

# NON-COMPLIANCE CLASS II CORRECTION WITH PENDULUM APPLIANCE: A CASE REPORT

Dr. Prateeti Pal\*, Dr. Rupam Kumari\*\*, Dr. Samarendra Ray\*\*\*  
Dr. Rajani Nair\*\*\*\*, Dr. Nilanjana Ghatak\*\*\*\*\*

## ABSTRACT

Over the past few decades, non-extraction treatment has been gaining increasing popularity for corrections of mild to moderate class II malocclusions, with a correct diagnosis. An option for creating space in the maxillary arch is to move the molars distally. Such distalization of maxillary molars may be utilized for gaining enough space in the maxillary arch for obtaining stable class I molar and canine relationships, without opting for bicuspid extraction. This is particularly useful in case of non-compliant patients. With new biomaterials evolving in the field of orthodontics and with proper understanding of mechanical forces at play, various authors have come up with different appliances for achieving this goal. Here, we present a case report, where, the Hilger's Pendulum appliance had been used for bilateral maxillary molar distalization in a patient with Class II Division 2 malocclusion with acceptable facial profile. The space gained was utilized effectively to align the arch and establish a class I molar and canine relation.

## KEY WORDS

**Molar distalization, Class II malocclusion, Pendulum appliance, Hilgers Pendulum appliance, non-extraction, non-compliance**

## ABOUT THE AUTHORS

\*Post graduate trainee 3rd year, \*\*Reader  
Department of Orthodontics and Dentofacial Orthopedics,  
Guru Nanak Institute of Dental Sciences and Research,  
Kolkata, \*\*\*Professor and H.O.D., Department of  
Orthodontics and Dentofacial Orthopedics, Guru Nanak  
Institute of Dental Sciences and Research, Kolkata  
\*\*\*\*Practicing Orthodontist, \*\*\*\*\*In-service Orthodontist

## CORRESPONDING AUTHOR

**Dr. Rupam Kumari**  
Reader, Department of Orthodontics and Dentofacial  
Orthopedics, Gurunank Institute of Dental Sciences and  
Research, Kolkata

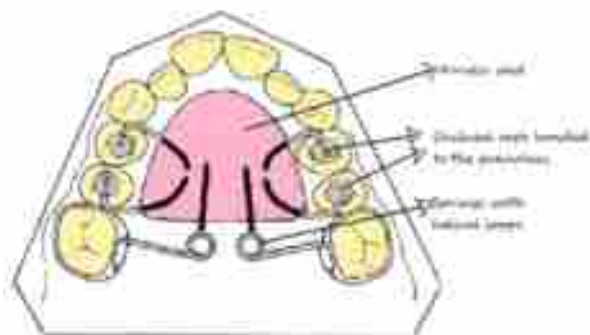
## INTRODUCTION

The technique that has been used frequently for the correction of Class II malocclusions is the “distalization” of the maxillary first molars to achieve a Class I molar relationship. This can also serve as the treatment of choice when there is no indication to extract maxillary teeth, and the mandibular tooth-size or arch-perimeter relationship does not permit mesial movement of the lower molars. The traditional approaches to distalization, like extra-oral traction, removable spring appliances, Wilson distalizing arches, sliding jigs with Class II intermaxillary elastics, require high level of patient compliance to be successful. In the now well-known study by Sinclair, all responding orthodontists used molar distalization, and almost all suggested that patient co-operation was the most important issue with distalization of maxillary molars.

Hence, there was an urgent need of appliances that needed less patient compliance, as relying on the patient's wish to wear an appliance consistently may lead to a longer treatment time. Intra-oral appliances that were thought to be less patient-reliant included the pendulum appliance, the Herbst appliance, molar distalizing bow (MDB) and repelling magnets.

## Design considerations

The pendulum appliance gained a lot of popularity amongst orthodontists because of its ease of fabrication as also less demand on patient compliance, as a means of distalizing molars in Class II patients. Hilgers in 1992 described the development of two hybrid appliances, the pendulum and the pendex. For distalizing the first molars, the appliance made use of the palate for anchorage with the help of an acrylic pad, connected to the dentition by means of occlusal rests that extended from the lateral aspect of the pad and bonded to the occlusal surfaces of the upper first and second premolars. The acrylic plate could also be integrated with a metal frame soldered to bands on the first premolars. The posteriorly directed distalization arms made from 0.032” TMA wire, extended from the distal aspect of the palatal acrylic



to form a helical loop near the midline before extending again laterally to insert into lingual sheaths on bands cemented on the maxillary first molars. The activation of the distalization arms has been done with the help of the closed helix, whereas the U-loops could be included in the spring assembly, to leave a scope for adjustment of the axial inclination during the distalization mechanotherapy. The appliance needed to be activated outside the patient's mouth and then cemented in place. This technique was recommended by Dr. Hilgers. In the passive state, the springs extended posteriorly, approaching the midpalatal raphe. After activation when inserted into the lingual sheaths, they produced a distalizing force against the maxillary first molars that moved the molars distally and medially. Usually, an initial activation of 60 degrees to 70 degrees (around one molar-width) generated around 250 g of force per side. The appliance needed to be monitored every month.

