

Molar distalisation with skeletal anchorage

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Background: Distalisation of the upper molars can be used to treat a dental Class II deep bite malocclusion with a flat facial profile. It is a useful procedure when extraction treatment has been refused and providing distalisation is an appropriate solution to the patient's problem.

Aims: To describe distalisation of the upper buccal segments using a modified distal jet appliance and miniscrew.

Methods: Two case reports are presented. The first case was treated with a distal screw appliance: a modified distal jet appliance with a palatal miniscrew and without the premolar arms. The Nance button was anchored to the palatal bone by a miniscrew inserted through a posterior locating plate. Locating holes in the plate ensured that the miniscrew was inserted into a site with optimal bone in the posterior part of the palate. The second case was treated with a similar distal screw appliance, but in this case the locating plate was embedded in the acrylic button. The miniscrew was inserted through a prepared hole in the button and plate. The locating hole(s) ensured that a screw could be inserted into an optimal site to one side of the median palatal suture.

Conclusions: The distal screw appliance can be used to distalise upper teeth with minimal or no anchorage loss.

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Introduction

Class II malocclusions occur in a significant number of orthodontic patients. Distalisation of the upper molars, aimed at increasing the lengths of posterior buccal segments, is a frequently used method of treatment for this condition.¹ This type of therapy is indicated in patients with a normal or hypodivergent face, a deep bite with or without a flat facial profile, missing upper third molars, and when patients and/or their guardians refuse extraction treatment and the orthodontist deems nonextraction treatment appropriate ethically. It is contraindicated in patients with increased facial divergence or a skeletal open bite as distalisation may result in extrusion of the upper molars, and an increase in the vertical skeletal dimension and backward and downward movement of the mandible.

Typically, the upper molars are moved distally before the premolars and anterior teeth are retracted. Distalisation is more effective if it is carried out before the premolars have emerged and prior to emergence of the upper second molars as it allows the leeway space to be exploited.^{2,3} Distalisation at this time

significantly shortens the treatment time and lessens the need for extractions.⁴

The popularity of distalisation has led to the evolution of a large number of intra-oral and extra-oral appliances for this purpose. Extra-oral appliances, such as headgear, rely on a system of anchorage located external to the oral cavity to discharge the unwanted reaction forces. Intra-oral devices, on the other hand, may be subdivided into single arch and intermaxillary or two arch appliances. The former are usually used in the upper jaw and may include: NiTi springs and wires, magnets, Jones jig, pendulum and the distal jet appliances.^{5–10} Two arch appliances, which exploit the mandibular arch for anchorage, include devices such as: the Herbst appliance, Jasper jumper, cantilever bite jumper, mandibular anterior and repositioning appliance (MARA) and eureka spring appliance.^{11,12}

Of the devices available for distalisation, we prefer to use a modification of Carano's distal jet appliance because it achieves about the same amount of distalisation in the same time frame as other distalising appliances. The distal jet appliance also leads to less

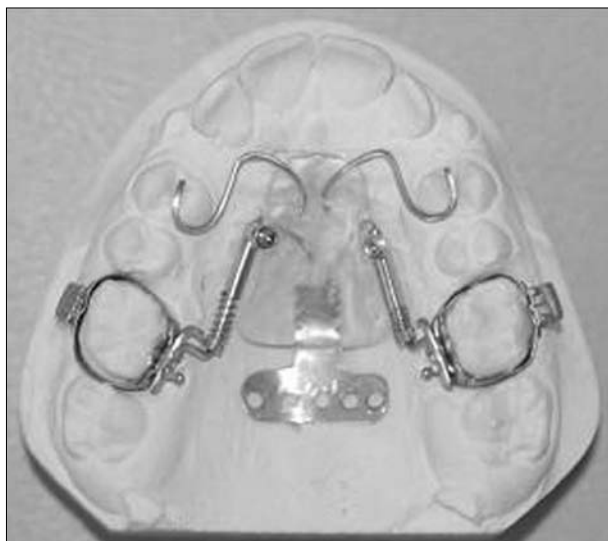


Figure 1. Initial version of the distal screw appliance (left) and latest version (right). Note the absence of stabilising arms, the positions of the locating plates and the locating holes for the miniscrews.

