

## Molar Uprighting Using Mini-Screws after Distalization by the Pendulum Appliance: A Case Report

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### Abstract

A 16-year-old Class II female patient was treated without tooth extraction. The upper first molars were distalized by the Pendulum appliance. After six months, the molars tipped significantly to the distal. To correct this side effect, we decided to upright the molars using skeletal anchorage. On each side, a mini-screw was inserted between first and second premolars in the buccal cortical plate. An auxiliary spring was placed between the mini-screw head and the molar buccal tube. The resultant moment made the first molar upright. In addition, the side effects of this mechanic, i.e. molar intrusion and molar buccal tipping, counteract the extrusion and medial movement caused by the Pendulum Appliance. The aim of this case report was to present an innovative method for molar uprighting using skeletal anchorage.

**Key words:** Distalization, mini-screw, molar uprighting.

### Introduction

Non-extraction treatment has gained popularity among orthodontists since the second half of the 20<sup>th</sup> century (1). Maxillary molar distalization is an increasingly popular option for orthodontic resolution of Class II malocclusions because it helps correct an increased overjet while facilitates space regaining (2). Patients with dental Class II or mild skeletal Class II relationships can be treated by maxillary molar distalization (1).

The Pendulum appliance is used to distalize the maxillary first molars in Class II non-compliant patients (1). An important side effect of this appliance is distal tipping of maxillary first molars (1,3-6).

One of the most common methods to correct the inclination of maxillary first molars is extra-oral traction (1,2). However, this technique has some limitations, of which the need for the patient compliance is perhaps the most important. In addition, the force delivered by the headgear is intermittent; hence the possible slower rate of tooth movement (1). Another method for counteracting molar distal tipping is to modify the Pendulum appliance and incorporate an uprighting bend into the distalizing spring (4). This bend, however, increases the extrusive tendency, displacement of the incisors and treatment time (7).

Skeletal anchorage has proved to be useful for various orthodontic tooth movements by minimizing the undesirable effects on the anchorage unit. Additionally, skeletal anchorage eliminates the need for the patient compliance (8). These advantages can potentially results in better outcomes. The aim of this study was to introduce an innovative method for molar uprighting using skeletal anchorage.

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## Case Report

A 16-year-old girl was referred to the Mashhad Faculty of Dentistry complaining of anterior crowding (Fig. 1). The patient's medical history showed no remarkable problems. Her facial profile was mildly convex. The clinical examination showed good facial symmetry and competent lips at rest. Intra-oral examination revealed a dental Class II malocclusion. A Class II skeletal pattern with no vertical dysplasia was confirmed by routine cephalometric analysis. There were no transverse problems.

The treatment plan for correcting molar relationship and reducing the overjet correction was a non-extraction approach via molar distalization by the Pendulum appliance. This appliance consists of an anterior acrylic Nance button which is secured on premolars by either banding or bonding. Two 0.032-inch TMA springs extend posteriorly from the acrylic plate and fit into the lingual sheaths of the first molar bands (Fig. 2).

The springs were initially activated 60-70°. After 6 months, a super Class I relationship was obtained. However, the appliance caused significant molar distal tipping and extrusion. Since the patient's cooperation was poor, a non-compliant approach to molar uprighting was planned. On each side, a 1.4- × 8-mm mini-screw with a bracket-type head (Jeil Medical Corporation, Seoul, South Korea) was inserted in the buccal cortical plate between the first and second premolars. An uprighting spring was constructed from a straight 0.017- × 0.025-inch TMA wire. While the distal end of the spring was inserted in the molar buccal tube, the mesial end was adjusted so that it passively lied occlusal to the mini-screw. To activate the spring, it was just hooked over the mini-screw head to create a single-point contact (Figs. 3 and 4). It was important to position the spring so that it was not free to slide distally as the molar was being uprighted. Two stops were placed in both ends of the spring to prevent sliding. By producing a moment, this design ensured molar uprighting by distal root movement with no mesial crown movement. One of the side effects of this mechanics was molar intrusion which counteracted the extrusion caused by the Pendulum Appliance. Another side effect was molar buccal tipping.

After 4 months, the molar inclination was corrected completely although slight molar intrusion had occurred (Figs. 5-8).