#### Indications for pendulum appliance include:

1. Phase one of orthodontic treatment of Class II molar relationship unilateral or bilateral distalization of maxillary first molars, mostly in non-compliant patients.
2. For gaining space in some cases of early loss of primary molars leading to mesial drift of upper first molars.
3. Non-extraction treatment of mild to moderate crowding.

The following is a case report describing the treatment of Class II malocclusion by distalization of the maxillary first molars with the help of the Hilgers' pendulum appliance.

## CASE REPORT

This was the case of a 14-year old Indian Bengali girl who reported with the chief complaint of irregular arrangement of upper front teeth. She was self-motivated and wanted an improved smile. On examination the patient had a symmetrical face with mesoprosopic facial form and an acceptable facial profile (Figs 1,2).

#### Problem list

- i. A full (one-cusp width) Class II molar relationship on the right side and an end-on relationship on the left side (Fig2,5).
- ii. The maxillary right canine was out of the arch with a slightly higher labial placement. The left canine was in an end-on relation with the lower canine.
- iii. The maxillary and mandibular incisors were retroclined with reduced overjet of 1 mm and an overbite of 4 mm.
- iv. Crowding was present in both the upper and lower arches.
- v. Study model analysis revealed a space deficit of 8 mm in the upper arch and 7 mm in the lower arch, and a curve of Spee of around 3mm. Both upper and lower dental midlines were co-incident with the facial midline.

Intraorally all permanent teeth had erupted except the third molars. The panoramic radiograph revealed no underlying pathology and showed normal eruptive pattern of the third molars, in the bud stage (Fig.3). Lateral cephalograms were obtained in natural head position. Cephalometric analysis revealed a normal Class I skeletal pattern with average growth pattern and retroclined upper and lower anteriors (Fig.4). The nasolabial angle was found to be within normal range (94°).

## TREATMENT PLAN

Distalization of the maxillary 1st molars into Class I molar relation was decided as the treatment of choice as the patient was not willing to opt for extraction. By careful examination of the case, it was felt that an extraction treatment plan might lead to worsening of the soft tissue profile of the patient. According to Ricketts, the normal maxillary molar position was given by the distal face of the molar to the pterygoid vertical (PTV). The clinical norm has been set at age+3mm with a deviation of 3mm. It was observed for this case that the distal of pterygoid vertical distance was 18.5 mm which was favorable for a maxillary molar distalization treatment plan. The maxillary second molars were fully erupted whereas the third molars had only reached crown formation stage. It was Ghosh and Nanda who in their 1996 study observed that the effect of presence of third molars on the amount of maxillary molar distalization was highly variable. Hence, after very careful assessment it was decided not to perform germectomy of the third molars. Since the upper incisors were already retroclined flaring of the same due to distalization would help them achieve a normal inclination. The space gained due to molar distalization and some amount of flaring of the maxillary incisors would be utilized to bring the canines into the arch. The crowding present in the lower arch could be relieved by proclination of the

## PRE-TREATMENT

**Fig1. Extra-oral photographs**



**Fig2. Intra-oral photographs**



**Fig 3. Pre-treatment Orthopantomogram**



**Fig 4. Pre-treatment Lateral Cephalogram**





**Fig 5. Pre-treatment study models showing Class II molar relation on right side and end-on molar relation on left side**