tipping during distalisation, it does not produce unwanted vertical changes, it does not rely on patient compliance and, finally, after the active distalisation phase the Nance button can be used for anchorage control.^{10,13}

Distal screw appliance

Use of the distal jet appliance, as with all intra-oral distalising appliances, involves a certain amount of anchorage loss, which consists of an unwelcome mesial movement of the premolars and an increase in overjet.¹ Indeed, Nishii et al.,¹⁴ who used a distal jet appliance, found that the second premolars moved 0.6 mm mesially for each millimetre of molar distalisation. Furthermore, they observed that the maxillary incisors also moved labially (approximately 2.4 mm of labial movement per millimetre of distalisation) and proclined approximately 4.5 degrees. Ngantung et al.¹⁵ observed that greater mesial tipping (approximately 12.2 degrees) occurred if the upper arch was banded at the time distalisation was undertaken.

Anchorage stability is often an essential factor for the successful treatment of Class II malocclusions, and unstable anchorage can lead to unfavourable occlusal relationships and complicate subsequent treatment procedures. Many implant systems have been employed in attempts to ensure stable skeletal anchorage during molar distalisation such as: the

Graz implant-supported pendulum, the bioresorbable implant anchor for orthodontics system, the Straumann orthosystem, the Frialit-2 implant system, the Oric implant system, the onplant system and, more recently, non-osseointegrated or partially osseointegrated orthodontic miniscrews.¹⁶

In order to achieve distalisation of the upper molars without anchorage loss, Carano combined the distal jet appliance with miniscrews.¹⁷ He placed the miniscrews palatally in the interradicular spaces either between the premolars or between the molars and premolars. He chose these sites based on work carried out by Poggio,¹⁸ who indicated that the optimal sites for implants in the maxilla were the interradicular spaces between the first molar and second premolar, the first and second molars and the first and second premolars. However, these sites are not without complications. Insertion of miniscrews between the molar and premolar roots requires a surgical protocol, does not allow good oral hygiene and, most importantly, impedes distal movement of the premolars. For these reasons we modified the original distal jet appliance to exploit skeletal anchorage in the palate. We also simplified the device and placement of the miniscrews and reduced the bulk of the appliance.

In order to discover the ideal sites for miniscrews in the palate, we measured the thickness of the palatal bone at four sites on both sides of the median palatal suture in children and adolescents between 10 and 15

