ORIGINAL ARTICLE

Assessment of Effect of the length of orthodontic mini-screw implants on their long-term stability: An Original Research

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ABSTRACT

Background: Mini-implants are widely used as skeletal anchorage in orthodontics. To reduce implant loss rate, sufficient primary stability is required. Hence; we assessed the effect of the length of orthodontic mini-screw implants on their long-term stability. **Materials & methods:**A total of 10 patients scheduled to undergo orthodontic mini-screw dental implants were included in the present study. All the individual subjects received both 6- and 8-mm-long intraoral skeletal anchorage devices (TISAD/TAD), in randomly selected quadrants. Skilled and experienced orthodontists carried out all the orthodontic procedures. Using NiTi springs, loading of the TISAD/TAD were commenced with forces parallel to the occlusal plane by using NiTi springs. For a time period of 1 year, all the patients were observed. **Results:** Success rate of TISAD in the 8mm group subjects was 70 percent, while success rate of 6 mm group subjects was 60 percent. **Conclusion:** Stability of 8 mm orthodontic mini-screws is higher than that of 6 mm mini-screws.

Key words: Implants, Orthodontic mini-screw, Stability

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INTRODUCTION

Stable anchorage is the main prerequisite for successful orthodontic treatment. The anchorage quality of dental structures in adult patients is often insufficient due to a periodontically-compromised and reduced dentition.[1-3]Mini-implants are widely used as skeletal anchorage in orthodontics. To reduce implant loss rate, sufficient primary stability is required.[4-6]There is clinical evidence from dental implantology that an implant's primary stability irrefutably determines its prognosis, as do other factors such as bone quality and oral hygiene. Implant stability immediately after insertion is called primary stability ("Press-fit").[6]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

We planned the present research in the department of orthodontics and it included assessment of effect of length of orthodontic mini-screw implants on their long-term stability. A total of 10 patients scheduled to undergo orthodontic mini-screw dental implants were included in the present study.

Physically compromised subjects, subjects more than 25 years of age were included in the present study. We also recorded optical bone dentistry between right and left sides of all the patients. Either 6mm or 8 mm orthodontic implant mini-screw was used on one side of the arch.Hence; all the individual subjects received both 6- and 8-mm-long intraoral skeletal anchorage devices (TISAD/TAD), in randomly selected quadrants. Skilled and experienced orthodontists carried out all the orthodontic procedures. Adequate instructions were given to all the subjects in relation to maintained of strict oral hygiene. Using NiTi springs, loading of the TISAD/TAD were commenced with forces parallel to the occlusal plane by using NiTi springs. For a time period of 1 year, all the patients were observed. All the results were analysed by SPSS software.

RESULTS

In the present study, a total of 10 patients with mean age of 22.5 years were included in the present study. 40 percent of the patients of the present study were males while remaining 60 percent were females. In all the patients, two types of orthodontic mini-screws were inserted with one type of mini-screw in each arch. Success rate of TISAD in the group 1 subjects was 70 percent, while success rate of TISAD in the group 2 subjects was 60 percent.

Table1: Demographic data

Parameter		**Number**
Number of patients		10
Mean age (years)		22.5
Gender	**Males**	4
	Females	6

