Case Report

Unilateral Distal Molar Movement With an Implant-Supported Distal Jet Appliance

A. I. Karaman, DDS, PhD[a]; F. A. Basciftci, DDS, MS[b]; O. Polat, DDS[c]

Abstract: With the guidance of the basis of the distal jet appliance, we present a new implant-supported distal jet appliance. In this case, we used a modified distal jet appliance that was supported by a palatal implant placed at the anterior edge of the rugae region of the palate for molar distalization. The treatment results were evaluated from lateral cephalometric and panoramic radiographs and dental casts. We conclude that an implant-supported modified distal jet appliance is effective in the correction of a Class II molar relationship. (*Angle Orthod* 2002;72:167–174.)

Key Words: Implant; Molar distalization; Distal jet appliance

INTRODUCTION

Correction of molar relationship is often required for the treatment of Class II malocclusions. For this purpose, extraoral appliances such as headgear are frequently used. Despite their success in tooth movement, these modalities have the major disadvantage of a heavy dependence on patient compliance and the need to follow directions.

Because of these disadvantages, clinicians have been searching for appliances that need minimal patient cooperation. Thus, intraoral distalization appliances have been introduced that minimized patient compliance and applied continuous forces. When a nonextraction treatment is planned, these appliances can distalize the maxillary molars one–two mm per month over four to five months.[1]

These appliances include the Hilger pendulum,[2] repelling magnets,[3] the Jones jig,[4] super elastic wire loops and coil springs,[5] and the distal jet.[6] Proprietary devices such as the pendulum and distal jet are supported by the hard plate as well as the premolars. A distal jet appliance consists of an acrylic Nance button and stainless steel wires. The appliance can easily be converted to a Nance appliance when the distalization is complete.

Although the need for minimum patient cooperation and ease in use are among the advantages of this appliance, the distal molar movement occurs mainly by tipping and rotation of the crowns, and an anchorage loss does occur in the premolars and incisors.

The progressive development of dental implants has led to their use as orthodontic anchorages. With the guidance of research done in the 1970s and 1980s, the loading of implants and their ability to resist stress vectors have provided new treatment options in orthodontics. After successful animal studies by Roberts et al[7] and Turley et al,[8] similar results were found by Roberts et al[9] and Ödman et al[10] in human studies. As there is no effect on tooth movement, palatal and retromolar regions are preferred for orthodontic anchorage. Palatal bone is probably the most suitable anchorage because of its histomorphology and the ease of application to this region.

Recently, Wehrbein et al[11] presented an implant anchorage system called Orthosystem. They obtained a resistant anchorage system that used an implant, four–five mm in diameter, placed in anterior palatal region. This system required 12 to 24 weeks for fixation and osteointegration. Byloff et al[12] used an implant-supported pendulum that they developed for molar distalization.

Kanomi[13] used miniplate fixation screws for anchorage. Among the advantages of this approach, they noted easy surgical placement, no need for osteointegration, and the potential for immediate loading.

In this study, we used an implant-supported modified distal jet appliance that has the advantages of implants and intraoral distalization appliances, and we assessed its effect on dentofacial structures.

CASE

An 11-year-old boy presented for treatment in the mixed dentition stage. The patient had a well-balanced face and

[a] Associate Professor, Selcuk University, Faculty of Dentistry, Department of Orthodontics, Konya, Turkey.

[b] Assistant Professor, Selcuk University, Faculty of Dentistry, Department of Orthodontics, Konya, Turkey.

[c] Research Assistant, Selcuk University, Faculty of Dentistry, Department of Orthodontics, Konya, Turkey.

Corresponding author: Faruk Ayhan Başçiftçi, DDS, MS, Selcuk Universitesi, Dişhekimliği Fakültesi, Ortodonti AD, 42079, Campus Konya, Turkey
(e-mail: fbasciftci@hotmail.com).

