Comparison of the intrusive effects of miniscrews and utility arches

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Introduction: The aim of this prospective study was to compare the effects of incisor intrusion obtained with the aid of miniscrews and utility arches. **Methods:** Twenty-four patients (10 male, 14 female) with a deepbite of at least 4 mm were divided to 2 groups. In group 1, 13 patients (3 male, 10 female; mean age, 20.90 ± 7.12 years) in the postpubertal growth period were treated by using miniscrews; in group 2, 11 patients (7 male, 4 female; mean age, 15.25 ± 3.93 years) were treated with utility arches. Lateral cephalometric headfilms were taken at the beginning of treatment and after intrusion for the evaluation of the treatment changes. Statistical analyses of the data were performed with a significance level of $P < 0.05$. **Results:** Intrusion lasted 6.61 ± 2.95 months for group 1 and 6.61 ± 2.46 months for group 2. The changes in the center of resistance of the incisors were 1.75 ± 0.4 mm ($P < 0.05$) for group 1 and 0.86 ± 0.5 mm ($P > 0.05$) for group 2; the difference between the groups was significant ($P < 0.05$). In the miniscrew group, the incisors were protruded 0.79 ± 1.4 mm ($P > 0.05$) relative to pterygoid vertical and 3.85° ± 2.4° ($P > 0.05$) relative to the palatal plane. In group 2, the incisors showed 3.91 ± 0.7 mm ($P < 0.05$) of protrusion relative to pterygoid vertical and 13.55° ± 2.4° ($P < 0.05$) relative to the palatal plane. The maxillary first molars showed significant distal tipping in group 2 ($P < 0.05$). **Conclusions:** Unlike with utility arches, true maxillary incisor intrusion can be achieved by application of intrusive forces close to the center of resistance by using miniscrews with no counteractive movements in the molars. (Am J Orthod Dentofacial Orthop 2011;139:526-32)

Correction of a deep overbite with incisor intrusion is an important stage during orthodontic treatment. Nonsurgical correction of deepbite involves either extrusion of posterior teeth, intrusion of incisors, or both.[1-5] The treatment of choice depends on a variety of factors such as smile line, incisor display, and vertical dimension.[6] The treatment for patients with normal vertical development and gummy smiles involves maxillary incisor intrusion.

Conventional methods of incisor intrusion usually involve 2 × 4 appliances such as utility arches, 3-piece intrusion arches, or reverse curved arches.[7-20] Labial tipping of the anterior teeth is commonly the outcome of these arches and gives the impression of deepbite correction from the change in the vertical incisal edge positions.[3,4,6,20] However, incisor protrusion is not the desired effect in patients with normal axial inclinations and in extraction patients who will need incisor retraction.

The introduction of skeletal anchorage as a source of stationary anchorage to orthodontic forces has made most complex tooth movements simple.[21-32] Because of their small dimensions, miniscrews offer the advantages of immediate loading, multiple placement sites, relatively simple placement and removal, placement in interdental areas where traditional implants cannot be placed, and minimal expenses for patients.[33] It has been shown that miniscrews can be loaded to forces up to 500 g and yet stay intact until the end of the treatment.[34] Previously, 2 case reports have been published showing miniscrew-supported incisor intrusion.[35,36] Moreover, in a clinical study that incorporated the records of some patients in this study, it was shown that true incisor intrusion can be achieved with simple mechanics via miniscrews with only minimal protrusion of the anterior teeth.[37] However, the orthodontic literature lacks comparative clinical studies on the effects of miniscrew-supported incisor intrusion and conventional methods. In this study, we aimed to compare the effects of incisor intrusion obtained with miniscrews and utility arches.