Graph1: Division of patients into study groups

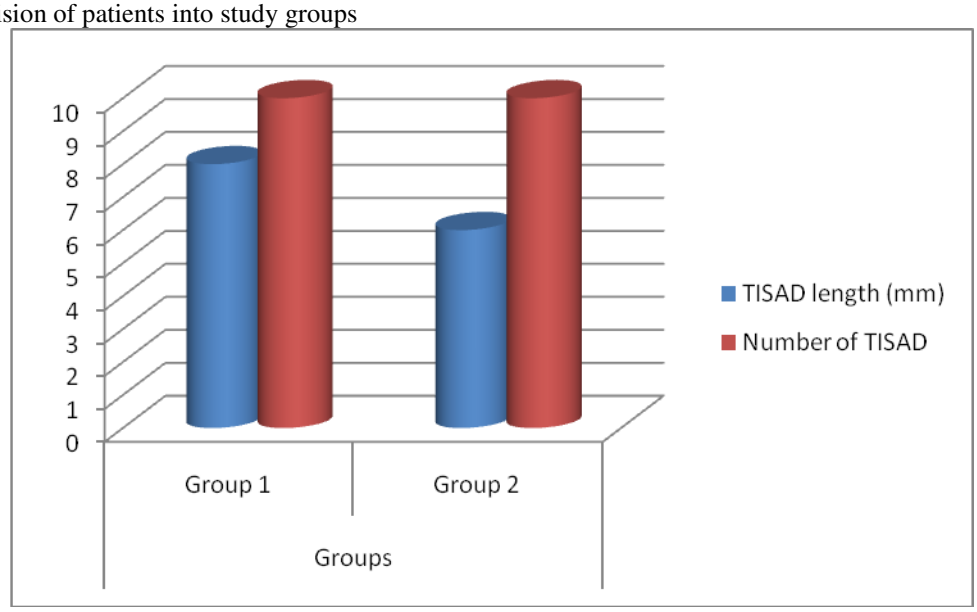

Table 2: Stability of TISAD

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
9	Yes	No	No	Yes
10	No	Yes	Yes	No
Total	3 (30%)	7 (70%)	4 (40%)	6 (60%)

DISCUSSION

In the present study, 40 percent of the patients of the present study were males while remaining 60 percent were females. In all the patients, two types of orthodontic mini-screws were inserted with one type of mini-screw in each arch. Success rate of TISAD in the group 1 subjects was 70 percent, while success rate of TISAD in the group 2 subjects was 60 percent. Wilmes B et al analyzed the factors influencing primary stability: bone quality, implant-design, diameter, and depth of pilot drilling. Thirty-six pelvic bone segments (ilium) of country pigs were dissected and embedded in resin. To determine the primary stability, we measured the insertion torque of five different mini-implant types (tomas-pin [Dentaurum, Ispringen, Germany] 08 and 10 mm, and Dual Top [Jeil Medical Corporation, Seoul, Korea] 1.6 x 8 and 10 mm plus 2 x 10 mm). Twenty-five or 30 implants were inserted into each pelvic bone segment following preparation of the implant sites using pilot drill diameters of 1.0, 1.1, 1.2 and 1.3 mm and pilot drill depths of 1, 2, 3, 6 and 10 mm. Five implants were inserted for reference purposes to establish comparability. Thicknesses of bone compacta were measured via micro-computer tomography. Insertion torques of orthodontic mini-implants and therefore primary stability varied greatly, depending on bone quality, implant-design, and preparation of implant site. Compared with the tomas-pin, the Dual Top screw showed significantly greater primary stability. Torque moments beyond 230 Nmm caused fractures of 9 Dual Top screws. Compacta thickness, implant design and implant site preparation have a strong impact on the primary stability of mini-implants for orthodontic anchorage.[7]

In another study, Wilmes B et al analyzed the impact of bone quality and pre-drilling diameter on the insertion torque of five different mini-implants. Twenty pig bone segments were dissected and embedded in resin. The insertion torques of two different mini-implant types (Tomas Pin, Dentaurum, Germany, 8 and 10 mm; and Dual Top, Jeil, Korea, 1.6 mm × 8 and 10 mm plus 2 mm×10 mm) were measured. After preparation of the implant sites using pilot drill diameters 1.0, 1.1, 1.2 and 1.3mm, 30 implants were inserted into each bone segment. Five reference implants were inserted into each segment for comparison. Micro CT evaluated bone compacta thickness. Insertion moments of orthodontic mini-implants, and hence primary stability, varied strongly depending on compacta thickness, implant

design, and pre-drilling at the implant site. The Dual Top consistently showed higher primary stability than the Tomas Pin. Insertion moments higher than 230 Nmm resulted in fractures in some cases. Compacta thickness, implant design and preparation of implant site affect the insertion torque of mini-implants for orthodontic anchorage.[8]Wilmes B et al evaluated the threshold torque values resulting in the fracture of various mini-implant types and diameters. Forty-one different mini-implants with diameters ranging from 1.3 to 2.0 mm (Aarhus screw, Abso Anchor, Ancora, Bone screw, Dual Top, Lomas, MAS, O.S.A.S, Ortho Easy, Spider Screw, and Tomas pin) were inserted in acrylic glass by a robot system. Ten specimens of each mini-implant type were tested. The insertion torque was measured and the maximum torque at the time of mini-implant fracture was evaluated. Significance of the mean value differences was evaluated by Kruskal-Wallis tests. Fracture moments varied depending on the diameter of the mini-implants. The measured values ranged from 108.9 Nmm (MAS 1.3×11 mm) to 640.9 Nmm (Lomas 2.0×11 mm). The differences were highly statistically significant ($P<0.001$). The risk of mini-implant fracture should be borne in mind at the time of insertion, especially if mini-implants with a small diameter are employed.[9]

CONCLUSION

Under the light of above obtained data, it can be concluded that stability of 8 mm orthodontic mini-screws is higher than that of 6 mm mini-screws. Therefore, we recommended further studies in future for better exploration of results.

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