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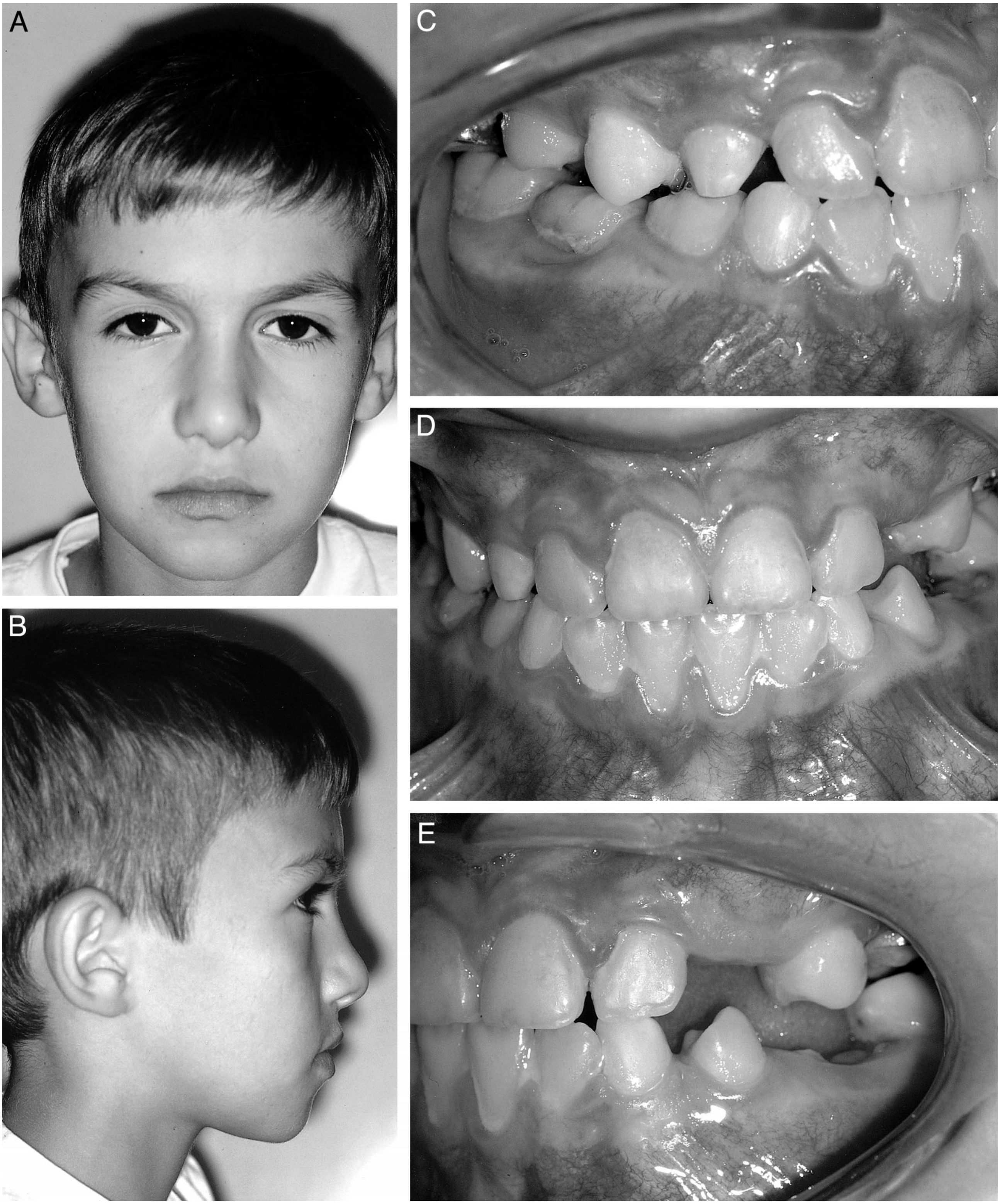


FIGURE 1. (A–E) Pretreatment photographs.

