Available online at www.sciencedirect.com

SciVerse ScienceDirect

journal homepage: www.elsevier.com/locate/mjafi

Original Article

Clinical evaluation of immediate loading of titanium orthodontic implants

Col S.S. Chopra [a,*], Surg Lt Cdr A. Chakranarayan [b]

[a] Senior Specialist (Orthodontics), Department of Dental Surgery, AFMC, Pune 40, India
[b] Graded Specialist (Oral & Maxillofacial Surgery), INHS Nivarini, Chilika, Orissa, India

ARTICLE INFO

Article history:
Received 20 March 2010
Accepted 21 January 2012
Available online 23 October 2012

Keywords:
Orthodontic micro implants
Retraction
Anchorage

ABSTRACT

Background: Skeletal anchorage using dental implants, miniplates, miniscrews and microscrews provides an absolute anchorage for tooth movement. Miniscrew and microscrew implants have many benefits such as ease of placement and removal and immediate orthodontic force application.

Methods: Fifteen subjects in the permanent dentition with an overjet ≥6 mm received treatment with the 0.018-inch pre-adjusted edgewise appliance system (Roth prescription) and extraction of all first premolars. Titanium orthodontic implants were placed in both the upper quadrants and were immediately loaded with elastic chain from the implant head to the sectional arch wire.

Result: The overall success rate of immediate loaded titanium orthodontic micro implants (OMI) in the present study was 83.33%, with a mean chairside time of 15.33 min of placing two implants in each patient. Peri-implant inflammation was the only complication observed. Most failures were in the initial part of the study. There was no significant difference in the success rate of implants based on sex, side of placement (right or left) and type of malocclusion.

Conclusion: The OMIs used in the present study proved to be effective and well tolerated in producing immediate orthodontic anchorage for the retraction.

Introduction

Orthodontic treatment is a complex process, requiring a method that balances the orthodontic biomechanics of an individual patient. Anchorage control is the cornerstone of the orthodontic force system. Anchorage is provided by the teeth that resist the forces of reaction generated by the active components of the appliance. Any unwanted tooth movement must be controlled; else the underlying malocclusion will worsen during tooth alignment.

Anchorage is a challenging aspect of orthodontic treatment. Conventional anchorage methods generally rely on patient compliance, result in unwanted reciprocal tooth movements and are a limiting factor in patients with compromised dentition. In an effort to overcome some of these problems, skeletal anchorage has been increasingly incorporated into orthodontic treatment.

Various forms of sliding mechanics have replaced closing loop arches, with the increased use of pre-adjusted appliance. Sliding mechanics have the benefits of minimal wire-bending

* Corresponding author.
E-mail address: drsschopra@hotmail.com (S.S. Chopra).
0377-1237/$ – see front matter © 2012, Armed Forces Medical Services (AFMS). All rights reserved.
http://dx.doi.org/10.1016/j.mjafi.2012.06.020

time and adequate space for activations. The retraction of four incisors after canine retraction is accepted as a method to minimize the mesial movement of the posterior teeth segment, whereas en masse retraction of six anterior teeth may create anchorage problems. In addition, the tipping action built into anterior brackets in pre-adjusted appliances may produce problems of anchorage. These problems may be overcome to some extent by the use of a transpalatal arch and extraoral appliances. Intraoral anchorage devices may provide inadequate anchorage, whereas extraoral appliances provide a suitable anchorage but are dependent on patient compliance. Skeletal anchorage using dental implants, miniplates, miniscrews and microscrews provides an absolute anchorage for tooth movement. By using microscrew implants in the mechanics of en masse retraction of six anterior teeth, treatment time can be reduced effectively and clinicians can move teeth to satisfy the treatment goal without patient compliance for anchorage devices.

The aim of the present study was to clinically evaluate immediate loading of titanium orthodontic micro implants (OMI) in the maxillary arch for anchorage control for en masse retraction of maxillary anterior segment in conjunction with the pre-adjusted edgewise appliance orthodontic therapy.