**Fig. 6. Immediately after pendulum appliance was fitted in the upper arch**



**Fig. 7. 2-months progression of distalization**



**Fig. 8. 6-months of distalization when the required amount of space was achieved bilaterally**



**Fig. 9. Lateral cephalogram after complete distalisation with pendulum appliance**



**Fig. 10. Mid-treatment Lateral cephalogram after alignment of the upper arch**



**Fig. 11. Mid-treatment Orthopantomogram showing retention of the space with upper Nance Palatal arch**

#### **MID-TREATMENT PHOTOGRAPHS**



**Fig12. Mid-treatment intra-oral photographs**

#### **POST TREATMENT PHOTOS**



**Fig13. Extra-oral photographs**



**Fig14. Intra-oral photographs**



**Fig. 15. Orthopantomogram taken immediately before debonding to check for root parallelism**



**Fig. 16. Lateral Cephalogram after debonding**



**Fig 17. Superimposition of initial and final tracings on SN, centered on S**

**Table 1**

Parameters		Standard values	Pre-treatment	Post-treatment
<b>Sagittal relationship</b>	<b>skeletal</b> SNA (°)	82	79	80
	SNB (°)	80	77	78
	SND (°)	76	75	75
	ANB (°)	2	2	2
	Wits appraisal (mm)	1	1	1.5
<b>Dental base relationship</b>	Upper incisor to NA (mm/°)	4/22	2/20	2.5/25
	Lower incisor to NB (mm/°)	4/25	1.5/17	3.5/28
	Upper incisor to SN plane (°)	102±2	99	105
	Lower incisor to mandibular plane angle (°)	90±3	91	95
<b>Dental relationship</b>		Inter-incisal angle	131	141
<b>Vertical relationship</b>	<b>skeletal</b> SN plane-Mand. plane (°)	32	29	33
	Facial height index(%)	65	66.67	68.3
<b>Soft tissues</b>		Upper lip thickness mm	15	13
		Total chin thickness mm	10-12	10
		Upper lip to E-plane	-4	-4
		Lower lip to E-plane	-2	-1
		Nasolabial angle	90-110	94
				90

retroclined lower incisors. The space thus created in the upper arch needed to be maintained with a Nance appliance. After the initial leveling and alignment, and retraction of the canines into the arch, correction of the bite and retraction of teeth into the spaces created by the molar distalization would be attempted.

## TREATMENT PROGRESS

The pendulum appliance was fabricated on a working model and pre-activated before placing it into the lingual sheaths of the concerned molars. The appliance activation should not exceed the width of a molar. The premolar arms were bonded on the occlusal surfaces of the premolars with the help of composite. The pendulum appliance was continued for 6 months with no other appliances or attachments on the remaining teeth (Fig. 6,7,8). Each month the patient was called for review and the distalizing arms were activated. Greater distalization was needed on the right side than the left. After achieving a Class I molar position on both the sides, the upper molars were retained by keeping the appliance in place for 3–4 months. As the premolars were free from any attachment, some amount of distal drift of the premolars via transeptal fibers were observed.

### Fixed appliance therapy

The second phase of the treatment consisted of fixed appliance therapy with preadjusted edgewise appliance, MBT prescription 0.022" slot. The space created by molar distalization was maintained with the help of Nance palatal arch, prepared by modification of the pendulum appliance. After initial

alignment was achieved and the canines were aligned into the arch, retraction was continued bilaterally with active tieback from canines to molars that closed the spaces mesial to the molars. Final retraction of the anteriors was completed with the help of retraction utility arch. Treatment consisted of 20 visits over a period of 2 years 3 months. Class II elastics were continued for a period of 2 months to maintain the molar relation in Class I bilaterally. The occlusion needed to be settled further, but as the patient was relocating to another city, debonding was done. Upper removable Hawley's retainer was delivered at debonding. Flexible spiral retainers were placed in both upper and lower arches.

## TREATMENT RESULTS

Post-treatment lateral cephalogram (Fig16) showed that both maxillary and mandibular incisor inclinations were improved (Table 1). The post-treatment Orthopantomogram (Fig15) also revealed good amount of root parallelism. The bilateral molar distalization proved adequate to bring the canines into the arch bilaterally. A good occlusion was achieved at the end of treatment (Class I molar and canine relationship bilaterally) with normal overjet and overbite. There was significant improvement in facial and smile aesthetics (Figs 13,14).

## DISCUSSION

The Hilgers Pendulum appliance served as an effective choice of treatment in the case reported here, meeting with most of the patient's demands. The space created was sufficient to align the canines into



the arch, with proper incisor inclination. It was observed by Byloff and Darendeliler that the pendulum moved the molar distally by about 1.02 mm (+ 0.68 mm) every month with an initial strength of 200 to 250 g, proving that it could be considered as a simpler alternative to headgear traction using a force of 680 to 770 g on each side. It took almost 6 months for distalization using force of about 250g with 6 weeks activation. As the patient did not want to opt for extraction the entire treatment was completed with a non-extraction protocol. It led to a mild compromise on the nasolabial angle and lip protrusion (Table 1). But the patient was satisfied with the overall outcome. Smile aesthetics improved significantly. The only disadvantage of this method is the unwanted tipping of the maxillary molars that might be observed during the distalization process. Newer intra-oral appliances are still being researched to overcome such problems. Some of these are:

- i. Bone-anchored pendulum appliance (BAPA)
- ii. Temporary anchorage device-supported molar distalization

These can be regarded as constructive modifications that may have the advantage of reducing treatment time and have less side-effects on the molars.

## CONCLUSION

The case reported here could thus be considered as a successful therapeutic approach for noncompliant patients or who is unwilling to undergo dental extraction as a method of obtaining the space required for orthodontic treatments. In these cases, the pendulum appliance could satisfy some important requirements:

- i. Ease of fabrication and cheap
- ii. Minimum biomechanical side effects
- iii. Less demand on patient co-operation

Declaration of patient consent:

The authors certify that they have obtained all appropriate patient consent forms.

Conflict of interest

None

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