Treatment outcomes of archwise distraction osteogenesis in mandibular dentoalveolar retrognathia cases


Abstract. The aim of this study was to describe the treatment of class II malocclusion by sagittal advancement of the alveolar bone in the symphyseal area using an intraoral archwise distractor device and to determine the effects of this method on the dentoalveolar complex. Fifteen patients (10 female, five male) aged 16–20 years with a class II division 2 malocclusion, characterized by mandibular dentoalveolar retrusion and a prominent chin, underwent archwise alveolar distraction in the anterior mandible. Lateral cephalometric radiographs were obtained before distraction (T0), after 6 weeks of consolidation (T1), and after debonding (T2). Linear and angular skeletal, dental, and soft tissue measurements were performed. Forty-seven parameters were measured for each of the 15 subjects on pre- and postoperative lateral cephalometric radiographs (T0, T1, and T2). The distraction protocol was successful in all patients. Skeletally, the mandible showed a clockwise rotation. B-point moved forward significantly ($P < 0.05$). Overjet decreased significantly ($P < 0.001$). The total profile angle was unaffected, and the improvement in the submental fold was highly significant ($P < 0.001$). The intraoral archwise distraction force that is applied through brackets and archwires is sufficiently effective for alveolar advancement. This procedure is simple and effective in the treatment of specific adult patients with a class II division 2 malocclusion, characterized by a prominent chin and severe mandibular dentoalveolar retrusion.

Key words: alveolar distraction osteogenesis; mandibular dentoalveolar retrusion; archwise distraction.

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Following the introduction of the Angle classification by Edward Angle in 1899, the aetiology of class II malocclusions and their treatment have been the subject of numerous investigations. The two divisions of class II malocclusion show very distinct differences. Class II division I cases have an increased overjet with proclined maxillary incisors and usually a short corpus length. They can have either a low angle or high angle vertical growth pattern. Accordingly, the amount of overbite can be either increased or decreased. In contrast, class II division 2 cases are characterized by a normal or low angle vertical growth pattern, mandibular dentoalveolar retrusion, a prominent chin, and an increased overbite with retroclined incisors. The corpus length is generally normal.

There are four basic categories of treatment for the correction of class II malocclusions: (1) orthognathic surgery (mandibular advancement with or without maxillary surgery); (2) fixed or removable functional appliances; (3) compensation treatment, usually with the extraction of maxillary first premolars; (4) mandibular advancement with distraction osteogenesis.

One of these treatment modalities is adopted depending on the patient’s age, remaining growth potential, and the aetiology of the malocclusion. Functional treatment is particularly beneficial for patients during childhood and adolescence. After the cessation of growth, orthognathic surgery can be an option. In the latter case, a genioplasty is usually necessary in addition to surgical advancement of the mandible in order to improve the profile. Camouflage treatment can have good outcomes in specific cases, but in many cases, the profile is usually sacrificed.

Distraction osteogenesis (DO) was first performed by Codivilla, and became widely known after Ilizarov described the method in detail. The procedure can be summarized as the periodical distraction of two bone segments that are separated with a smooth osteotomy cut. It depends on the principle of tissue regeneration parallel to the distraction vector between two bone segments. Stretching of the tissues that the bone segments are connected to stimulates not only bone regeneration between these two segments, but also regeneration and adaptation of the neurovascular bundle, muscles, and surrounding soft tissue.

The aim of this study was to describe a treatment modality for class II division 2 malocclusion by sagittal advancement of the alveolar bone in the symphyseal area and to investigate the effects of this method on the dentoalveolar complex and the profile.

Materials and methods

Fifteen consecutive patients were included in this prospective study and formed the study group. Ten were female and five were male, and they were aged between 16 and 20 years (mean age 18 years). The parent of each patient provided informed consent after receiving information that included treatment alternatives (such as camouflage treatment and orthognathic surgery) and possible complications. The study was approved by the Ethics Committee of Marmara University, Institute of Health Sciences. The following inclusion criteria were applied: class II canine relationship, incisor mandibular plane angle (IMP) greater than 90°, A-point–nasion–B-point (ANB) angle greater than 2°, overjet greater than 2 mm, normal or low angle vertical growth pattern, normal or increased overbite. Patients with a systemic bone disease, high angle growth pattern, deficient chin, anterior mandible short in height, open bite tendency, and ANB smaller than +2° were excluded.

All subjects received 0.022-inch slot brackets (Gemini; 3M Unitek, St. Paul, MN, USA) for pretreatment alignment of the upper and lower arches. Distraction osteogenesis was performed after pretreatment orthodontic alignment and skeletal correction. Distraction was performed with a combination of gradual and rapid distraction stages. Distraction was performed for 14 days followed by consolidation for 8 weeks. After 8 weeks of consolidation, occlusion was maintained with maxillary and mandibular removable orthodontic appliances.

Fig. 1. (A) Surgical release. (B) Diagram showing the osteotomy lines. (C) Panoramic radiograph obtained after 6 weeks of consolidation (T1).
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