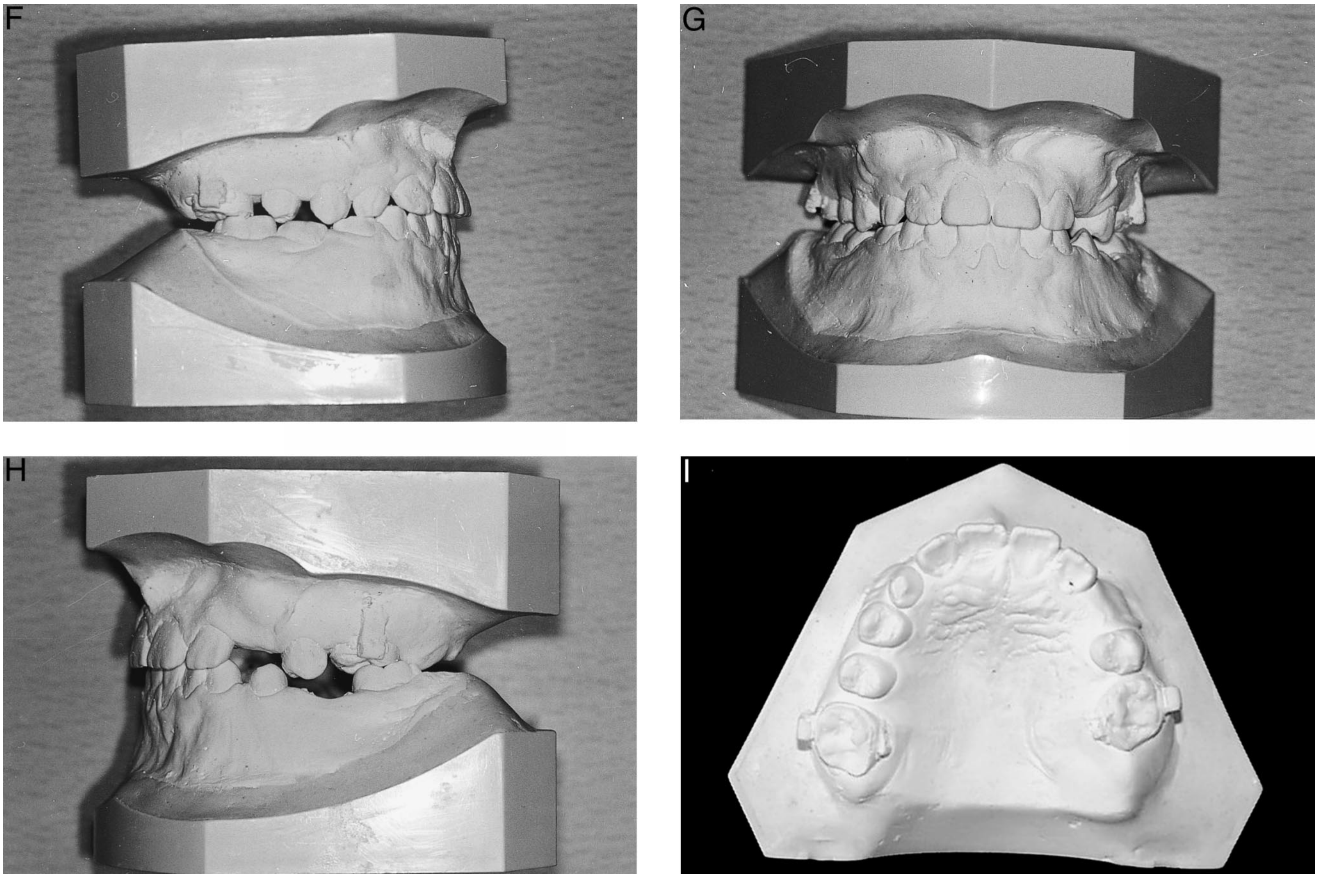


FIGURE 1. Continued. (F–I) Pretreatment models.

straight profile. The patient could close his lips without strain in the mentalis muscle. He had adequate gingival tissue on full smile.

The dental casts showed a Class II molar relationship on the left side and a super Class I relationship on the right. The left maxillary molar was tipped mesially as a result of premature loss of the maxillary left deciduous molar. There was inadequate space for the eruption of the second premolar in the upper left buccal segment. Diastemata were present in the upper right buccal segment (Figure 1). There was adequate overjet and overbite. The canines had not yet erupted. The mandibular teeth had a favorable alignment and eruption pattern. There was no transverse discrepancy.

Panoramic radiographs showed the presence of all of the teeth except the lower wisdom teeth. The eruption pattern of all of the teeth was normal, but the upper left second premolar was impacted because of the mesial movement of the upper left molar.

Cephalometrically, the patient had an SNA angle of 78°, an SNB angle of 78°, and an ANB angle of 0° (Table 1). The mandibular plane (Sn-GoMe) angle was 37°, the lower incisors had an 82° angle relative to the mandibular plane, and the upper incisors had a 116° angle relative to the palatal plane. The patient was compensated for the Class III tendency, and the nasolabial angle was within limits.

