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Unilateral molar distalization with molar slider (Two Case Report)

Molar slider apareyi ile tek taraflı molar distalizasyonu: (İki vaka nedeniyle)

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Özet: *Çalışmamız 2 vaka raporundan oluşmaktadır. Vakaların her ikisi de dişsel tek taraflı sınıf II molar ilişkisine sahip vakalardan oluşmaktadır. Vakalarımızın her ikiside daimi ikinci molarları mevcut ve alt çenelerinde yer darlığı sergilememektedirler. Maksiller molar distalizasyonu için yeni bir aparey geliştirilmiştir. Molar Slider adı verilen aygıt ön tarafta ısırma plağı içeren bir Nance butonu ve molar ve premolar dişlere yapılan bantlarından oluşmaktadır. Palatinal tarafta distalizasyonu gerceklestirilecek sınıf II 1. molar dişlerin resistans merkezinden geçecek şekilde kuvvetin uygulanış noktası ayarlanmıştır. Ni-Ti sarmal yaylar kullanılarak 200 gramlık distal kuvvet uygulanmıştır. Lateral sefalometrik filmler tedavi öncesi ve distalizasyondan 2 ay sonra değerlendirilmiştir. Sonuçlarımız her iki vakada da gövdesel distalizasyon şeklinde olmuş ve sınıf II 1 premolarlarda ankraj kaybı gözlenmemiştir ancak keserlerde protruzyon görülmüştür. Derin kapanışa sahip vakamızda derin kapanış düzeltilmiş ne varki her iki vakada da overjette artış gözlenmiştir. Molarların stabilizasyonu ve kaybedilen ankrajın kazanılması için Nance apareyi uygulanmıştır. Sabit tedavi uygulamasından sonra keser protruzyonunun ve artmış overjetin düzeltilmiş olduğu sefalometrik değerlendirilme sonucu görülmüştür. Sonuç olarak Molar Slider apareyi hasta koperasyonuna gerek kalmadan tek taraflı sınıf II kapanışa sahip bireylerde rahatlıkla kullanılabilir.*

Anahtar Kelimeler: *Molar distalizasyonu, molar slider*

Summary: *We selected 2 patients for unilateral molar distalization. Dentally, the patients presented unilateral Class II molar relationship. The patients were on permanent dentition; second molars were erupted and presented well-aligned lower dental arch. For maxillary molar distalization a new intraoral appliance was developed. Molar Slider was composed of 2 premolar and 2 molar bands and the anchorage unit was composed of a Nance button with anterior bite plane. In its design from the palatal side, the point of distal force application was carried towards the level of center of resistance of the maxillary 1st molar. Ni-Ti coil spring was used and 200g of distal force was applied to the Class II 1st molar. Lateral cephalograms were taken and analyzed before and 2 months after the molar distalization. The results showed that Class II molars distalized bodily no mesial migration of Class II 1st premolars were observed, incisor protrusion and incisor proclination was observed after the removal of Molar Slider. Over bite was reduced in one of the case and overjet was increased in both of the patients. For stabilization, corrected Class II unilateral molar relationship was maintained with Nance button for 2 months. At the end of the fixed orthodontic treatment maxillary incisor proclination was reduced back to the original inclination. In conclusion this newly developed device achieved bodily distal molar movement with minimum patient cooperation.*

Key words: *Molar distalization, molar slider*

Introduction:

Over the past few years non-extraction treatment approach and non-compliance therapies have become more popular in correction of Class II malocclusions (1,2). Unilateral Class II relationship can be corrected by headgear with the application of asymmetric face bows (3,4,5). Many modifications have been designed and introduced to the literature however the undesirable lateral forces that tend to move molars into crossbite was unavoidable. According to Siatkovski's review (6) about the effect of unilateral headgear, distal force existed on both sides, but they were three times greater on the long outer bow side than on the short outer bow side and lateral forces existed which would develop cross bite. He recommended to stop using this mechanism if cross bite development begins to occur. Yoshida (7) investigated in vivo the effect and side effect of asymmetric face bows. He concluded that the force delivery system with a combination of an asymmetric face bow and the neck strap unavoidably produced lateral forces and the resultant transversal side effects were clinically critical.

The difficulties of the headgear wear, to depend on patient co-operation and undesired side effects of unilateral headgear stimulated investigators to develop new intraoral devices and techniques for molar distalization. The search for non-compliance treatment modalities eliminated the dependence on the patients never the less most of them could not achieve bodily molar distalization.

Reiner (8) introduced an intraoral modified Nance appliance for unilateral molar distalization. His results showed that molars were distalized a mean of 0.19mm/week, however the type of the movement has not been mentioned in the article. From the point of the location of force application, the molars would tend to tip distally.