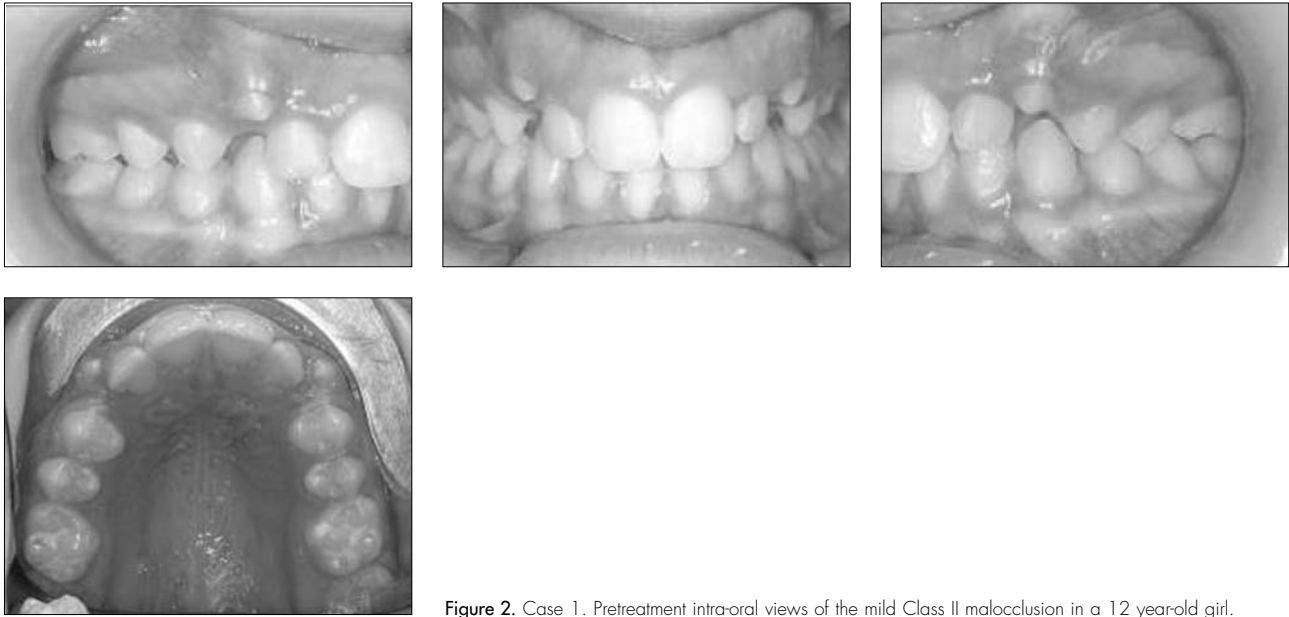


Figure 2. Case 1. Pretreatment intra-oral views of the mild Class II malocclusion in a 12 year-old girl.

years of age.¹⁹ We found that the palatal bone thinned progressively from anterior to posterior and from medial to lateral. Our data supports Carano and co-workers,¹³ that the anterior paramedian regions of the palate are the sites of choice for miniscrews. In children and adolescents the thickest bone was found 4–8 mm behind and 6 mm lateral to the incisive foramen. Posterior sites are suitable for implants, despite the fact there is less bone, because in this area there are double cortical plates covered with thin mucosa.¹⁹

Based on these data we modified the original distal jet appliance by removing the arms for premolar anchorage and adding a stainless steel locating plate to the Nance button. We have called this appliance the distal screw appliance. Initially, we tried adding a shaped stainless steel plate to the posterior periphery of the Nance button. The plate had holes for miniscrews at appropriate distances on both sides of the median palatal suture. In our latest version we have incorporated the locating stainless steel plate into the resin and pierced both resin and plate with six holes, 3 mm and 6 mm on both sides of the median palatal suture (Figure 1). The holes in this latest modification take advantage of the thicker bone anteriorly and, as a result, the appliance is more secure than our first design.

The distal screw appliance has some additional advantages over the conventional distal jet appliance. By removing the premolar stabilising arms the

appliance is less bulky and spontaneous distalisation of the premolars can occur in the early stages of treatment. Furthermore, the combination of the Nance button and a palatal miniscrew provides maximum anchorage upon completion of distalisation. Unlike other intra-oral distalising appliances, which require the upper molars to be distalised before the premolars and anterior teeth can be retracted, the distal screw appliance allows the premolars to move spontaneously or to be moved distally. Once a Class I molar relationship has been achieved any residual spaces in the upper arch can be closed. In our experience this appliance results in shorter treatment and chair times and requires less patient compliance than other designs.

Case 1

A 12 year-old girl with a Class II malocclusion presented in our clinic and we decided to treat the problem by distalising the upper molars (Figure 2). We used a distal screw appliance with a pierced locating plate extending posteriorly from the Nance button and a 9 mm miniscrew. The appliance was activated monthly and the upper molars were distalised without loss of anterior anchorage in 4 months (Figures 3 and 4). During treatment the premolars spontaneously moved distally (Figure 4).

We found that the upper first molars were moved distally 3.88 mm and tipped distally 3.08 degrees with