TABLE 1. Pretreatment and Posttreatment Cephalometric Values

	Pretreatment	Posttreatment
SNA, degrees	78	78
SNB, degrees	78	78
ANB, degrees	0	0
SN-GoGn, degrees	34	34.5
FMIA, degrees	70	69.5
FMA, degrees	28	28.5
IMPA, degrees	82	82
A to McNamara line, mm	0	0
Overjet, mm	1	1
Overbite, mm	0	0
U1 to NA, mm	4	4
U1 to NA, degrees	30	31
SV-U6, mm	29	25

Temporomandibular joint evaluation showed no signs of clicks or crepitation, and the facial and masticatory muscles were asymptomatic.

Treatment objectives

The treatment objectives included achieving a Class I molar relationship with distalization of the upper left first molar, eruption of the impacted premolar, and controlled eruption of all of the erupting teeth.

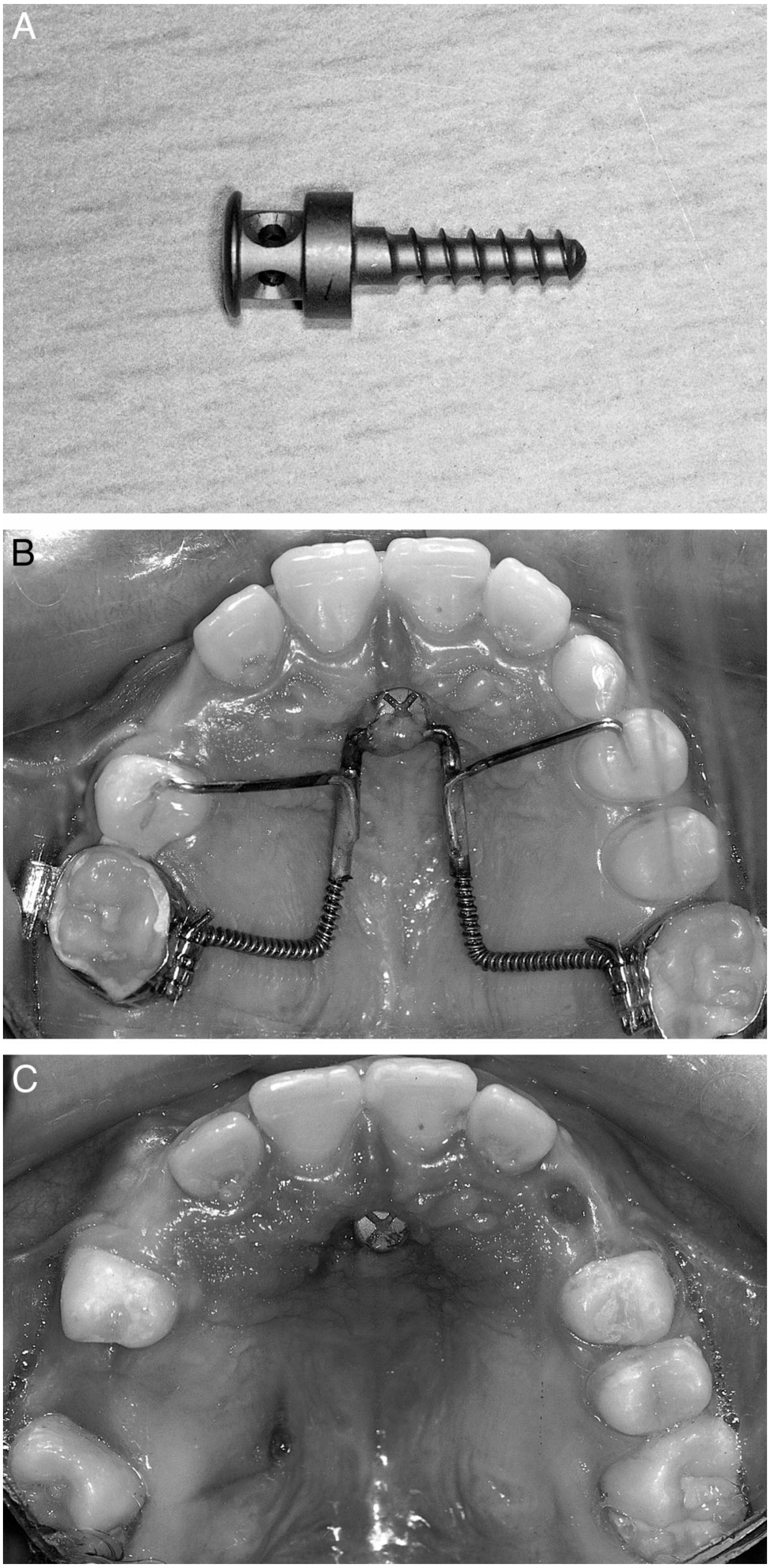


FIGURE 2. (A) Anchorage screw. (B) Anchorage screw with distal jet appliance attached. (C) Anchorage screw after distalization.

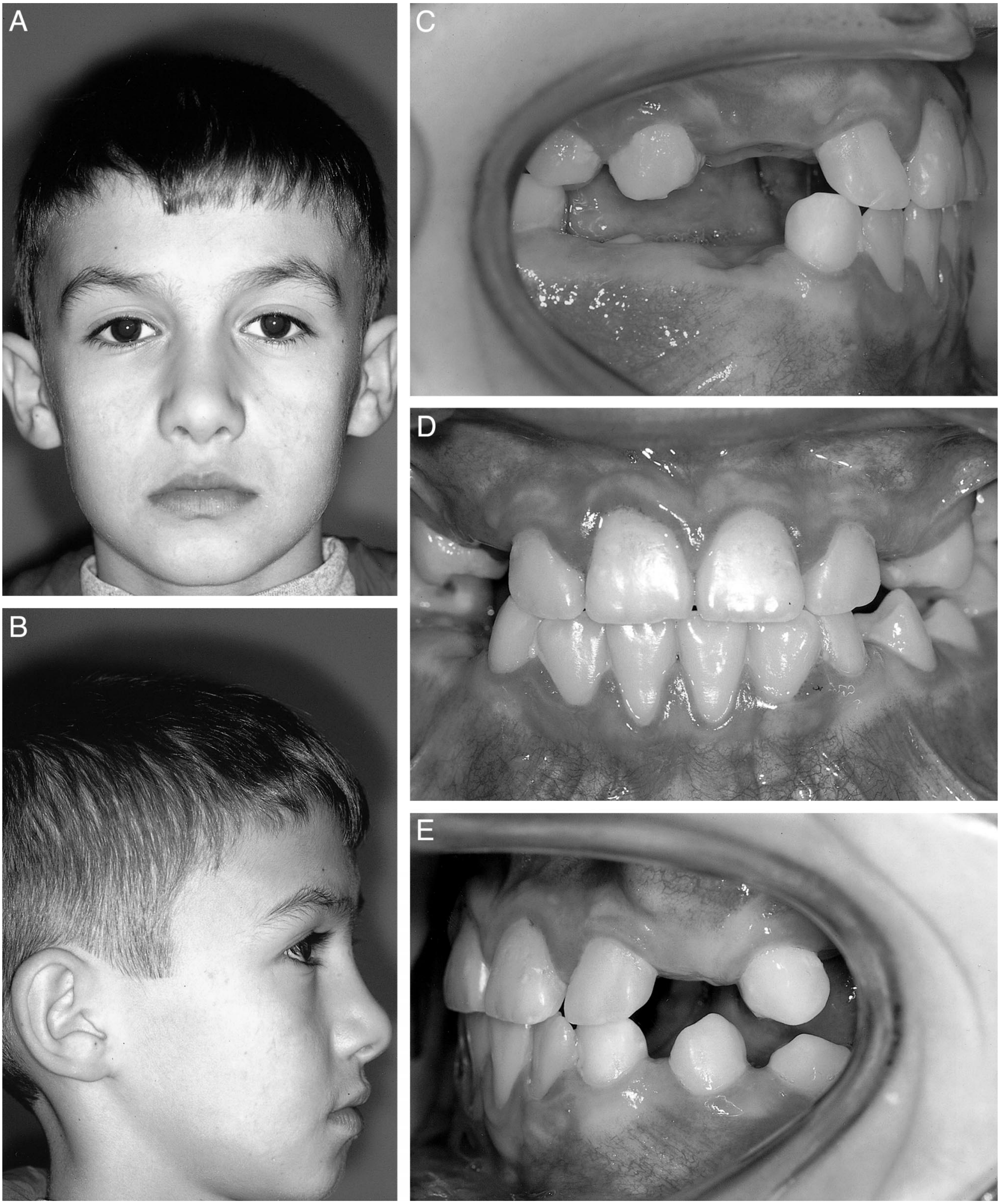


FIGURE 3. (A–E) Posttreatment photographs. (F–I) Posttreatment models.