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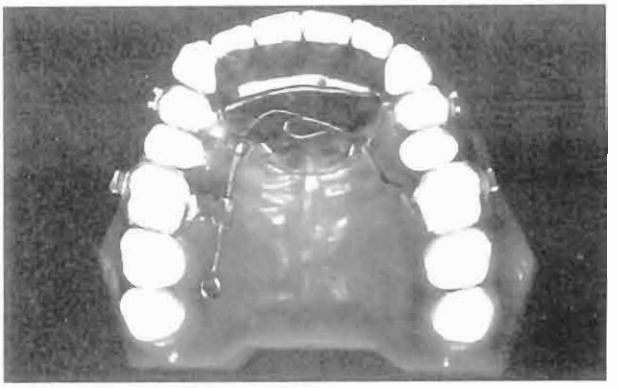

Figure 1: Occlusal wiev of the Molar Slider

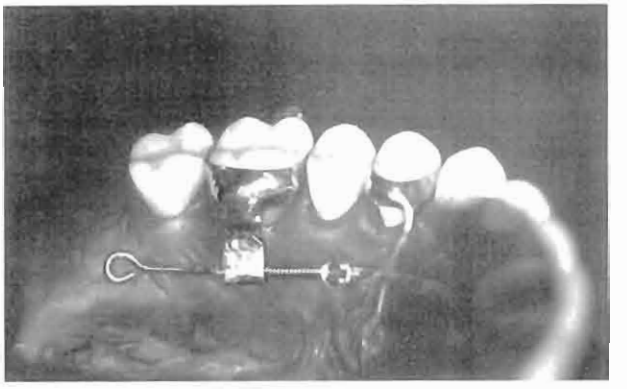

Figure 2: Palatal view of Molar Slider

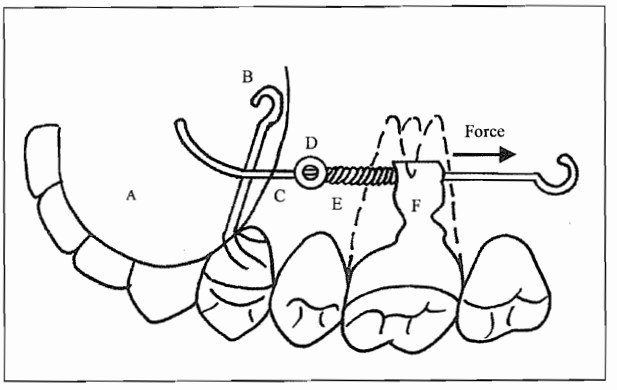

Figure 3: Biomechanics of Molar Slider

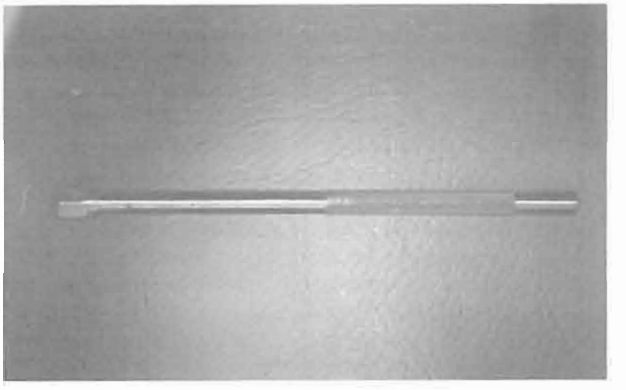

Figure 4: Special type of screw driver

Distal force is applied at the level of center of resistance of maxillary 1st molar

A. Acrylic anterior bite plane

B. Retaining wire for maxillary 1st premolar

C. 0.036 inch in diameter wire rod for distal sliding of maxillary 1st molar

D. Adjustable screw for activation of the coil spring

E. 0.036 inch heavy Ni-Ti open coil spring

F. Special tube soldered to the first molar band

The publications about unilateral molar distalization were limited. The lack of studies about unilateral molar distalization and the side effects of unilateral headgear motivated us to carry out an investigation and develop a new appliance, which would avoid distal tipping of maxillary Class II 1st molar and eliminate the headgear wear and minimize patient co-operation.

