

Case Report



Pendulum appliance and K-loop combination for molar distalization: A case report

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Abstract

Most non-extraction Class II malocclusions are treated by extraoral and intraoral appliances for molar distalization. Extraoral traction is effective but depends on patient cooperation. This led to the use of intraoral appliances; however, they too have drawbacks such as molar tipping and loss of anchorage. In this case report, a 13-year-old patient with Class II malocclusion with good facial balance is treated non-extraction. The two quadrants were divided into pendulum only and pendulum K-loop combination to compare the amount of molar tipping and dentoalveolar changes on both sides. The left upper quadrant has Hilgers pendulum appliance (pendulum only). On the right side, pendulum was adjuncted buccally by Karla's K-loop appliance using split-mouth technique. It was concluded that Class I molar and canine relation was achieved faster on pendulum only side, though it presented with more distal molar tipping as compared to pendulum K-loop combination side which showed a controlled molar distalization.

Keywords: Class II treatment, Molar distalization, pendulum K-loop combination

Introduction

Angle's Class II malocclusion manifests with challenges to the orthodontists. One can no longer exclusively think about extraction line of the treatment because experiences have shown that indiscriminate extraction of teeth in some borderline cases makes the profile more concave. Non-extraction line of the treatment of Class II malocclusion differs in growing and adult patients.^[1]

A common strategy to correct Class II malocclusion in growing patients, using non-extraction protocol, is to distalize the maxillary molars to achieve Class I molar relationship. Extraoral traction with headgear is one of the earliest and efficient methods to move molars distally, although they depend primarily on patient cooperation. This led to the emergence of patient-friendly intraoral distalization appliances such as magnets, pendulum, NiTi coil springs, Jones jig, and distal jet.^[2-5]

Among these, Hilgers pendulum appliance is widely used. However, it causes undesirable distal tipping of maxillary molars and loss of anterior anchorage during distalization.^[3] K-loop, introduced in 1995 by Kalra,^[6] developed more biomechanically efficient system to control molar tipping. Studies have shown that both these appliances have similar skeletal and dentoalveolar effects.^[7] There is only one comparative study in the literature that evaluated the effects using pendulum appliance buccally

supported with a K-loop and compared it with extraoral traction. It stated that distal tipping and anterior anchorage loss were significantly reduced using the combination of pendulum and K-loop appliance.^[1]

Hence, in this case report, we used pendulum only and pendulum K-loop combination on two opposite sides in the same patient, same intraoral environment to compare the effectiveness of combining K-loop with pendulum appliance.

Treatment procedure

A 13-year-old patient reported with a chief complaint of irregularly placed upper teeth. On examination, she has mild skeletal Class II base with Angle's Class II malocclusion, average growth pattern with a negative VTO, deep overbite, moderate crowding in both jaws, and good facial balance with average nasolabial angle [Figure 1].

A non-extraction treatment plan was decided with distalization of maxillary molars to gain space for decrowding as well as correction of the molar and canine relation. The patient refused the use of headgear, thus the Hilgers pendulum appliance was chosen. To compare and control molar tipping, it was supported on one quadrant with a K-loop, fabricated with 0.017 × 0.025" titanium molybdenum alloy wire as described by Kalra.^[6] The pendulum arm was made 2 mm longer on pendulum only side so similar distalization distance achieved on both sides [Figure 2].

After insertion of the appliances, the patient was monitored every 3 weeks and the appliances were activated every 1 month.

Treatment results

Significant distalization with super Class I molar relation was achieved on pendulum only side within 11 weeks of the treatment. The pendulum K-loop combination side progressed slowly with completion of Class I relation in 15 weeks. However, it showed more of bodily movement of molar, while the pendulum only side showed more of molar tipping and slight rotation of molar mesiobuccally.

The patient was bonded with MBT 0.022 appliance. In the upper arch, segmental bonding was done initially along with the distalization appliances, to relieve anterior crowding. After distalization, the appliances were removed on both sides and a Nance palatal button was given for retention. Complete bonding of both the arches was done. Leveling and aligning followed by

closure of distalization spaces were done. Finishing and detailing were done using NiTi archwires [Figure 3].

Post-treatment radiographs [Figure 4] revealed good root parallelism and the cephalometric values have remained more or less the same as pre-treatment values [Table 1].

Mandible has very slightly rotated forward. Comparison of pre-treatment and post-treatment records reveals good esthetic and functional result [Figures 5 and 6].