Figure 1. Intra-oral photographs before treatment

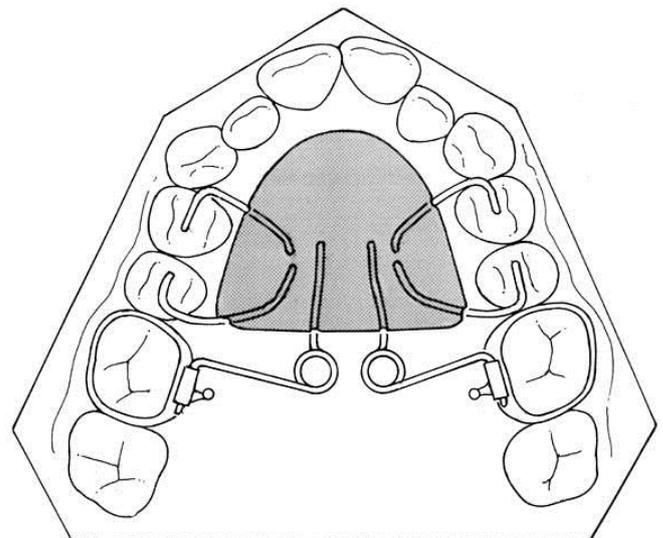
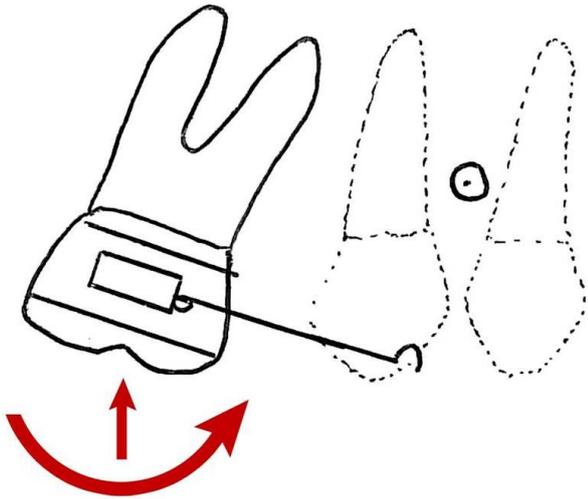