Materials And Method:

Appliance Construction: Maxillary 1st molars and 1st premolars were banded. On the palatal side of the Class II 1st molar band, 1.1mm diameter tube was soldered (Leone A 076-45). Class I molar and 1st premolar bands were attached with 1.1mm in diameter s.s. retaining wires to the Nance button. The acrylic button also consisted of an anterior bite plane. The purpose of creating an anterior bite plane was to disocclude the posterior teeth, enhance the molar distalization and also correct the anterior deep bite (Figure 1). 0.9mm in diameter s.s. wire was imbedded into the acrylic about 5mm apical to the gingival margin of the Class II 1st molar, which passed through the tube and oriented parallel to the occlusal plane (Figure 2). For molar distalization 2cm in length, 0.9mm in diameter, heavy Ni-Ti coil spring was placed in between the screw on the wire and the tube in full compression. The amount of force generated with the full compression of the 2cm open coil was about 200g. This force system would apply consistent distal force at the level of center of resistance of Class II 1st molar (Figure 3). Patients were seen once every month and the screw was reactivated with a special screwdriver (figure 4). After the distalization the appliance was removed and molars were stabilized by Nance appliance for 2 months before the second phase orthodontic treatment and maintained until the end of canine distalization.

Cephalometric Analysis: To analyze the parameters related to the maxillary dental changes, the method, which was developed earlier was used (9). Most of the time it is difficult to identify the inclination of the right and left molars and premolars on cephalometric radiographs because of the superimposition of the right side on the left side. 0.8mm wire markers were oriented vertically and retained in acrylic caps, which were made for maxillary Class II 1st molar, Class II 1st premolar and central incisor (Figure 5). The markers were

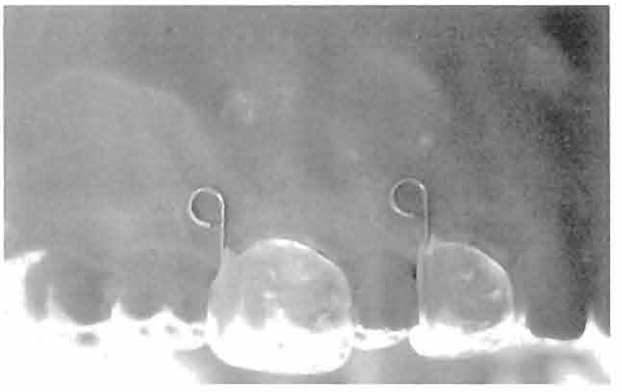

Figure 5: *Construction of the wire markers for cephalometric analysis*

Figure 6: *Lateral cephalometric radiograph of a patient with the wire markers cemented temporarily for measuring the inclination of the 1st molars, 1st premolars and central incisor before and after molar distalization.*

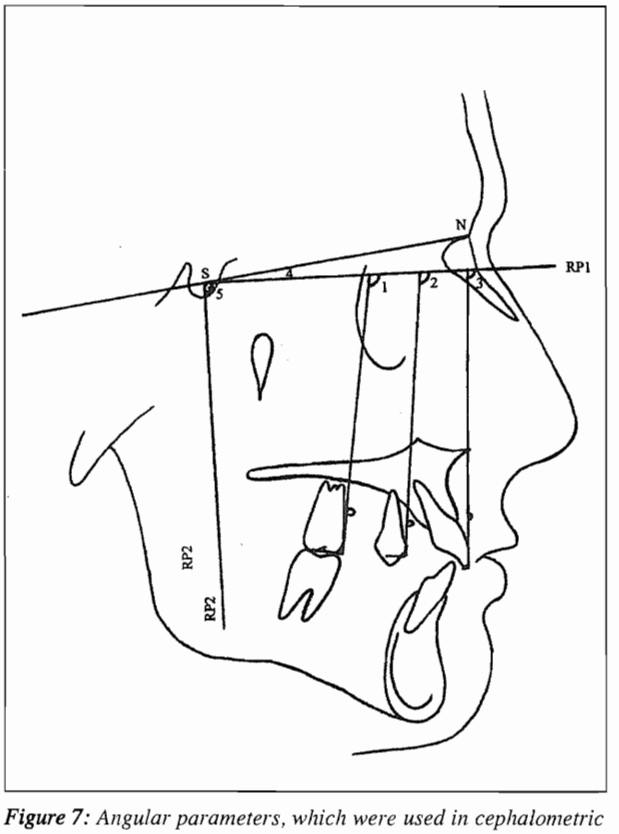

Figure 7: *Angular parameters, which were used in cephalometric analysis*

RP1= Horizontal reference plane
RP2= Vertical reference plane
1= Angle between the RP1 and the wire marker of the upper first molar
2= Angle between the RP1 and the wire marker of the upper first premolar
3= Angle between the RP1 and the wire marker of the upper incisor
4= Angle between the SN line and the RP1 is 7°
5= Angle between the SN line and the RP2 is 90°