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Table I. Mean ages and treatment durations of the study groups

	Patients (n)	*Age at T1 (y)*	*Period of intrusion (mo)*
Group 1 (miniscrew)	13	20.90 ± 7.12	6.61 ± 2.95
Group 2 (utility arch)	11	15.25 ± 3.93	6.61 ± 2.46

MATERIAL AND METHODS

The sample of this prospective study comprised 24 patients (10 male, 14 female) with deepbite who sought orthodontic treatment at the Department of Orthodontics at Baskent University in Ankara, Turkey. The criteria for selection of the treatment group were (1) a deepbite of at least 4 mm, (2) excessive gingival display on smiling, and (3) normal vertical dimensions represented by a GoGnSN angle of 32° ± 6°.

This study was approved and supported by the Medical Scientific Ethics Committee (project D-KA06/07) of Baskent University. Informed consent forms were obtained from the patients or parents. The patients were divided into 2 groups. In group 1, 13 patients (3 male, 10 female; mean age, 20.90 ± 7.12 years) in the postpubertal growth period were treated by using bone anchorage; in group 2, 11 patients (7 male, 4 female; mean age, 15.25 ± 3.93 years) were treated by using utility arch mechanics (Table I). The records of 11 subjects in group 1 were used in a previous study.[37]

In group 1, brackets were bonded to the 4 maxillary incisors only, and the teeth were leveled with 0.016-in and 0.016 × 0.022-in nickel-titanium segmental wires. After leveling, a 0.016 × 0.022-in stainless steel wire was bent to the maxillary anterior segment with small hooks at its distal ends for intrusion. Two miniscrews (Absoanchor, Dentos, Taegu, Korea), 1.2 mm in diameter and 6 mm in length, were placed distally to the maxillary lateral incisors under local anesthesia. The implants were placed at the mucogingival junction into the bone without drilling. Placement was carried out by the same oral surgeon (F.V.). The screws were loaded 1 week later with medium super-elastic nickel-titanium closed-coil springs, and an intrusion force of 80 g was applied (Fig 1). Control appointments were every 4 weeks, and the force levels were checked at every appointment.

In group 2, brackets were bonded to the 4 maxillary incisors, and bands were cemented to the maxillary first molars. The incisors were leveled with passive preformed nickel-titanium utility arches. At the end of leveling, custom-made utility arches were made from 0.016 × 0.016-in blue Elgiloy wire (Rocky Mountain Orthodontics, Denver, Colo). Before the placement of the utility arch, a 45° tip back to the molar section was given, and the arch was cinched back.

Fig 1. Application of the implants distally to the maxillary lateral incisors.

No other treatment was performed until intrusion was completed.

Two conventional lateral cephalometric headfilms of the patients, one at the beginning of treatment (T1) and the other at the end of intrusion (T2), were obtained. All cephalograms were traced by the same investigator (O.P.O.) over a negatoscope in a dark room using a 0.3-mm lead pencil. Twenty-one landmarks were located, and 19 measurements (9 angular, 10 linear) were made on the cephalometric tracings (Fig 2). Two vertical reference planes for constructed for measurement confirmation of the dental movements. The first reference was the pterygoid vertical (PTV) drawn perpendicular to the sella-nasion (SN) plane, and the second was drawn perpendicular to the constructed horizontal plane (7° to the SN plane) from the point of intersection of the anterior wall of sella turcica and the anterior clinoid process (VR). The center of resistance (CR) of the maxillary central incisor was determined for each patient rather than the CR of the anterior segment because of its ease of location and high reproducibility.[38] The CR of the maxillary central incisor was taken as the point located at one-third of the distance of the root length apical to the alveolar crest.[39]

Periapical radiographs were obtained for each patient in group 1 at T1 and T2 to determine any signs of root resorption.

Statistical analysis

One week after T1, 10 radiographs were retraced by the same investigator to determine the method error. Spearman rho correlation coefficients, calculated for repeatability, were found to be over 0.85. Descriptive statistics for age, duration of treatment, mean differences, standard deviations, and minimum and maximum values were calculated between T1 and T2. The data were checked for normal distribution by using the Shapiro-Wilks test. According to the results of this test, a paired *t* test or a Wilcoxon signed rank test was