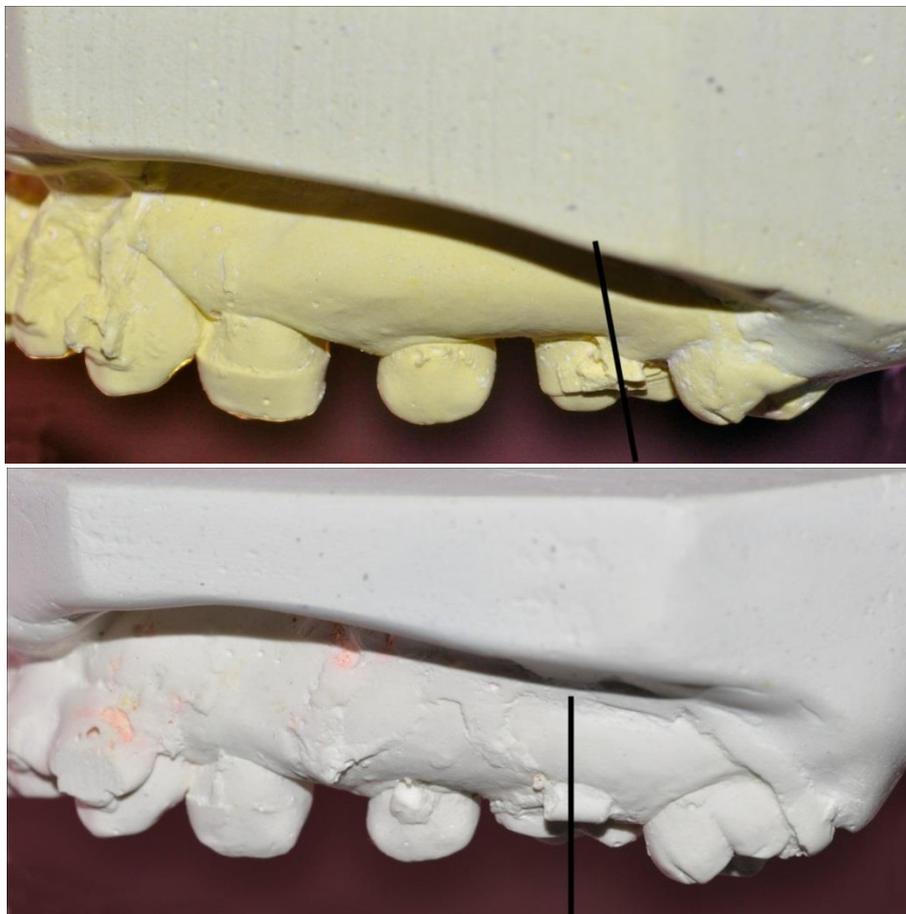
Figure 2. The Pendulum appliance



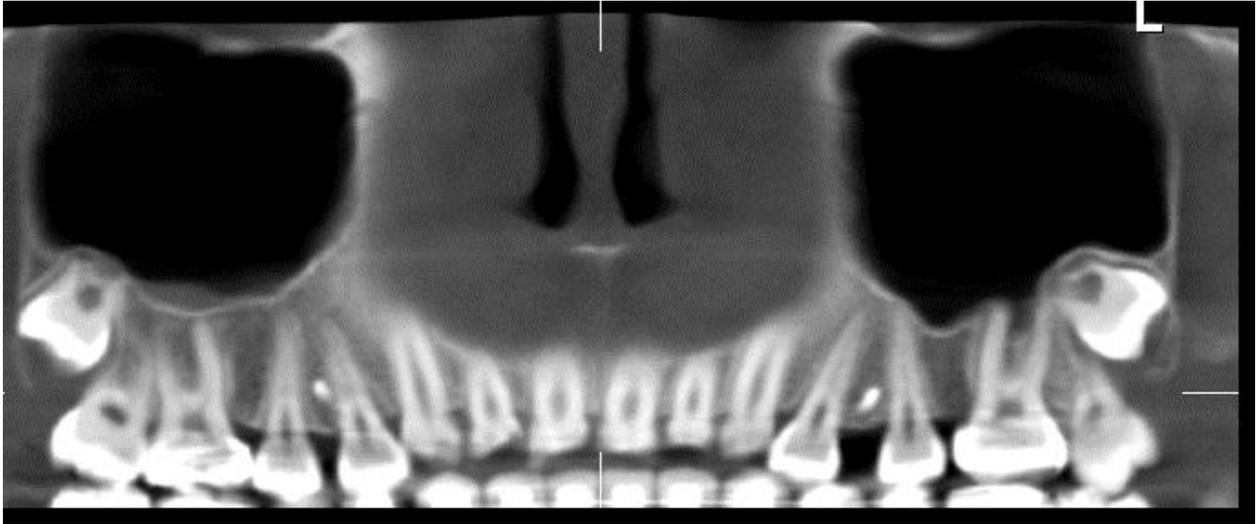
**Figure 3.** The schematic view of applied mechanics



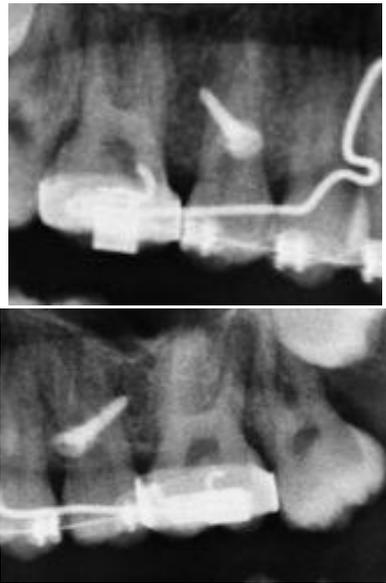
**Figure 4.** Assembly of uprighting spring and mini-screw



**Figure 5.** Correction of molar inclination. Upper figure: before treatment, Lower figure: after treatment



**Figure 6.** CBCT view after molar uprighting



**Figure 7.** Periapical view after molar uprighting



**Figure 8.** Intra-oral view after molar uprighting

## Discussion

The intra-oral Pendulum appliance was first introduced by Hilgers (9). Despite its efficacy for maxillary molar distalization, there are some side effects including protrusion of maxillary incisors and premolars and distal tipping of maxillary molars (10). These side effects need to be corrected during the fixed appliance treatment phase (9,10).

An uprighting force can be added as described by Byloff (2). In this way, molars are distalized in a more bodily fashion at the cost of increased overjet and molar extrusion (2). To avoid these undesirable side effects, the mentioned method was innovated.

This design has some advantages that make it suitable for molar uprighting after distalizing it by the Pendulum. First, it proved an absolute anchorage. Second, it is less critical regarding patient cooperation. Third, it offers a relatively simple force system.

This appliance design enables the clinician to efficiently correct the distally tipped molars in a relatively short duration. When the mesial end of uprighting spring hooks over the mini-screw head, a counterclockwise moment will produce that tends to move molar roots distally. Since the spring cannot slide in mesial or distal direction, the Class I molar relationship will be maintained. A TPA can be used to control the molar buccal tipping tendency. The auxiliary spring can also cause molar intrusion. Considering the extrusive effect of the Pendulum appliance, this side effect is useful.

After molar uprighting, a TPA is needed to maintain the treatment results. The mini-screw should be removed to allow the first premolar drift distally.

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