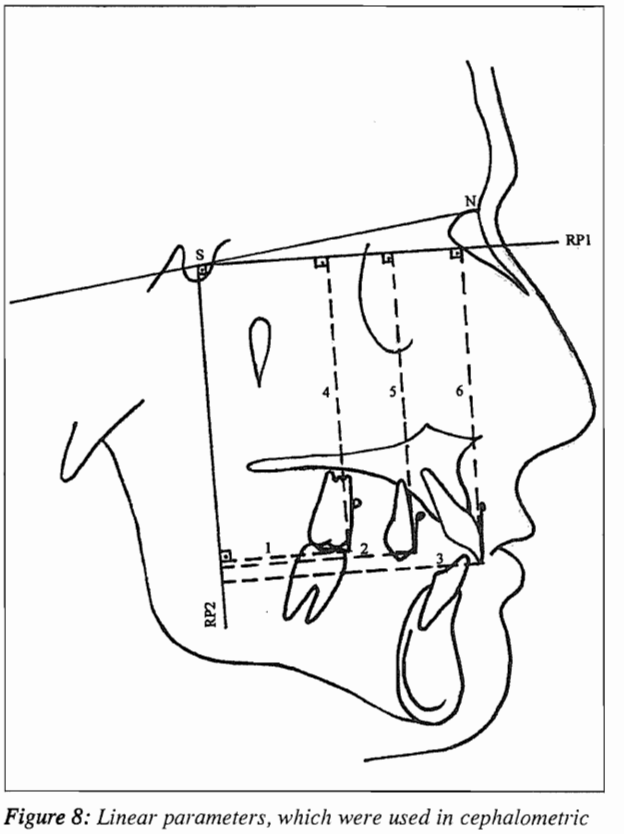

Figure 8: *Linear parameters, which were used in cephalometric analysis*

1= The distance between the RP2 and the wire marker of the upper first molar
2= The distance between the RP2 and the wire marker of the upper first premolar
3= The distance between the RP2 and the wire marker of the upper incisor
4= The distance between the RP1 and the wire marker of the upper first molar
5= The distance between the RP1 and the wire marker of the upper first premolar
6= The distance between the RP1 and the wire marker of the upper incisor

Figure 9: *Intraoral frontal view of O.Y. before the treatment*

Figure 10: *Intraoral right side view of O.Y. before the treatment*

Figure 11: *Intraoral left side view of O.Y. before the treatment*

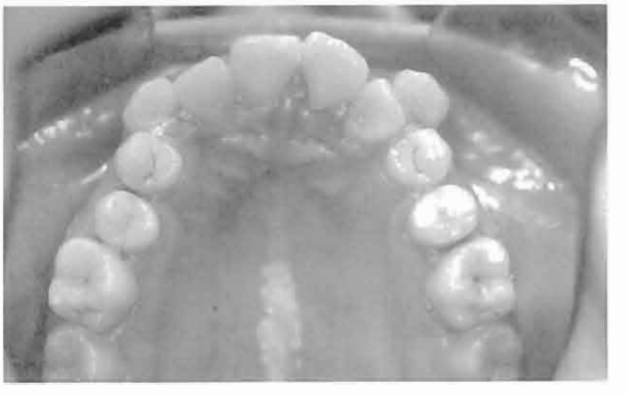

Figure 12: *Intraoral occlusal view of O.Y. before the treatment*

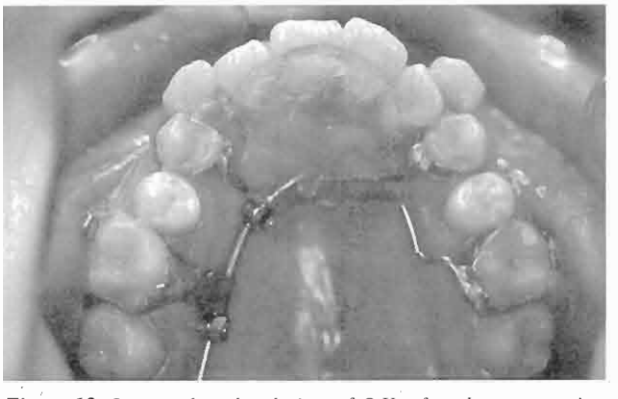

Figure 13: *Intraoral occlusal view of O.Y. after the cementation of Molar Slider*

Figure 14: *Intraoral right side view of O.Y. after the distalization (Distal drift of 2nd premolar with the help of transeptal fibers)*

cemented temporarily and lateral cephalometric radiographs were taken and analyzed before and 2 months after the removal of the appliance (Figure 6). The cephalometric parameters which were used in our study were presented in figure 7, 8 and table I.