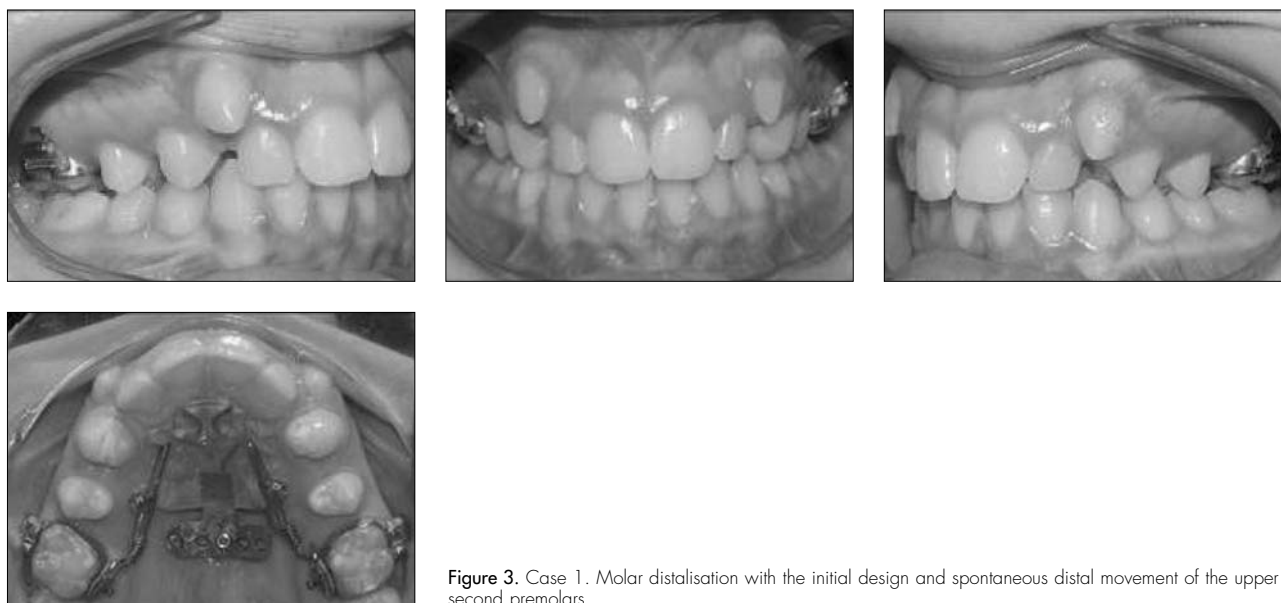


Figure 3. Case 1. Molar distalisation with the initial design and spontaneous distal movement of the upper second premolars.

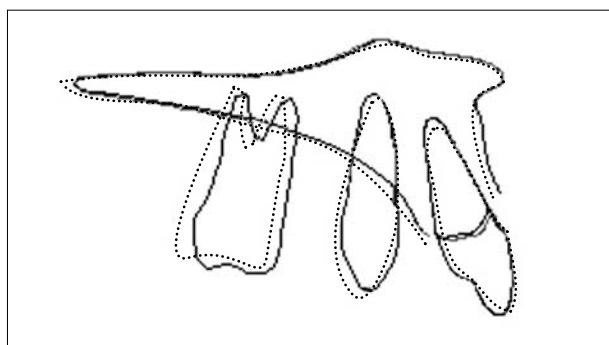


Figure 4. Case 1. Pre- and post-distalisation tracings superimposed on maxilla.

respect to the base of the cranium.²⁰ There was no appreciable change in the position of the upper incisors. The premolars spontaneously moved 1.68 mm distally and tipped 3.74 degrees distally. Our data agrees with the data published by Carano, who reported a mean molar distalisation of 3.2 mm and distal tipping of 3.1 degrees in 20 patients treated with the distal jet appliance.¹ However, Carano's appliance resulted in the upper premolars moving mesially 1.3 mm and tipping 2.8 degrees mesially.¹

Case 2

This 15 year-old male adolescent presented at our clinic with a Class II malocclusion, a hypodivergent profile and slight anterior crowding. To obtain a Class

I dental relationship we decided to distalise the upper molars with a distal screw appliance. We removed the premolar arms and embedded a stainless steel locating plate in the Nance button. The plate and acrylic had holes for miniscrews, 3 mm and 6 mm on both sides of the median sagittal plane. In this case a single 1.5 mm diameter, 9 mm miniscrew was used. After 9 months treatment a Class I molar relationship was achieved. (Figures 5 and 6).

The upper occlusal photographs show how the absence of the stabilising arms on the premolars permitted spontaneous distal migration of the anterior teeth and partial resolution of the crowding. On tracings of the patient's pre- and post-treatment cephalometric radiographs the upper molars were distalised 3.88 mm and tipped distally 3.08 degrees. The premolar crowns also moved 1.68 mm distally and tipped 3.74 degrees distally while the incisors remained more or less stable. (Figure 7).

