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The Clinical Success of Self-tapping and Self-drilling Orthodontic Miniscrews

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ABSTRACT: Researches stated that overheating during drilling, poor primary stability caused by overdrilling, inflammation, or local disturbances could have prevented normal healing in the early period. The theory was further supported by the higher cumulative survival of mini-implant systems in the maxilla. So, the aim of the current study was to investigate the clinical success of self-tapping and self-drilling orthodontic microimplants. Of the 57 patients, 49 were women and 8 were men. Self-tapping and self-drilling microscrew were randomly located in left and right side of maxillary of patients, respectively. All patients were under local anesthesia for insertion of the mini-implants. Then patients asked to impress their feeling for pain based on pain scale from 0 to 10 based on numeric rating NRS). In the second referred, the inflammation, hyperplasia and hemorrhage monitored in all patients. The mobility was checked from the second referred and continued for 6 months after placement. Force application was done using 200 g for 6 months. According to de results, of both methods was 93% and only 7% of patients faced the mobility of miniscrews. The inflammation was observed in 8.8% of miniscrews. The Chi-square test results revealed there was significant correlation between mobility and inflammation P = 0.022. 2.47 (based on NRS) but there was no significant difference among two groups. These results suggest there is no difference for self-tapping and self-drilling orthodontic miniscrews.

Keywords: Self-tapping, Self-drilling, Orthodontic microimplants

INTRODUCTION

Orthodontic anchorage is defined as resistance to unwanted movement of the tooth. In the anteroposterior dimension, 3 anchorage situations are traditionally defined by the ratio of
retraction to molar protraction. While moderate anchorage entails reciprocal space closure, maximum anchorage means that most of the space is closed by retraction of the incisors, and minimum anchorage means that most of the space is closed by protraction of the posterior segments. Absolute anchorage, when the anchorage parts keep on fully immobile, is occasionally desirable but is usually unreachable with traditional orthodontic mechanics. The exception is the incidence of ankylosed teeth in the anchorage part. Beneath these exceptional circumstances, forces applied to those teeth are entirely transferred to the nearby skeletal structures. This condition is occasionally named skeletal anchorage and, by the above definition could also be called absolute anchorage (Baumgaertel *et al.* 2008).

However, undesirable tooth movement, leads to anchorage loss, is a chief pitfall of these anchorage strengthening techniques. Within a decade, several kinds of noncompliance skeletal anchorage arrangements such as implants, onplants, mini plates and mini- or microscrews (Kim *et al.* 2005) have gained in acceptance between clinicians, as a means to get absolute orthodontic Miniscrews, which were first introduced by Kanomi (1997) to avoid undesirable tooth movement, can be easily placed into various locations in alveolar bone due to their small dimensions. The insertion procedure does not involve extensive trauma, and they can bear load immediately after placement. Moreover, they are easy to remove and involve relatively lower treatment costs compared with implants and onplants (Park et al Nevertheless, as a disadvantage, miniscrews could be remove simply with low elimination torques in comparison to implants because of their slight diameters and short lengths (Costa *et al.* 1998).