Case I:

O.Y. is 14 years 3 months female diagnosed as Class II div. 1 subdivision right relationship (Figure 9-12). Dentally, 10% over bite, 3mm overjet were observed (Figure 9). Maxillary midline was deviated 4 mm to the left side (Figure 9) and posterior cross bite tendency was present on the right posterior side (Figure 10). Maxillary canines were both buccally positioned and 9mm crowding was present. Maxillary 3rd molars were congenitally missing. For her treatment we applied Molar slider (Figure 13) and 4.5 months later we observed that maxillary molars distalized bodily 4mm on the right side, posterior cross bite was corrected (Figure 14) and Class I molar relationship was maintained on the left side (Figure 15), maxillary midline deviation did not worsen after the unilateral distalization (Figure 9,16). Maxillary second premolars

Figure 15: Intraoral left side view of O.Y. after the treatment (Class I Molar relationship was maintained)

Figure 16: Intraoralfrontal view of O.Y. after thedistalization (Maxillary midline deviation did not get worsen after the distalization

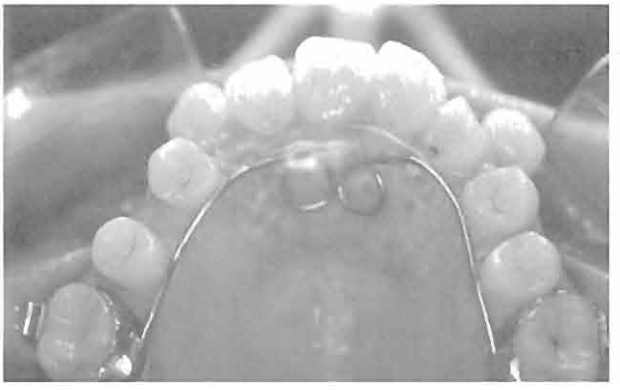

Figure 17: Intraoral occlusal view of O.Y. after the distalization (Stabilization with Nance button for 2 months)

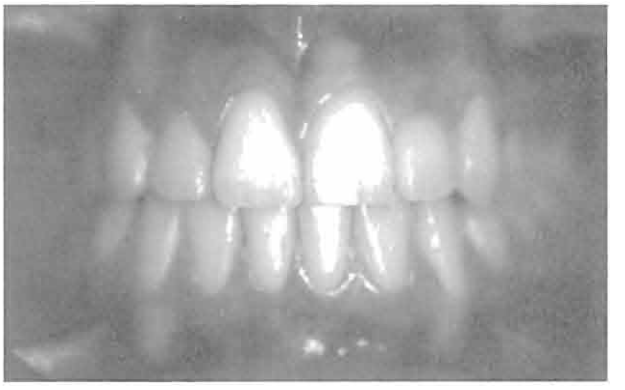

Figure 18: Intraoral frontal view of O.Y. at the end of 2nd stage treatment

Figure 19: Intraoral right side view of O.Y. at the end of 2nd stage treatment

Figure 20: Intraoral left side view of O.Y. at the end of 2nd stage treatment

drifted distally without any orthodontic force with the help of the transeptal fibers (Figure 14). We observed no anchorage loss on the 1st premolars however maxillary incisors were proclined and overjet was increased 2mm (Table I). The molars were stabilized by Nance button for 2 months before the fixed orthodontic treatment (Figure 17). Second stage fixed bonded and banded treatment lasted 14 months and bands and brackets were removed and retention stage started. At the end of second stage treatment intraoral pictures of O.Y. were presented at Figure 18-21. The cephalometric measurements were presented at table II.

Case II:

S.K. is 22 years 8 months male diagnosed as Class II div. 1 subdivision right relationship (Figure 22-25). He represents full cusp Class II molar and canine relationship on the right side (Figure 23). Dentally, 70% over bite, 3mm overjet were observed (Figure 22). Maxillary midline was deviated 2 mm to the left side (Figure 22) and maxillary right canine was buccally positioned (Figure 23). Maxillary 3rd molars were impacted on the right side and they were extracted before the treatment. Molar Slider was cemented

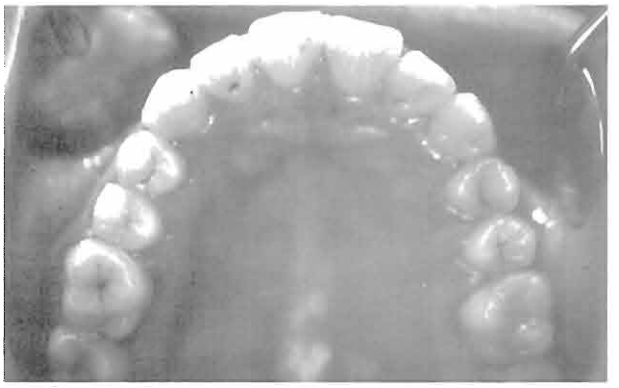

Figure 21: *Intraoral occlusal view of O.Y. at the end of 2nd stage treatment*

Figure 22: *Intraoral frontal view of S.K. before the treatment*

Figure 23: *Intraoral right side view of S.K. before the treatment*

Figure 24: *Intraoral left side view of S.K. before the treatment*

Figure 25: *Intraoral occlusal view of S.K. before the treatment*

Figure 26: *Intraoral occlusal view of S.K. after the cementation of Molar Slider*