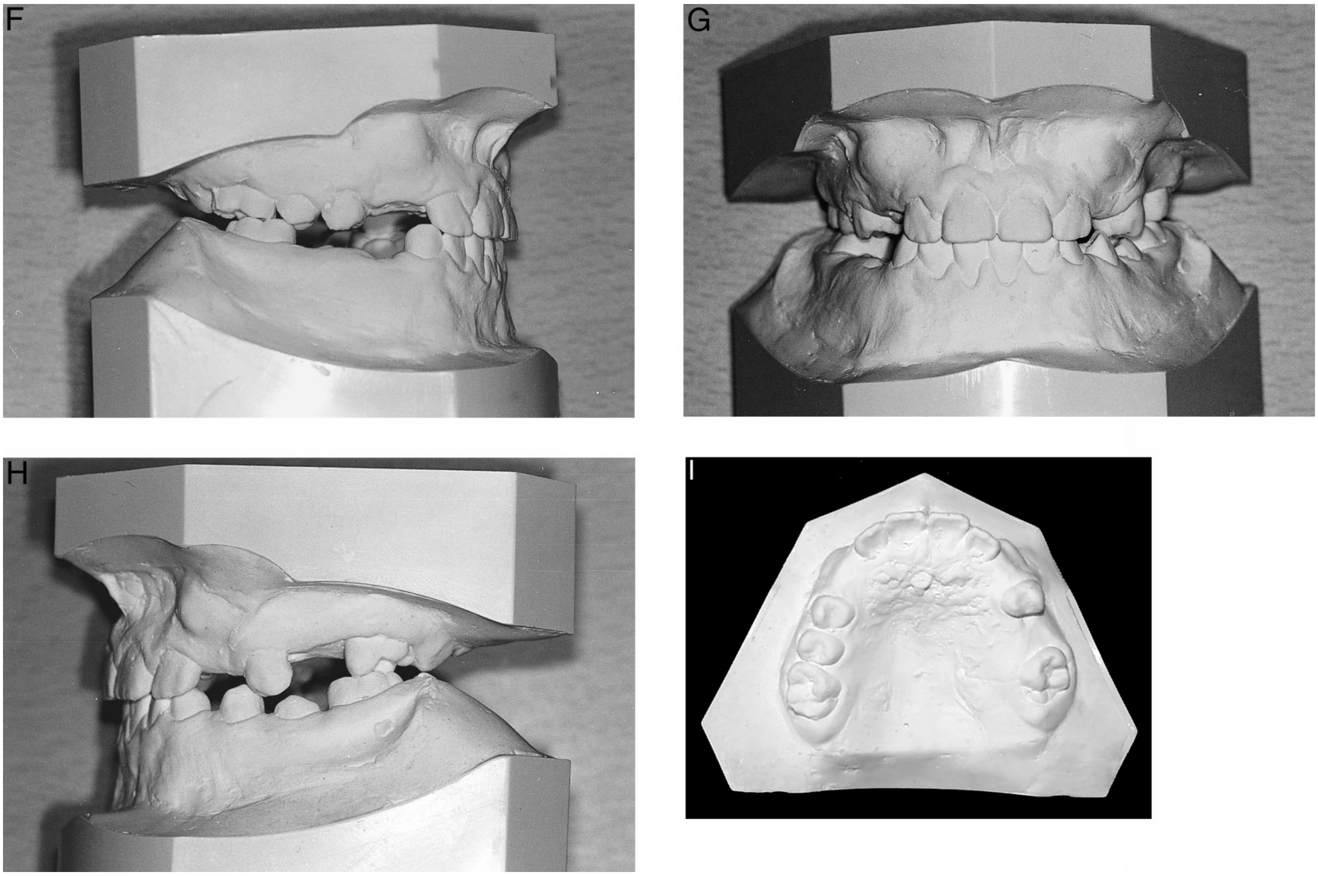


FIGURE 3. Continued. (F–I) Posttreatment models.