Because of the challenge of controlling reciprocal tooth movement in noncompliant patients, periodontically compromised patients, and those with a reduced number of teeth undergoing orthodontic treatment (Block and Hoffman, 1995; Baumgaertel, 2014) anchorage systems have been described in the literature over the past decades (Melsen *et al.* 1998; da Cunha *et al.* 2015). The wide acceptance orthodontic mini-implant as a temporary anchorage device can especially be attributed to minimal anatomic limitations for placement, thus broadening the clinical applications. Obtaining an efficient interface between mini-implant and bone tissue & continues to be the key point to achieving higher success rates (Papadopoulos and Tarawneh, 2007; Coletti *et al.* 2007). The recommended position is between the first molar and second premolar level of the attached and unattached gingiva. In this position avoidance of injury to the roots cannot be guaranteed (Roccia *et al.* 2005; Gibbons al. 2007; Dao *et al.* 2009). Researches stated that overheating during drilling, poor primary stability caused by overdrilling, inflammation, or disturbances could have prevented normal healing in the early period. The theory was further supported by the higher cumulative survival of mini implant systems in the maxilla than in the mandible (Park, 2003). Because bone density is high in the mandible, implants can have high torque and good initial stability. Overheating of the pilot drill causing bone damage, might contribute to the high failure rate, so copious irrigation with saline solution was needed. The self-drilling method, a new technique, was used in recent studies (Xun *et al.* 2007). Its placement procedure is simplified, without pilot drilling and incision. Even though success rates were diverse, it was believed that failure rates might be further reduced with increasing clinical experience and perfecting of the placement technique. To date, few clinical studies have assessed miniscrew success rates, the predictability of placement techniques, or the management of risk factors for failure. So, the aim of the current study was to investigate the clinical success of self-tapping and self-drilling orthodontic miniscrew on subsequent inflammation and pain in patients.

MATERIAL AND METHODS

The study sample consisted as in vivo study. The mini-implants were designed originally for the purpose of achieving anchorage in orthodontic tooth movement. Of the 57 patients, 49 were women and 8 were men. The minimum age for the patients was 15 years. Then the patients were treated for Cl II malocclusion and retraction of maxillary teeth. Special attention was required during mini implant placement to decrease the incidence of injury to delicate anatomic structures like vessels, nerves and dental roots. All patients were under local anesthesia for insertion of the mini-implants Self-tapping and self-drilling miniscrew were randomly with respect of priority located in left and right side of maxillary, self-drilling for the right side and self-tapping for the left side. Screws purchased from Jeil Medical Corporation, Seoul, South Korea (the image is presented below). The coordination of the screws was: 1.4 mm in diameter and 8 mm height, titanium alloy. Screws were placed between first molar and second placed at 90ø to buccal surface of alveolar of the maxillary bone (Park *et al.* 2006). All miniscrews placed by an expert orthodontist, to subsequent experimental error. A pilot hole was drilled with physiologic serum on that part which self-tapping screws intentioned Park *et al.* 2006). Then patients asked to impress their feeling for pain based on pain scale from 0 to 10 based on numeric (Breivik *et al.* 2008). In the second referred, the inflammation, hyperplasia and hemorrhage monitored in all patients. The mobility was checked in the second referred and continued for 6 months after placement. Force application was done after 2weeks to 1 month after application, using 200 g for 6 months.

Statistical analysis: Data obtained from pain score or inflammation proceed in excel then analyzed by one-way analysis of variance (ANOVA) using SPSS 16.0 for Windows. For treatment showing a main effect by ANOVA, Chi-square test and t-test were used. $P<0.05$ was considered as significant differences between treatments.

RESULTS

The effects of self-tapping and self-drilling orthodontic microimplants on inflammation and pain on patients are presented in figs. 1-5.

Effect of self-tapping and self-drilling orthodontic miniscrew s on pain frequency is shown in Fig. 1. According to the data, the observed pain score was between 0-7 based on NRS (0 stands for less and 7 for high) but this score is from 0-10 and in this study there was no report for scores 8, 9 and 10. As seen, the frequency for score 1 was much more than the others. Also, the score 3 was reported by 30 miniscrews. According to the results, the in the inflammation was only in 8.8% of patients (green section). So, it seems the self-tapping and self-drilling orthodontic miniscrew had scarce effect on inflammation accuracy.

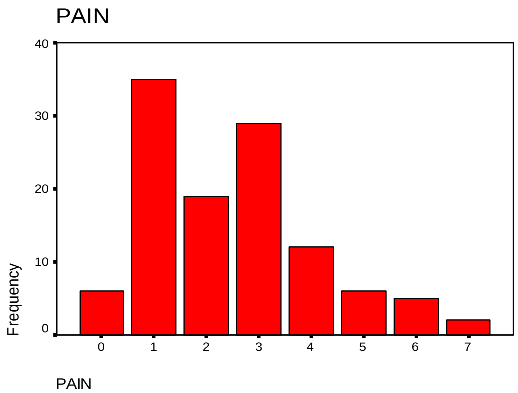

Fig. 1. Effect of self-tapping and self-drilling orthodontic microimplants on pain frequency.