(Figure 26) and 6 months later we observed that maxillary molars distalized bodily 5mm on the right side (Figure 28) and Class I molar relationship was maintained on the left side (Figure 29). Overbite was reduced to 20% and maxillary midline did not worsen after the unilateral distalization (Figure 27). Maxillary second premolars drifted distally without any orthodontic force with the help of the transeptal fibers (Figure 28). We observed no anchorage loss on the first premolars however maxillary incisors were proclined and overjet was increased 2.5mm (Table I). The molars were stabilized by Nance button for 2 months before the fixed orthodontic treatment (Figure 30). Fixed bonded and banded second stage treatment lasted 12 months and bands and brackets were removed and retention stage started. At the end of second stage treatment intraoral pictures were taken (Figure 31-34). The cephalometric measurements were presented at table III.

Discussion:

Our results showed in both cases that Class I molar and canine relationship was achieved by unilateral bodily molar distalization, maxillary midlines were corrected,

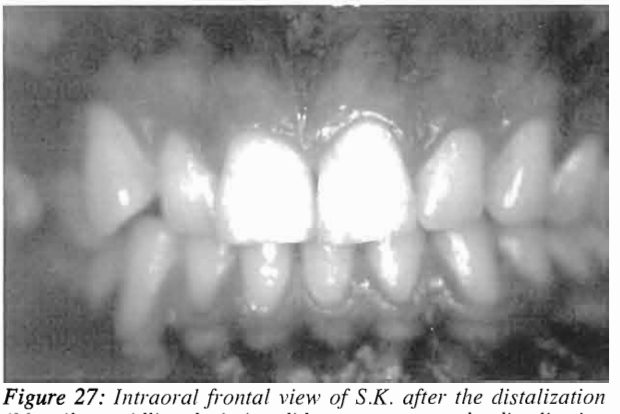

Figure 27: *Intraoral frontal view of S.K. after the distalization (Maxxilary midline deviation did not get worsen the distalisation and deep bite was reduced)*

Figure 28: *Intraoral right side view of S.K. after the distalization (distal drift of 2nd premolar with the help of transeptal fibers)*

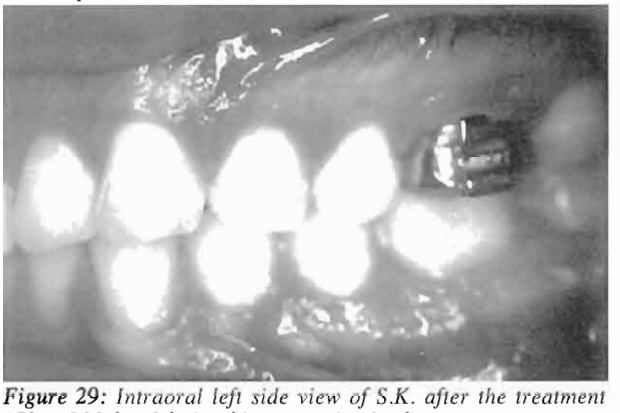

Figure 29: *Intraoral left side view of S.K. after the treatment (Class I Molar delationship was maintained)*

Figure 30: *Intraoralocclusal view of S.K. aftre the distalization (Stabiliztion with Nance button for 2 months)*

