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Class II Correction By Distalization With Modified Pendulum Appliance- A Case Report

KEYWORDS: Class II, Distalization, Modified pendulum appliance

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ABSTRACT *14-year male presented with skeletal Class I jaw base with unilateral Class II molar relationship with well aligned lower arch and lower incisors upright over basal bone. Distalization was planned in upper arch to correct unilateral Class II molar relation and upper incisor proclination. Modified Pendulum appliance was used to distalize upper left molar. Molars were distalized by 5 mm in a span of 4 months. Post treatment Class I molar relationship was achieved bilaterally and incisor proclination reduced. Post treatment cephalogram showed minimal changes in the vertical dimension of face at the end of treatment. The total treatment ended in 19 months.*

Introduction

Correction of Class II malocclusion has always been a challenge for the orthodontist. Extraction and non extraction methodologies have been used to correct the same condition.[1] Molar distalization can be initiated when extraction of maxillary teeth is not indicated and mandibular tooth-size/arch perimeter does not permit mesial movement of lower molars[2]. With extra oral mechanisms implementing molar distalization, the success of the treatment depends upon patient's compliance[2]. Since the early 1980s, therapeutic approaches and devices have been focused increasingly on options for correcting malocclusions in which patient compliance could be almost ignored. As a main approach of noncompliance appliances, intra arch devices for molar distalization have been introduced. Various distalization appliances are headgear[3], cetlin appliance[4], TPA[5], ACCO appliance[6], Pendulum appliance[7], Wilson biometric distalizing arch[8-9], fixed functional appliance[10,11], distal jet[12,13], first class appliance[14], repelling magnets[15], NiTi coil spring[16], superelastic NiTi wires[17], K loop[18]. However, many of these methods can also cause mesial movement of the maxillary premolars and anterior. In addition, the loss of anterior anchorage often leads to relapse of the maxillary molars during the correction of the canine relationship, overbite, and overjet[19]. Many of the distalization techniques use Nance palatal arch to avoid anterior anchorage loss during molar distalization and canine retraction.

Fig 1: Pre treatment facial photographs

Fig 2: Pre treatment intra oral photographs

Pendulum appliance developed by Hilgers, has become one of the most popular and highly efficient designs. It is simple, economic, easy to fabricate, and eliminates the need of patient compliance. Hilgers stated pendulum appliance produces 5 mm of distalization of molar in a three to four months period[7]. This case report describes unilateral distalization of maxillary molar with Modified Pendulum appliance in Class II subdivision malocclusion.

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Fig 3: Pre treatment panoramic and lateral cephalometric radiographs

Patient selection

Distalization therapy is indicated in case with Class II molar relation, Class I skeletal jaw base, brachyfacial or mesofacial type, horizontal growth pattern, healthy tempromandibular joint and upright lower teeth along with good alignment. It is imperative to determine the space available for maxillary first molar in relation to the Ricketts' pterygoid vertical line on the lateral cephalogram. As a rule, this distance is calculated as the patient's age plus 3 mm in growing individuals and a minimum of 18 mm in non growing individuals.

Case report

14-year male presented with the chief complaint of forwardly placed upper front teeth. No relevant medical history was present. On clinical appraisal, no abnormality was detected with tempromandibular joint. Facial form was mesoprosopic and mild convex soft tissue profile. (Fig 1) Intraorally, Class II molar relation on the left side and a Class I molar relation on the right side, 5 mm overjet and 40 % overbite. Lower incisors were ideally aligned and upright over basal bone. Upper midline was shifted to right side by 3 mm in relation to facial midline. (Fig 2) Panoramic radiograph showed third molars were in their eruptive stage. The lateral cephalogram revealed ANB of 2° and Wits appraisal of -1 mm, indicative of a Class I skeletal relation. The skeletal pattern was horizontal as evidenced by the SN-MP angle of 31°. The patient had proclined maxillary incisors with U1-SN 109°, normally inclined lower incisors with L1-MP 97°. (Fig 3) The distance between Ricketts' PTV line and distal surface of maxillary first molar was 18 mm.

Treatment objectives

Treatment objectives were to correct Class II molar and canine relation on left side, dental midline correction in relation to facial midline, to reduce incisor proclination. Other objectives were to correct overjet, overbite and maintain Class I molar and canine relation on left side. Treatment objectives of occlusion included anterior disclusion with canine guidance.

Treatment plan

Extraction of upper third molar followed by unilateral distalization of maxillary molars using a Modified Pendulum appliance. The distance between Ricketts' PTV line and distal surface of maxillary first molar was 18 mm. According to Ricketts', minimum distance required for 14 year male patient is 17 mm. So adequate space was available which made distalization possible without producing crowding in posterior segment. Later, the patient was treated by fixed appliance therapy.

Table 1. CEPHALOMETRIC FINDINGS

VARIABLE	STANDARD	PRE-TREATMENT	POST-TREATMENT
SKELETAL			
SNA	82° ± 2°	82°	76°
SNB	80° ± 2°	80°	71°
ANB	2°	2°	5°
GO GN – SN	32°	31°	44°
WITS APPRAISAL	0 mm	-1 mm	3.5 mm
DENTAL			
U1 – SN	102° ± 2°	109°	100°
U1 – NA	4 mm / 22°	8 mm / 32°	6.5 mm / 30°
L1 – NB	4 mm / 25°	4 mm / 26°	5.5 mm / 29°
IMPA	92° ± 5°	97°	100°
SOFT TISSUE			
NASOLABIAL ANGLE	98 mm	95°	98°
U LIP – S LINE	0 mm	1.5 mm	1 mm
L LIP – S LINE	0 mm	1.5 mm	1.5 mm

Treatment progress

Modified Pendulum appliance was fabricated and inserted onto the banded maxillary first molars. (Fig 4) The appliance was activated by 90°, which delivered approximately 220 grams of force. The molar started showing distal movement, the molars showed a distalization of 5 mm by the end of four months. (Fig 5) Mid treatment orthopantomograph and lateral cephalogram showed molar distalization and revealed bone deposition on the mesial aspect of upper left first molar. Modified Pendulum appliance was only used as a retainer; the occlusal rest from premolars was removed on the upper left quadrant. After the desired distalization was achieved, 0.022×0.028" MBT brackets (Ormco, Glandora, CA) were bonded.