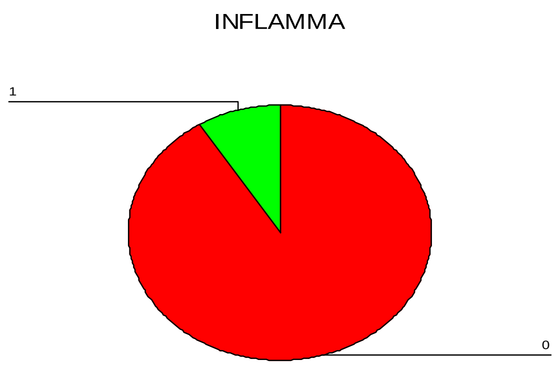

Fig. 2. Effect of self-tapping and self-drilling orthodontic miniscrews on inflammation. 1: inflammation, 0: without inflammation.

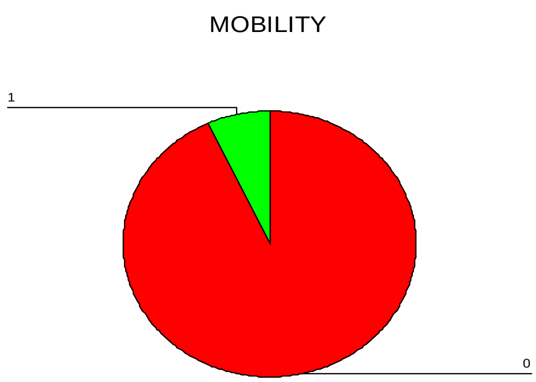

Fig. 3. Effect of self-tapping and self-drilling orthodontic miniscrews on mobility. 1: Mobility, 0: without mobility.

As seen in Fig. 3, the mobility was detected in only 1.1 percent of self-tapping and self-drilling orthodontic miniscrews -treated patients.

Fig. 4 reveals effect of age on success of self-tapping and self-drilling orthodontic miniscrews. The mean of age was 25.7.

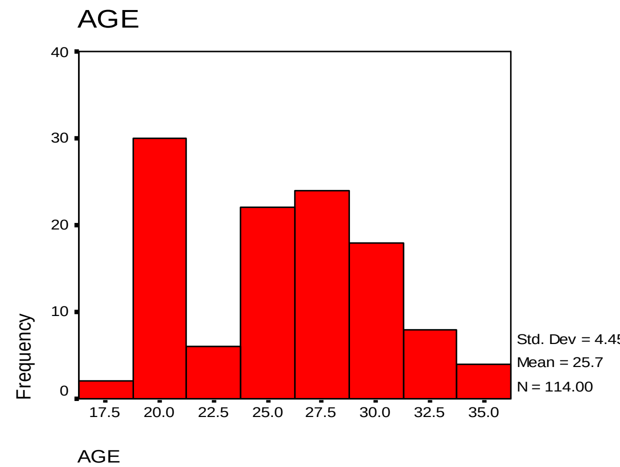

Fig. 4. Effect of age on success of self-tapping and self-drilling orthodontic microimplants.

As seen in Fig. 5, there was no significant difference on right or left self-tapping and self-drilling on inflammation incidence. According to the Chi-square test the difference was not significant p = 0.7. Also, Chi-square test revealed there was a significant difference on pain between both sexes P = 0.03. Also, a significant correlation observed between mobility and inflammation P = 0.022.