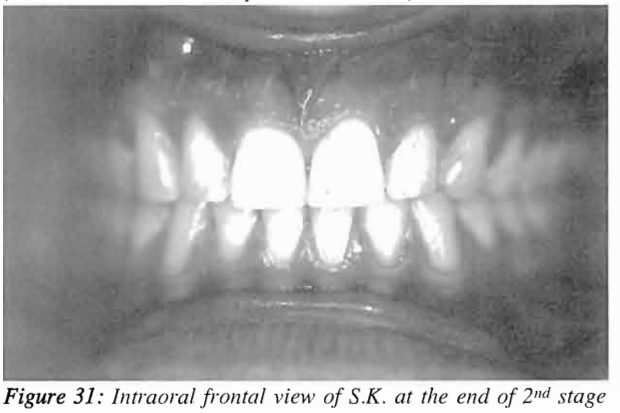

Figure 31: *Intraoral frontal view of S.K. at the end of 2nd stage treatment*

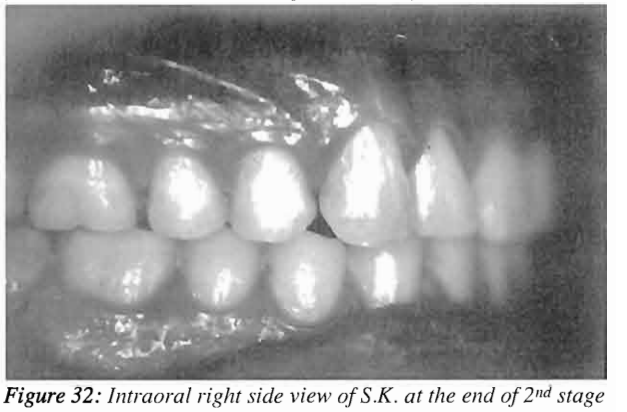

Figure 32: *Intraoral right side view of S.K. at the end of 2nd stage treatment*

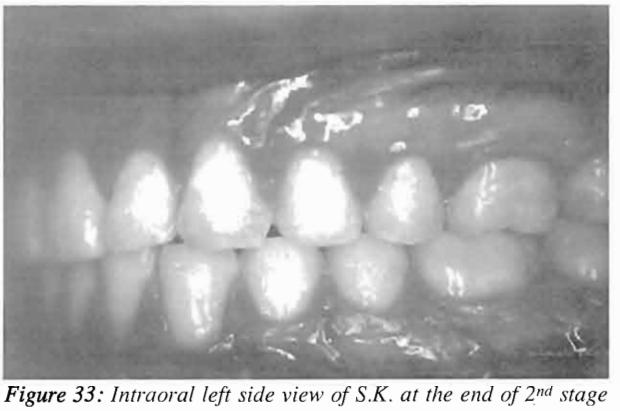

Figure 33: *Intraoral left side view of S.K. at the end of 2nd stage treatment*

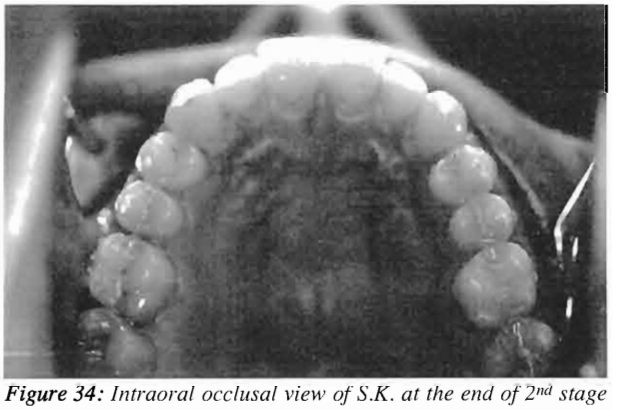

Figure 34: *Intraoral occlusal view of S.K. at the end of 2nd stage treatment*

Tablo I: Cephalometric evaluation of dental changes before the treatment and 2 months after the removal of molar Slider

Measurement	*Case I*			*Case II*		
	Before	**After**	**Difference**	Before	After	**Difference**
Dental-Angular						
Maxillary ClassII 1st molar – RP1	104	105	**-1**	98	96	**2**
Maxillary Class II 1st premolar – RP1	90	88	**2**	88	87	**1**
Maxillary incisor – RP1	91	86	**5**	84	77	**7**
Dental – Linear (mm)						
Maxillary Class II 1st molar – RP2	37	33	**-4mm.**	76	71	**-5mm.**
Maxillary Class II 1st premolar – RP2	51	51	**0mm**	75	75.5	**0.5mm**
Maxillary incisor – RP2	63	65	**2mm.**	80	82.5	**2.5mm.**
Maxillary Class II 1st molar – RP1	68	68	**0mm.**	54	55	**1mm.**
Maxillary Class II 1st premolar – RP1	68	69	**1mm.**	68	70	**2mm.**
Maxillary incisor – RP1	74	72.5	**-1.5mm.**	84	83.5	**-0.5mm.**
Overjet	3mm.	5mm.	**2mm.**	2.5mm.	4.5mm.	**2mm.**
Overbite	1mm.	1.5mm.	**-0.5mm.**	3mm.	1mm.	**-2mm.**

(-) Values represent distalization, distal tipping and bite opening

Tablo II: Case (O.Y) Skeletal and dental measurements, which were taken before and at the end of the fixed orthodontic treatment.