Treatment alternatives

There were three treatment alternatives for this case: (1) extraction of the left first premolar, (2) extraction of the impacted left second premolar and (3) distalization of the upper left molar.

Treatment progress

The patient and his family choose the nonextraction alternative, and a distal movement of the upper left first molar was planned. The negative ANB angle prevented the use of a headgear for upper molar movement. To achieve this movement, the use of intraoral distalization mechanics was planned. The upper left canine was also erupting, so preventing anchorage loss of the first premolar was important. We selected a modified implant-supported appliance consisting of a distal jet for treatment.

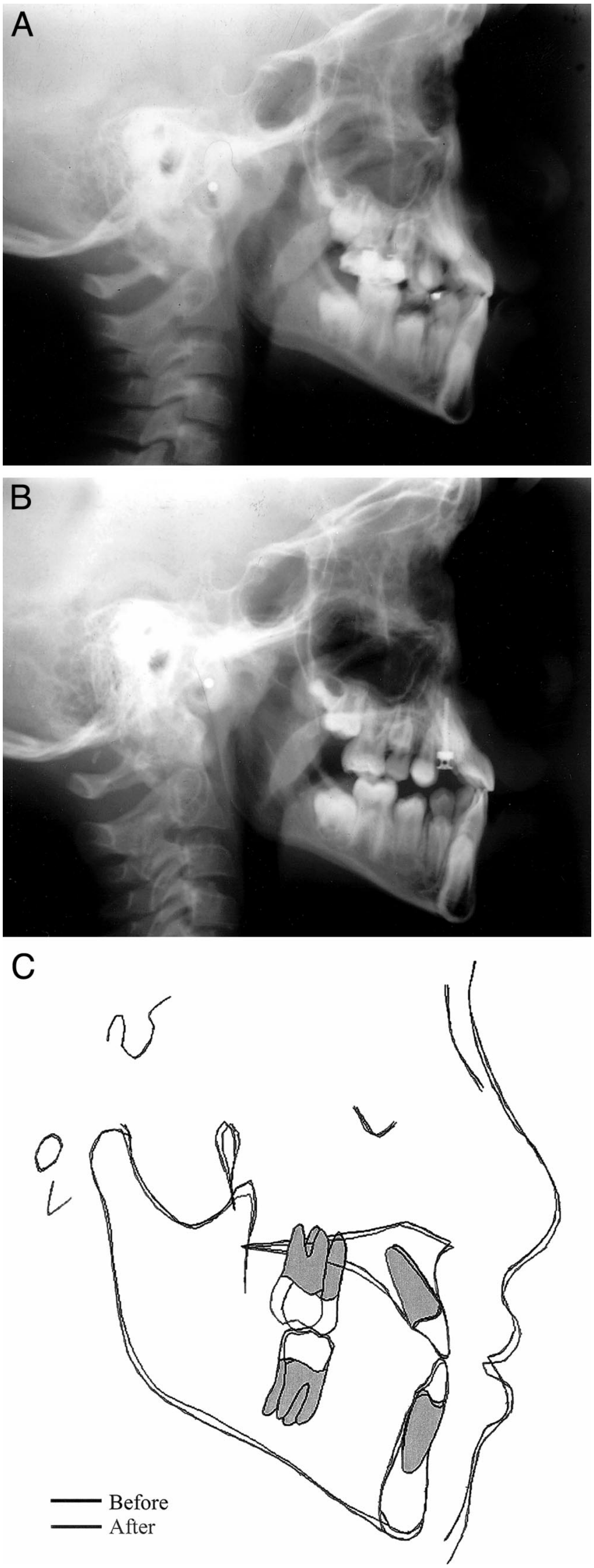
Appliance fabrication

Molar bands with palatal tubes were fitted to the upper first molars. An anchorage screw (Leibinger, Germany) three mm in diameter and 14 mm in length was placed at the anterior palatal suture, two–three mm posterior to the canalis incissivus under local anesthesia (Figure 2). During the same visit, alginate impressions were taken, and model casts were obtained for the constriction of the appliance.