The objectives were to study the following aspects of titanium orthodontic micro implants for anchorage control:

(i) The clinical chairside time required for placement of OMI.
(ii) Patient tolerance to the surgical procedure of OMI placement.
(iii) OMI failure, if any.
(iv) Patient tolerance to immediate loading of the OMI.
(v) Ease of removal of the OMI at the scheduled end of therapy.

Material and methods

The subject material consisted of 15 patients seeking orthodontic treatment for correction of protrusion of maxillary anterior teeth. All patients had an overjet $\geq$6 mm and a minimum age of 12 years at the beginning of treatment (to ensure optimal patient compliance) and no congenitally missing teeth (except for the third molars). There was no history of digit sucking, mouth breathing or previous orthodontic treatment. Maximum anchorage was predicted on the need to restrict mesial movement of posterior teeth so that the excessive overjet could be resolved through complete retraction of the upper anterior teeth en masse.

All patients received treatment with the 0.018-inch Roth prescription pre-adjusted edgewise appliance system and extractions of upper and lower first premolars. Once the initial leveling and aligning was complete, segmental (canine to canine) 0.017 $\times$ 0.025-inch stainless steel arch wire, with distal end of arch wire bent mesially (distal to canines), was fixed to engage the elastic chain in the upper arch. Titanium orthodontic implants (1.3 mm in diameter and 8 mm in length) were surgically inserted between the roots of the first molar and the second premolar in both upper quadrants.

All patients were made to rinse with 0.02% chlorhexidine immediately prior to the surgical procedure to reduce the intraoral bacterial load. Topical anesthesia was used prior to infiltration anesthesia to reduce needle prick pain. 0.5 ml of 2% lignocaine with 1:80,000 adrenaline was sufficient for this simple surgical procedure, to insert the Titanium orthodontic implants. The aim was not to achieve profound anesthesia of the teeth, instead get numbness of soft tissue only. It was prudent for the teeth to have some sensitivity, as the patient's complaint of discomfort in the event of bone drill contacting the roots of the teeth would be an indicator to redirect the drill away from the roots.

Speed-reduction contra angle hand piece with constant normal saline irrigation was used to make the original entry into the bone. A round bur (0.9 mm diameter) was used to first make a small indentation on the bony surface. Small indentation on the bone surface prevented slippage of pilot drill. The diameter of the pilot drill end was 1 mm. The drill was used to penetrate the mucosa, attached gingiva and underlying bone without a surgical flap. A slow drill speed (400–500 RPM) with constant normal saline irrigation for reducing the heat and to keep the surgical site lubricated was used. A long hand driver was used for driving the OMI perpendicular to the bone surface.

The OMI's were checked for stability and were immediately loaded with elastic chain from the implant head to the sectional arch wire. The elastic chains were calibrated to deliver 150 g of force on each side, for en masse retraction of the upper anterior teeth. Conventional mechanics were used for the lower arch.

Follow-up appointments were scheduled after 24 h and 7 days of placement of the OMI and subsequently every 3–5 weeks until the desired amount of tooth movement had been achieved. After the space-closure phase, customary orthodontic treatment proceeded without interruption. On achieving appropriate angulation and inclination of teeth and optimum overjet and overbite, debonding and debanding of the cases was done and implants removed. Implant removal was done without the use of local anesthesia, by un-screwing the OMI with the long hand screw driver.

The data were obtained by clinical evaluation of the implants at each appointment and by self-administered questionnaire, for assessment of the patient's perception, level of motivation for and experiences with the OMIs.

Five clinical variables were investigated. The variables were divided into two categories: host factors and environmental management factors. Host factors were related to age, sex and side of screw placement i.e. right or left. Environmental management factors were oral hygiene and inflammation around the screw implants.

Mobility of OMI's was checked with cotton tweezers at each appointment after placement. There were 2 groups: yes (mobile) and no (not mobile) based on the presence or absence of any discernible mobility. If there was any discernible mobility, the screw implant was considered to have failed.

Each patient received a retrospective questionnaire which included a 10-point visual analog scale (VAS) concerning discomfort caused by the OMI surgery, not by the adjustment of the orthodontic appliances. They were asked whether they experienced any of the following forms of discomfort after implantation: pain (time course and intensity), swelling, difficulty in chewing, speech difficulty and difficulty in tooth