Vertical parameters	*Mean*	*Before the Tx*	*After the Tx*
Go-Me-SN	32°±8°	37°	36°
Saddle angle	123°±5°	124°	125°
Articulare angle	143°±6°	144°	142°
Gonial angle	130°±7°	129°	128°
Interior angle Σ	396°±3°	397°	396°
Jarabak ratio	59-62%	63%	64%
ANSMe/Nme	55%	54%	52%
Ant. Notch	2mm	3mm	3.5mm
Max. depth angle	60°	61°	62°
FMA	25°	30°	28°
Y axis angle	59.4°	59.5°	60°
Sagital parameters			
SNA	82°±2°	78°	78°
SNB	80°±2°	79°	78°
ANB	2°	-1°	0°
N per-P.A.	-1mm	4mm	4mm
Dental Parameters			
I-SN	103°	107°	107°
I-NA	22°	29°	29°
I-NA	4mm	5mm	7mm
I-FH	112°	116°	115°
IMPA	90°	88°	94°
I-NB	25°	18°	28°
I-NB	4mm	2mm	3mm
Pog-NB	4mm	6mm	6mm
Holdaway	1/1	2/6	3/6
I-I	131°	133°	124°

Tablo III: Case II (S.K.) Skeletal and dental measurements, which were taken before and at the end of the fixed orthodontic treatment.

Vertical parameters	*Mean*	*Before the Tx*	*After the Tx*
Go-Me-SN	32°±8°	22°	22°
Saddle angle	123°±5°	121°	122°
Articulare angle	143°±6°	144°	144°
Gonial angle	130°±7°	118°	118°
Interior angle Σ	396°±3°	383°	384°
Jarabak ratio	59-62%	75%	76%
ANSMe/Nme	55%	54%	52%
Ant. Notch	2mm	3mm	3.5mm
Max. depth angle	60°	59°	60°
FMA	25°	16°	16°
Y axis angle	59.4°	62°	62°
Sagital parameters			
SNA	82°±2°	84°	84°
SNB	80°±2°	82°	82°
ANB	2°	2°	2°
N per-P.A.	-1mm	108mm	109mm
Dental Parameters			
I-SN	103°	107°	107°
I-NA	22°	24°	24°
I-NA	4mm	4mm	4mm
I-FH	112°	115°	116°
IMPA	90°	96°	98°
I-NB	25°	21°	23°
I-NB	4mm	3mm	3mm
Pog-NB	4mm	4mm	4mm
Holdaway	1/1	¾	3/4
I-I	132°	133°	130°

ideal overbite, overjet, was achieved. Stable treatment result was established by establishing good interdigitation.

According to Gianelly (10), one factor that influences the rate of distal molar movement is the type of movement. Slow movement occurs when the molar moved distally bodily. After the molar distalization, the molars were stabilized by Nance appliance for 2 months prior to 2nd stage orthodontic treatment. We observed spontaneous distal drift of 1st and 2nd premolar with the help of transeptal fibers during the stabilization period by Nance. Gianelly (10) recommended after the molar distalization at least 4-5 months stabilization period prior to the bracket alignment.

For guided molar distalization 0.9mm stainless steel wire was used, and the coil spring activated once every month. The usage of a heavy rod for molar distalization allowed to control the direction of the force and also achieve bodily distalization with sliding mechanics. Consistent distal force at the level of center of resistance moved the Class II maxillary 1st molar bodily.

Molar Slider had some similarities with Distal-Jet appliance (11) from a mechanical point of view, however there were significant differences in its design. In the design of Molar Slider, a helix was made at the distal tip of the steal rod, which secure the amount of distalization and prevent the detachment of the tube for the rod. In Distal Jet appliance after certain amount of distalization there was a risk of detachment of the bayonet wire from the tube. In Molar Slider the use of heavy 0.9mm stainless steal rod allowed the molars slide distally without tipping in a controlled manner with less friction. In Distal Jet appliance the bayonet wire was inserted into a long tube. Increased surface area in contact between the tube and the wire increased the amount of friction. In Molar Slider the wide acrylic plate was effective to minimize the anchorage loss and the anterior bite plane was effective to open the bite and enhance the distal drift of molars by disoccluding the posterior teeth. Rather than connecting the appliance to the 2nd premolars as it was described in Distal Jet, the 1st premolars were banded and connected to the acrylic unit. This design difference enabled 2nd premolars drift distally freely with the help of the transeptal fibers.

Conclusion:

Our results showed that Molar Slider was a very effective fixed device to distalize molars bodily. Unilateral Class II relationship was corrected in both patients. Guided consistent distal force at the level of center of resistance allowed to move the molars distally without the cost of tipping and excessive anchorage loss. The other advantage of this appliance was short chair time and ease of reactivation. Molar Slider can also be used bilaterally for molar distalization. The anchorage loss in bilateral distalization could be greater, however while stabilizing with Nance the premolars would drift distally with the help of transeptal fibers. Further studies needed to be done at the end of the second stage orthodontic treatment in order to examine the stability of distally translated molars when correcting the class II canine relationship and reducing of the overjet.

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