Conclusions

The distal screw appliance is a modified distal jet appliance without the premolar arms and with a locating plate embedded in the Nance button. The locating plate allows a miniscrew to be placed in the thick palatal bone to one side of the median palatal suture. The absence of the premolar arms permits the premolars to spontaneously move distally. It can be used to distalise the teeth in the upper arch with



Figure 5. Case 2. Pretreatment intra-oral views of the mild Class II malocclusion in the 15 year-old male patient.

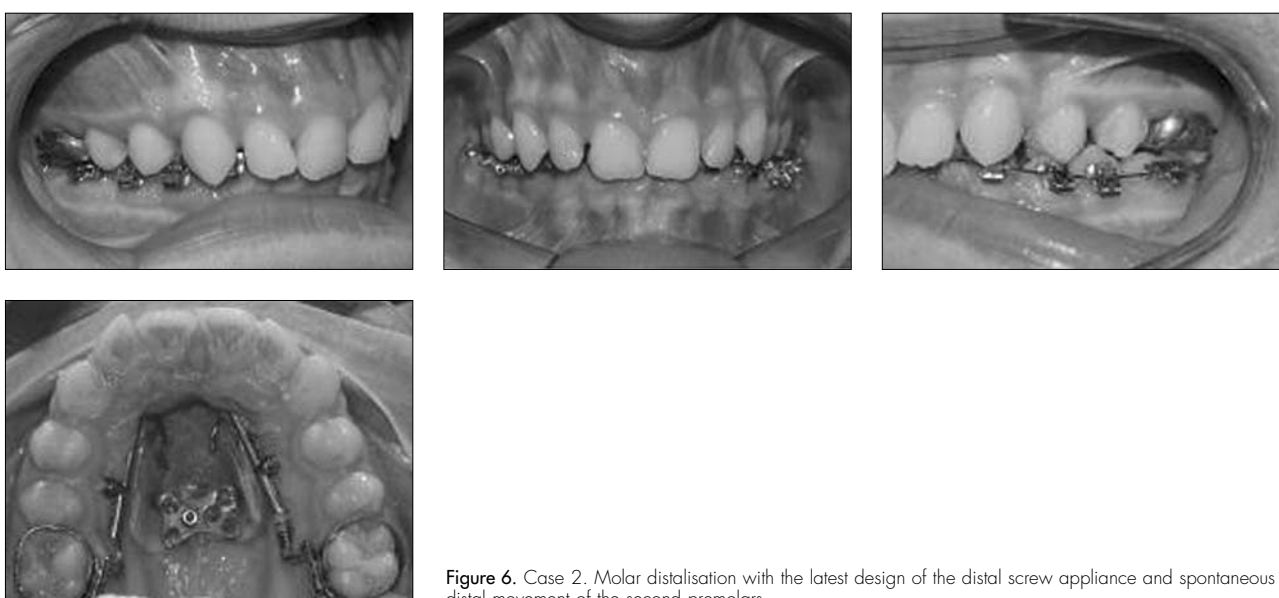


Figure 6. Case 2. Molar distalisation with the latest design of the distal screw appliance and spontaneous distal movement of the second premolars.

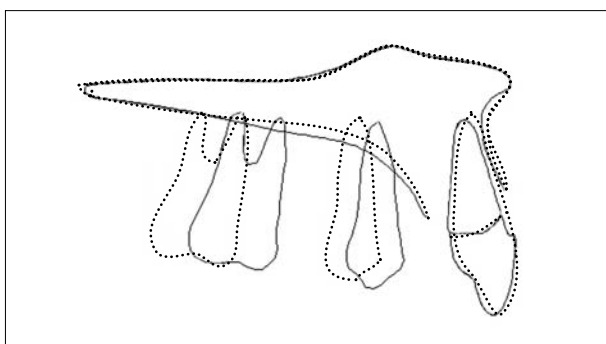


Figure 7. Case 2. Pre- and post-distalisation tracings superimposed on maxilla. Note there was minimal change in the upper incisors.

minimal or no anchorage loss and in a relatively short treatment time. The appliance does not rely on patient compliance.

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