

Original Article

Assessment of Effect of the length of Orthodontic Mini-screw Implants on their long-term stability: An Observational Study

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ABSTRACT:

Background: Bone anchorage devices can be either osseointegrated or non-osseointegrated depending on their bone-endosseous surface interface and design features. Since their introduction, orthodontic miniscrews have shifted the paradigm of anchorage in orthodontics and tooth movements that were once difficult have become easier. Hence; we planned the present study to assess the effect of the length of orthodontic mini-screw implants on their long-term stability. **Materials & methods:** The present study included assessment of effect of the length of orthodontic mini-screw implants on their long-term stability. A total of 8 patients were included in the present study. Calculation of optical bone density (OPD) was done in all the cases. Each patient received both the 6- and 8-mm-long Temporary intraoral skeletal anchorage devices (TISAD/TAD), in randomly selected mandibular quadrants (left or right). Loading of the TISAD/TAD was done with forces parallel to the occlusal plane by using NiTi springs. **Results:** In the patients with 8 mm TISD length, stability was seen in 75 percent of the cases, while failure occurred in 25 percent of the cases. In the patients with 6 mm TISD length, stability was seen in 62.5 percent of the cases, while failure occurred in 37.5 percent of the cases. **Conclusion:** In comparison to the 6 mm mini-screws, the stability of 8 mm orthodontic mini-screw implants is higher.

Key words: Implants, Mini-screw, Stability.

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INTRODUCTION

Bone anchorage devices can be either osseointegrated or non-osseointegrated depending on their bone-endosseous surface interface and design features. The non-osseointegrated type can be further subdivided according to whether screw (miniscrew) or plate (mini-plate) components are the principal design elements.¹⁻³ Clinically, the use of osseointegrated implants for orthodontic anchorage is associated with a success rate of 86– 100%. However, osseointegrated implants present a significant problem of removal once they are no longer required at the end of treatment. Unlike osseointegrated implants, miniscrews and miniplates derive their retention by mechanical means only.^{4,5} Since their introduction, orthodontic miniscrews have shifted the paradigm of

anchorage in orthodontics and tooth movements that were once difficult have become easier.^{6, 7} Hence; under the light of above mentioned data, we planned the present study to assess the effect of the length of orthodontic mini-screw implants on their long-term stability.

MATERIALS & METHODS

The present study was conducted in the department of orthodontics and it included assessment of Effect of the length of orthodontic mini-screw implants on their long-term stability. Ethical approval was obtained from institutional ethical committee and written consent was obtained after explaining in detail the entire research protocol. A total of 8 patients were included in the present

study. Inclusion criteria for the present study were as follows:

- Physically healthy subjects,
- Subjects within the age group of 20 to 26 years,
- Subjects with tooth brushing history of more than three times per day,
- Subjects with absence of symptoms of oral diseases
- Subjects scheduled to undergo orthodontic dental extraction of lower first premolar

In accordance with Segner and Hasund lateral cephalogram analysis, presentation of all the patients was Class I skeletal pattern with the hyperdivergent angle between the maxillary and mandibular planes. Calculation of optical bone density (OPD) was done in all the cases. Recording of OPD discrepancy between right and left sides of all the patients was done. Application of only single type of TISAD/TAD was done (either 6 mm or 8 mm). Each patient received both the 6- and 8-mm-long

TISAD/TAD, in randomly selected mandibular quadrants (left or right). All the procedures were carried out by experienced orthodontist. All the subjects were given instructions to maintain strict oral hygiene. Loading of the TISAD/TAD was done with forces parallel to the occlusal plane by using NiTi springs. All the patients were observed for a time period of 1 year.

RESULTS

In the present study, a total of 8 patients were analyzed. Mean age of the patients of the present study was 24.5 years. There were 2 males and 6 females in the present study. Two types of TISAD length mini-screws were used; 6 mm and 8 mm. In the patients with 8 mm TISAD length, stability was seen in 75 percent of the cases, while failure occurred in 25 percent of the cases. In the patients with 6 mm TISAD length, stability was seen in 62.5 percent of the cases, while failure occurred in 37.5 percent of the cases.

