted on mini-implant failure rate have predominantly focused on those placed in inter-radicular regions\(^3\). Uribe et al.\(^2\) conducted a study regarding infra-zygomatic mini-implants and reported a success rate of 78.6% which is slightly lower than our study. Another study conducted by Liu et al.\(^2\) reported an outstanding success rate of 100% for mini-implants placed in this region.

5. CONCLUSIONS

Infra-zygomatic mini-implants had a high success rate of approximately 85% and could be clinically utilized for distalization of maxillary 1st molar. In addition, infra-zygomatic mini-implants reported a comparable pain score to inter-radicular mini-screws. Infra-zygomatic mini-implants have suitable characteristics as an orthodontic skeletal anchorage.

6. REFERENCES