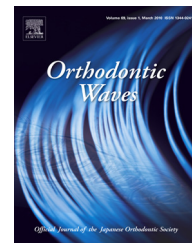


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Original article

Non-surgical treatment of anterior open bite using miniscrew implants with posterior bite plate

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ABSTRACT

Purpose: This study describes the quantitative relations between the intrusion of posterior teeth and changes in overbite and lower anterior facial height after treatment of open bite patients with miniscrew implants and posterior bite plates. The study also assessed changes in masticatory muscular activity that may result from the use of bite plate.

Materials and methods: Fifteen patients (mean age \pm SD = 20.6 \pm 4) with anterior open bite were treated with two miniscrew implants in each side of posterior maxillary dentoalveolar bone and fixed posterior bite plate. Changes in upper posterior dental height (UPDH), overbite (OB) and lower anterior facial height (LAFH) were measured using cephalographs. Activities of masseter and anterior temporalis muscles during clenching and swallowing were assessed before treatment, after placement of bite plate and after removal of the plate. Linear regressions were used to investigate the relationships between morphologic parameters, and paired t-test was used to test changes in muscular activity.

Results: Linear relationships were found between posterior teeth intrusion and the increase of overbite and reduction in LAFH. Each 1 mm intrusion improves the open bite by 1 mm and the LAFH by 0.7 mm. The muscular activity decreased after placement of the plate but recovered immediately after its removal.

Conclusion: Outcomes after treatment with miniscrew implants and bite plate can be predicted by the amount of intrusion in posterior teeth. The bite plate seems not to affect the muscular activity after removal of the plate.

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1. Introduction

Temporary anchorage devices (TADs) like miniscrew implants (MSIs) and miniplates are commonly used in modern

orthodontic treatment. They present reasonable stability along the treatment and facilitate treatment plans that were difficult or impossible before [1–3]. Skeletal anterior open bite (AOB) malocclusion in adults is one of the most difficult types of malocclusion that may face an orthodontist. In severe cases

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it is usually required to either have a combined orthodontic and surgical treatment or to use extraoral appliances [4]. Recently this type of malocclusion has been efficiently treated with TADs eliminating the need for surgery or the use of extraoral appliances [5]. The treatment core concept depends on intrusion of maxillary posterior teeth allowing forward autorotation of the mandible. Autorotation of the mandible will contribute to the closure of the AOB and decrease the lower anterior facial height which is usually increased in this type of malocclusion. Autorotation will also advance the chin, which is a favorable effect if the open bite is accompanied with class II component.

Some authors delivered the intrusion force to posterior teeth through brackets attached to teeth, while others used posterior bite plates bonded on posterior teeth (Table 1). The later method seems to provide more control on the buccolingual inclination of the posterior teeth during intrusion and is preferable in the cases where considerable amount of intrusion is required.

The currently available studies that used TADs for correction of AOB reported inconsistent results in regard to the necessary amount of intrusion of posterior teeth. The inconsistency may be partially related to the variation among studies and among the subjects of each study in age of subjects and the severity of open bite before treatment. Scheffler et al. [6], for example, studied a group of patients whose age ranged between 13 and 48. The initial average open bite ranged -1.2 to -4.0 mm (Table 1). It would be useful from the clinical perspective to know how much correction of open bite correction we may obtain for a certain amount of intrusion. Availability of such information may help choose the appropriate treatment approach for each patient according to the severity of open bite, expect the necessary treatment time, and determine the feasibility of complete correction of open bite. In the current study, we described the relations between the amount of intrusion achieved using MSIs and

posterior bite plate and the changes in over bite and lower anterior facial height. We also assessed the muscular activity before and after treatment to investigate the effect of bite plate on masticatory muscles.

2. Materials and methods

2.1. Sample and treatment procedures

Fifteen consecutive non-growing subjects with anterior open bite were recruited for the study. The inclusion criteria were that overbite <-1 mm and mandibular plane angle (MPA) ≤ 40 degrees. Patients who had systemic diseases or syndromes were excluded. The power of study was more than 80% for detecting a standardized change in overbite of 0.8, whereas $SD=1.7$ mm for overbite in AOB malocclusion in adults [10]. Treatment plan and the nature of the study were explained for each patient, and informed consent was obtained. The study was approved by the Academic Committee for Research Ethics in Damascus University. The sample consisted of seven males and eight females, and average age (SD) was 20.6 (4) years. They had average overbite (SD) equal to -3.7 (1.9)mm, and average MPA (SD) equal to 46.9 (5) degrees.

Each patient received four miniscrew implants (Dewimed Medizintechnik GmbH, Tuttlingen, Germany), two in each side of the maxilla. In each side, one implant is placed between second premolar and first molar, and a second implant is placed between the first and second molars. All miniscrew implants had 1.8mm-diameter and 8mm-length, and were placed by the same author (Y.A.) using self-drilling technique. A 3mm-thick bite plate was constructed for each patient with two transpalatal bars to control the buccolingual inclination of posterior teeth during intrusion, as illustrated in Fig. 1A. The plate was fixed with glass ionomer cement all the time of treatment. Two coil springs (G&H Orthodontics, Franklin, IN)

Table 1 – Summary of studies that used TADs with biting plate to intrude posterior teeth in patients with AOB malocclusion.

	N Age (yrs) Initial OB	Mean and range of period of treatment (months)	TAD type and position	Δ UPDH Δ OB Δ LAFH Mean (SD)
(Scheffler et al., 2014) [6]	30 12.7~48.1 -1.2 (SD 1.7)	6 (3.6-9.6)	One MSI 5-6 or 6-7	-2.3 (1.4) 2.2 (1.6) -1.6 (2.2)
(Foot et al., 2014) [7]	16 12.2~14.3 -2.2 (SD 1.7)	4.9 (2.5-7.7)	Two MSIs 4-5-6	-2.2 (1.7) 3.0 (1.5) -0.9 (1.1)
(Akan et al., 2013) [8]	19 17.7 -3.2 (SD 1.4)	6.8 (SD 1.6)	Zygomatic miniplate	-3.4 (1.2) 4.8 (1.4) -4.2 (1.7)
(Erverdi et al., 2007) [9]	11 19.5 -4.0	9.6 (SD 1.8)	Zygomatic miniplate	-3.6 5.1 -2.9

UPDH; upper posterior dental height, OB; overbite, LAFH, lower anterior facial height.

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