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Fig 4: Modified Pendulum appliance

Alignment and leveling in both the arches was carried out by following wire sequence: (a) 0.016" heat activated nickel-titanium arch wires (b) 0.018" stainless steel arch wire and (c) 0.017×0.025" stainless steel wires. The arch wires were cinched distal to molar to avoid maxillary and mandibular incisor proclination. After alignment and leveling, Class II elastics were used on 0.017×0.025" stainless steel wire to augment anchorage, to correct canine relation and overjet. Co-ordination of both the arches was carried out on 0.019×0.025" stainless steel wire. 0.021×0.025" titanium molybdenum alloy wire was placed for two months. Vertical Settling elastics were given on 0.021×0.025" braided stainless steel wire.

Fig 5: Fixed appliance after distalization

The treatment was completed in nineteen months. At debonding visit, patient was given a maxillary and mandibular bonded lingual retainer. Patient is being recalled every six months for follow up.

Treatment result

A good occlusion was established resulting in bilateral Class I molar and canine relationships along with normal overjet and overbite. (Fig 6, 7) Maxillary first molar was distalized by 5 mm in 4 months. Upper dental midline was coinciding with facial midline. Position and inclination of the upper and lower incisors were normalized. (Fig 8) Nasolabial angle presented within the normal range and upper and lower lips exhibited a normal position in relation to the E-line.

Fig 6: Posttreatment facial photographs

Fig 7: Posttreatment intraoral photographs

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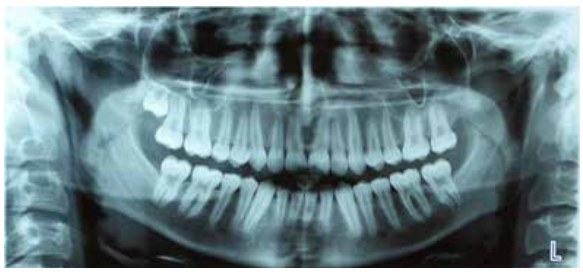

Fig 8: Posttreatment orthopantomograph and lateral cephalogram

Discussion

Unilateral Class II molar was successfully treated with Modified Pendulum appliance. Unilateral distalization had the advantage of stronger anchorage because the contralateral side was utilized as a anchorage unit as well we fabricated helical spring with stainless steel wire in right quadrant. Unilateral distalization seems to be associated with less anchorage loss and less tipping of the molar than bilateral distalization[20, 21]. Scutzey showed an effective distal molar movement and less anchorage loss of front teeth are advantages of unilateral distalization[22].

Influence of second molar on the distal movement of the first molar remains a matter of debate. Some authors reported that presence of second molars increases treatment duration, produces more tipping of molars,[17] and more anterior anchorage loss.[23] On the contrary, some authors have reported that presence and position of second molars does not affect the amount and type of maxillary first molar distal movement.[24, 25] Upper left anterior were displaced towards the contra lateral side and proclined[26-29]; it was also indicative of anchorage loss of anterior which was corrected during fixed appliance phase.

Modified Pendulum appliance consisted of a palatal Nance component with rests that were on the upper first premolar teeth. The distalizing spring was fabricated by bilateral helical springs composed 0.032" TMA alloy which was inserted into 0.036" lingual sheath welded to first molar band. The springs were mounted close to the centre and distal edge of the button to produce a broad swinging arc (or pendulum) of force. Each spring consists of a closed helix, an omega-shaped adjustable horizontal loop for molar expansion and prevention of crossbite following palatal movement of the molar.[30] TMA spring produced 220 grams of force in left quadrant in activated state and stainless steel spring was passive in right quadrant. Previous studies have indicated that various appliance produces a molar distalization between 3.14 and 6.1 mm [31-33]. In this case, 5 mm unilateral maxillary molar distalization was achieved in a span of 4 months.

Maxillary second premolar was also distalized about 2.5 mm due to transseptal fibers pull. The applied force was occlusally in respect to the centre of resistance of the molar. Therefore we noticed minimal distal tipping of first molar followed by uprighting. After molar distalization, Rest was removed from left maxillary first premolar, but Nance button and rest on right maxillary first premolar continued to enhance anchorage while anterior retraction. 3.5 ounce Class II elastics were used to augment anchorage, correct unilateral Class II canine relation and incisor proclination. Many studies assessed efficacy of the Pendulum appliance, reporting data relative to orthodontic and orthopedic changes[26, 34]. In this case, pre and post treatment cephalograms were obtained to show treatment effects. The maxillary first molar was distalized by 5 mm on left side. The proclination of upper anterior teeth were reduced by 1.5 mm after fixed appliance therapy. The lower anterior facial height increase by 2 mm and mandibular plane was rotated clockwise by 1.5°. The lower incisors were proclined by 1 mm and 2°.

Conclusion

Modified Pendulum appliance was found to be efficient, non-invasive and non compliance appliance for attaining of molar distalization. Distalization is one of the most efficient space gaining method and highly effective in borderline cases. In our case, 5 mm of distalization was achieved in 4 months and Class I molar and canine relation was achieved.

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