Table 1: Demographic data

Parameter		Number
Number of patients		8
Mean age (years)		24.5
Gender	Males	2
	Females	6

Table 2: Division of patients into study groups

Parameter	Groups	
	Group 1	Group 2
TISAD length (mm)	8	6
Number of TISAD	8	8

Table 3: Stability of TISAD

Patient number	Group 1		Group 2	
	Failure	Stable	Failure	Stable
1	No	Yes	Yes	No
2	Yes	No	No	Yes
3	No	Yes	Yes	No
4	No	Yes	No	Yes
5	No	Yes	No	Yes
6	No	Yes	No	Yes
7	Yes	No	Yes	No
8	No	Yes	No	Yes
Total	2 (25%)	6 (75%)	3 (37.5)	5 (62.5%)

DISCUSSION

Precise indications for skeletal anchorage are not well documented. Most of the published articles have been case reports in which new devices have been described as alternatives to other anchorage methods—for example, in ex-traction cases using implants instead of head-gear. Mini-implants have replaced other types of fixed appliances for the delivery of differentiated force systems for posterior tooth movement or extrusion of impacted canines.⁶⁻⁸

Orthodontic implants or temporary intraoral skeletal anchorage devices (TISADs) are a compliance-free alternative to more traditional forms of anchorage. They are not attached directly to the teeth, unlike other methods of anchorage reinforcement. TISADs are regarded as simple to place and have reported survival rates ranging from 80% to 94% and have therefore been advocated as the potential method of choice when anchorage reinforcement is necessary during treatment.^{8,9}

In the present study, a total of 8 patients were analyzed. Mean age of the patients of the present study was 24.5 years. There were 2 males and 6 females in the present study. Two types of TISAD length mini-screws were used; 6 mm and 8 mm. Sarula M et al analyzed the influence of the length of temporary intraoral skeletal anchorage devices (TISAD/TAD) on their long-term stability in the mandible in a homogenous group of patients. A group of generally healthy patients of the same gender (female) and with a statistically insignificant age difference (20–29 years) highly homogenous with respect to known factors affecting the success rate of TISAD/TAD was evaluated. One type of TISAD/TAD was applied (6- or 8-mm long). Each patient received both 6- and 8-mm-long TISAD/TAD in randomly selected mandibular quadrants: left or right. The long-term success rate of TISAD/TAD was analyzed. The 8-mm orthodontic mini-screw implants were significantly more stable than the 6-mm ones in the analyzed group. The length of the TISAD/TAD may be one of the factors that can affect the long-term success rate in the mandibles of 20- to 29-year-old women.¹⁰

Wu TY et al evaluated failure rates and factors associated with the stability of mini-implants used for orthodontic anchorage. A total of 414 mini-implants with diameters ranging from 1.2 to 2.0 mm were evaluated. Clinical variables for analysis were divided into host-related and implant-related factors. Mini-implants that could be maintained for orthodontic anchorage for more than 6 months were considered to be successful. Statistical analysis was used to evaluate the failure rate in our study cohort and to identify possible associated factors. The overall failure rate was 10.1% (42 of 414 screws) with

orthodontic force loading for more than 6 months. Most failures were due to loosening and occurred within the first 2 weeks. Differences in overall failure rates for the maxilla and mandible (9.3% and 16.3%, respectively) were not statistically significant. A lower failure rate was found for the maxilla with implant diameters equal to or less than 1.4 mm ($P = .036$). The left side had a lower failure rate than the right (6.7% vs 13.9%, $P = .019$). Length and type of mini-implants, age, and gender were not associated with mini-implant failure. Use of mini-implants for anchorage is reliable. In their study the overall success rate was 89.9%.¹¹

In the present study, in the patients with 8 mm TISD length, stability was seen in 75 percent of the cases, while failure occurred in 25 percent of the cases. In the patients with 6 mm TISD length, stability was seen in 62.5 percent of the cases, while failure occurred in 37.5 percent of the cases. Justens E et al evaluated clinical success and longevity of mini-screws during orthodontic treatment and to assess the patient's opinion. Fifty mini-screws were inserted in the mandible and maxilla of 21 patients with a flapless technique under local anesthesia. The patients were recalled after 2 weeks and from then on every other 2 months, and periodontal parameters and stability of the screws were evaluated at regular intervals. Patients received a questionnaire to assess their opinion regarding the treatment. The results do suggested that a waiting period of 1 week before loading improves success, and mini-screws inserted into the anterior region score better also compared to the posterior region. Initial periodontal parameters, which are very important in prognosis of orthodontic treatment, are not influencing the success rate in the examined group. Patients complained in 40-50% of the cases of pain during or after surgery, but this did not negatively affect the final general satisfaction with the treatment. The mini-screw implant is an easy and an inexpensive method for temporary anchorage of orthodontic appliance.¹²

CONCLUSION

From the above results, it can be concluded that in comparison to the 6 mm mini-screws, the stability of 8 mm orthodontic mini-screw implants is higher. However; further studies are recommended.

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