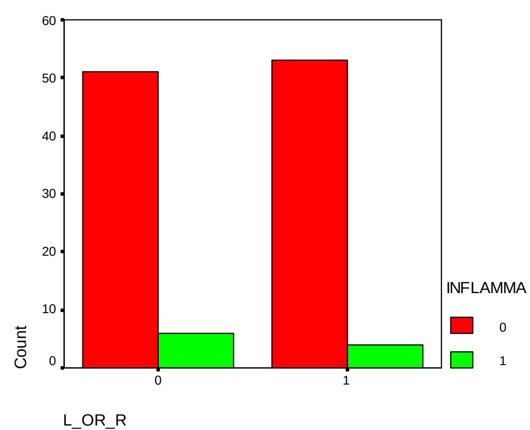

Fig. 5. Effect of right or left self-tapping and self-drilling on inflammation. 0: self-drilling, 1: self-tapping.

DISCUSSION

Anchorage control is the most important factor in successful orthodontic treatment. Various techniques have been devised and used in orthodontic practice to strengthen anchorage. Traditional techniques, like use of a multi-bracket appliance, extra oral anchorage by headgear and functional therapies, cannot effectively control anchorage, especially in adult patients. The reinforcement of anchorage requires complicated biomechanics and good patient compliance. Application of the mini-implant as alternative anchorage for various types of tooth movement has been demonstrated (Tseng *et al.* 2006).

Maino *et al.* (2003) u used implants to provide anchorage when retracting the maxillary. Kyung *et al.* (2003) applied mini-implant anchorage to stretch inferior second molars to first molar extraction sites. Carano *et al.* (2005) used the mini-implants to provide anchorage during incisor intrusion. Lee *et al.* (2004) that midpalatal mini-implants could be effectively used for intrusion of maxillary molars. The principle gateway of stability for mini-implants is a mechanical lock within the bone. Poor quality or an insufficient quantity of available bone may cause lack of retention of the mini-implant. Oral hygiene could also influence the success rate of mini-implants. According to the results, it seems the self-tapping and self-drilling orthodontic miniscrews had scarce effect on inflammation accuracy when hygiene quality is optimum. Also, mobility was detected in only 1.1 percent of tapping and self-drilling orthodontic miniscrews -treated patients. Additionally, there was no significant difference on self-tapping and self-drilling groups on inflammation incidence.

According to the data, the observed pain score was between 0-7 based on NRS. A commonly used clinical measure of pain is the NRS. Patients are asked to indicate the intensity of pain by reporting a number that best represents it. The NRS is easy to administer verbally in a clinical setting and is a familiar clinical tool. Also, the visual analog scale (VAS) has been used extensively in clinical research. An advantage of the VAS is that pain is measured continuously. The reliability and validity of the VAS in the ED setting have been demonstrated. The lowest clinically significant difference in pain can be identified by patients has been recognized and validated in several diverse data sets (Bijur *et al.* 2003). Screw implants fails for numerous causes. The reasons of dental implant failure are host aspects (osteoporosis and diabetes and smoking), surgical factors of improper surgical method.

These factors have adverse effect on failure of screw implants, though, should be elucidated in a forthcoming study (Ashley *et al.* 2003).

Surgical factors include improper surgical techniques like lack of initial stability, overheating during placement, and the fitness of the pilot hole to the diameter of the screw implant. In current study, all screw implants were placed by same dentist using similar technique

the surgical factors had no effect on the clinical success. Nevertheless, using this procedure,

dentists may have acceptable success in practice. Management causes can count as poor care, inflammation, oral hygiene and even excessive load. In a previous study 6 of 12 failed screw implants failed within 2 months post placement. The other 6 screw implants failed until 10 months, and the cause might be might indicate surgical and management actions are crucial for screw implant success (Park, 2003). Current study is a novel field our knowledge is less about the reasons that affect the success of screw implants. Screw implant features, host related issues such as recipient sites, procedure and environmental management were evaluated. Amongst them, local host and management factors are the most important ones (Park *et al.* 2007).

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