On the upper dental cast, a stainless steel tube (Dentaurum, Ispeingen, Germany) one mm in diameter was adjusted to the implant. Anchor wires 0.8 mm in diameter were soldered to the tubes for occlusal rests on the first premolars. The 0.9-mm wire extended through each tube, ending in a bayonet bend that was inserted into the palatal tube of the first molar band. For force application, nickel-titanium open-coil springs 0.76 mm in diameter (Dentaurum) were adjusted (Figure 2).

The implant-supported modified distal jet appliance was attached to the anchor premolars with light-cured composite adhesive (Transbond, 3M Unitek, Monrovia, California). The joint between the implant and the tubes was secured with composite material to eliminate plaque retention and increase the stability of the appliance. Force arms were placed in the tubes, and the appliance was activated.

Two months after the insertion of the appliance, the space between left first premolar and first molar had increased to 4.5 mm without anchorage loss. At the fourth visit four months after insertion of the appliance, an 8-mm space for the eruption of the second premolar was achieved. Meanwhile, space for the canine was maintained. At this visit,



final records were obtained, and the screw was removed without anesthesia and with no discomfort for the patient during the removal (Figures 3 and 4). An upper Hawley appliance was worn full time for retention.

TREATMENT RESULTS

After a treatment period of four months, the left maxillary molar had been moved five mm distally without anterior movement of the anchor premolars. There was a two-mm intrusion of the left first molar (SN⊥U6). Because the coil spring on the right arm was not activated, the position of the right molar showed no signs of change.

At the completion of treatment, the mandibular plane was 34.5°, and the lower facial height remained unchanged. The upper incisor position remained stable throughout treatment. The lower incisor position remained unchanged as well at 82° to the mandibular plane.

DISCUSSION

Several methods have been used for molar distalization including headgear, Wilson mechanics, the pendulum, and the distal jet, but all of these techniques require varying degrees of patient compliance and show anchorage loss.[14]

Although molar relationships can easily be corrected with a headgear in cooperative patients, the negative ANB angle and Class III skeletal pattern of our patient prevented the use of a headgear. To distalize the molar, the use of an intraoral distalization was planned, and a palatal implant was used for anchorage.

In conventional intraoral distalization appliances, the anchor unit, which consists of the first and second premolars connected through a wire frame and acrylic coverage in the palatal depth, is unable to completely resist the reciprocal mesial force of the appliance. Despite the five mm of distal molar movement that Hilgers[2] obtained in three to four months with a pendulum, he saw mesial movement of the premolars. In our study, model examination showed no loss of anchorage at the premolars. The main reason that anchorage was preserved was the fact that the main anchor was the implant, and the implant is considered stable under orthodontic loading. Lateral cephalometric superimpositions showed that the position of the incisors was unchanged. This is an indication of adequate support of the palatal implant.

Gianelly et al[3] found 0.75 to one mm distalization with repelling magnets. These values vary according to the eruption of second molar. In the patient in our study, the second molars had not erupted, and we obtained eight mm distalization in four months.

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FIGURE 4. (A, B) Pretreatment and posttreatment cephalometric radiographs. (C) Superimposition of pretreatment and posttreatment radiographs.

Byloff et al[12] advised loading of the palatal implant after a minimum of two-week osteointegration period. This period varies according to the fixation technique. There was no need for a fixation period after the application of the screw used in our study; this implant could be loaded immediately. The placement of the implant was done under local anesthesia in quite a short time. Furthermore, the surgical method is less traumatic to the patient. The patient was instructed to brush the appliance with mild pressure so that no irritation occurred, and oral hygiene around the implant was maintained. The removal of the screw was as easy as the placement, and removal did not require local anesthesia. There was no sign of scar tissue or an alveolar defect, and we therefore assume that this method is more hygienic than other intraoral methods.

Irritation of the palatal mucosa and gingival hyperplasia occur because of poor oral hygiene in a patient. Careful attention was taken in the construction of the appliance so that the patient could maintain optimum oral hygiene.

CONCLUSION

The results of this study have shown that the implant-supported modified distal jet appliance is an effective and reliable method for distalizing maxillary molars, and this treatment requires minimal patient compliance. The main advantages of the appliance are its stability against rotational movements, the possibility of immediate loading, active bilateral or unilateral force application, and ease of insertion and removal. Adequate distal movement of the molar tooth was achieved without the loss of anchorage. The efficiency of this method should be evaluated in a larger sample in the future.

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