Discussion

Non-extraction treatment of Class II malocclusion requires maxillary molar distalization by means of extraoral or intraoral forces. Headgear traction has been undoubtedly proven efficient in correction of skeletal Class II discrepancy; however, the dependence on the patient cooperation and associated soft tissue injuries is of concern. A randomized review on molar distalization suggested that intraoral appliances are more effective than headgear.^[7]



Figure 1: Pre-treatment extraoral and intraoral photographs



Figure 3: Post-treatment photographs



Figure 2: Appliances for molar distalization: Pendulum appliance, supported buccally by a K-loop (right quadrant)

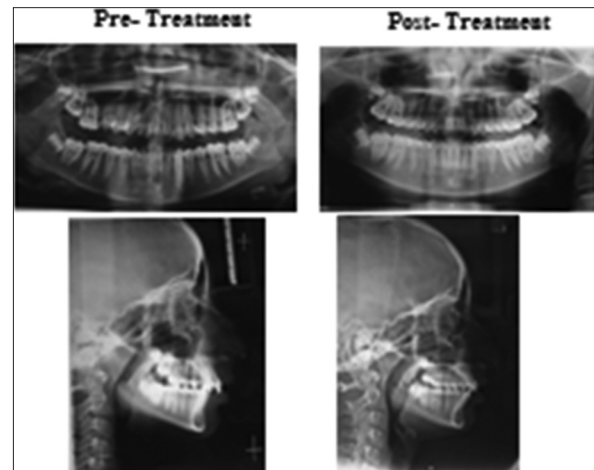


Figure 4: Comparison of pre- and post-treatment orthopantomogram and lateral cephalographs

Table 1: Cephalometric data pre-treatment and post-treatment

Measurement	Average range	Pre-treatment	Post-treatment
SNA	82±2°	81°	82°
SNB	80±2°	77°	78°
ANB	2°	4°	3°
SN-Go-Gn	32°	32°	32°
LAFH	60–62 mm	53 mm	55 mm
SN-U1	102°	105°	103°
U1-NA	22°	23°	21°
	4 mm	5 mm	4 mm
LI-NB	25°	18°	24°
	4 mm	3 mm	5 mm
Nasolabial angle	102±8°	107°	108°

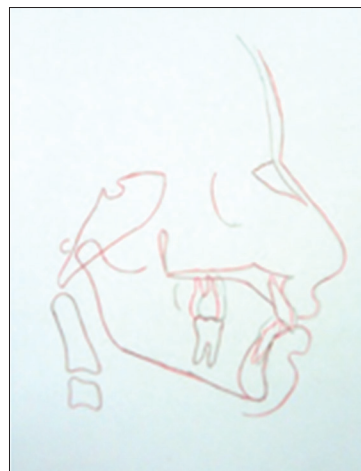
Various intraoral appliances were introduced for molar distalization, but unfortunately, none can control molar movement in all three dimensions. Kalra's K-loop was introduced for effective molar control and manipulation of moment-to-force ratio. It claimed to achieve bodily molar movement with controlled tipping. However, a recent prospective comparative study has concluded similar skeletal and dentoalveolar effects of both pendulum appliance and K-loop.^[8] In another study, the authors have found the use of a pendulum appliance supported buccally by K-loop, overcame the disadvantages of intraoral appliances, namely distal molar tipping and loss of anchorage.^[1]

In the present study, a combination of two intraoral appliances (pendulum and K-loop) was used and results were compared to pendulum only appliance. Two quadrants of same patient were chosen as a split-mouth technique. It was found that the dentoalveolar effects of both sides differed.

Molar distalization of 5.1 mm was achieved faster on pendulum only side, with molar moving into super Class I relation in 11 weeks. The side effects were more pronounced, with distal tipping of molar. Contrary to this, the combination of pendulum K-loop appliance progressed more bodily without molar tipping, with 4.7 mm of super Class I molar achieved in 15 weeks' time. Several studies have shown upper incisors protrusion during distalization with intraoral appliances; however, in the current case, no such effect was seen.

Conclusion

Until now, very few studies have been published in the literature to substantiate the biomechanical effectiveness of K-loop appliance. It is technique sensitive and requires proper balancing of moment-to-force ratio and anti-rotation bends. Pendulum appliance provides palatal anchorage from its Nance button. These two appliances when combined together can overcome the unwanted movements of each other, with consistency in force delivery resulting in controlled molar distalization. The

**Figure 5:** Comparison of pre- and post-treatment records**Figure 6:** Lateral cephalometric superimposition: Pre- (black) and post-distalization (red)

authors recommend further long-term investigations to confirm these findings and the use of combination pendulum K-loop appliance.

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