ORTHODONTICS

MOLAR DISTALIZATION WITH CUSTOM MADE BILATERAL PALATAL DISTALIZER

ABIDA IJAZ, BDS, D. Orth, MCPS.Orth, MS. Orth (Turkey)

ABSTRACT

Class II malocclusion with moderate space deficiency in the maxillary arch and relatively well-aligned mandibular arch can be treated with both extraction and non-extraction strategies. In case of therapeutic extractions however, bite opening may become a problem, particularly in excessive overbite. In non-extraction mechanics, the aim is to distalize the maxillary first molars to class I molar relationship in order to gain space in the buccal segments for retraction of cuspids and anterior teeth. Different methods may be used for maxillary molars distalization, namely extra oral traction, combination of removable and extra oral appliances and intra oral fixed distalizers. The last being the most recent approach, specifically in Dental Class II malocclusion where skeletal effect is not needed. Amongst the intra oral fixed molar distalizers, the palatal or lingual distalizer system comprises the latest approach, being more aesthetic and most effective. This presentation reports on a female patient of 15 years, who presented with a mild Class II malocclusion. Her prominent nose and excessive overbite did not allow therapeutic extractions. The final treatment plan came to be the Bilateral Palatal Distalizer, which was custom made and modified in its design from an existing Italian appliance. The appliance was used for seven months with excellent results attaining an average of 5.5mm distalization of maxillary first molars.

Key words: Molar distalization, Bilateral Palatal distalizer.

INTRODUCTION

Treating mild skeletal or dental Class II malocclusions with relatively well-aligned mandibular dental arch and normal or horizontal growth pattern with extra oral appliances or combination of extra and intra oral appliances, demands patient's cooperation. Results with such appliances also depend upon patient's compliance. Intra oral fixed mechanics, on the other hand, being fixed and independent of patient's compliance produce excellent results. These appliances comprise the recent approach of molar distalization.

William L. Wilson, Robert C. Wilson' described the modular first phase appliance for multidirectional functional class II treatment. The appliance consisted of maxillary three dimensional bimetric distalizing arch and a three dimensional mandibular lingual arch with class II elastics. Class I molar relation was reported as a result of maxillary molar distalization and mesial movement of the mandibular first molars.

Richard D Jones, J White Michael' reported distal movement of the molar to Class I relationship with an open coil Nickel Titanium jig that delivered 70-75 gm of force. The Nance used by Jones was 1/2 an inch in diameter with out vertical addition of acrylic.

A. A Gianelly, P. W Bonds and W.M. Johnson' achieved effective molar distalization using a modified Nance with repelling magnets. They reported 1.7mm per month of molar distalization with out second molar...
eruption, 0.75 to 1.0mm per month with second molar eruption. The anchorage loss in this study was calculated as 20%.

Bondemark and Kurol reported an effective molar distalization together with distobuccal rotation using repelling magnets.

A.A Gianelly obtained an average of 1-1.5 mm molar distalization per month by 8-10mm activation of super elastic Nickel Titanium coil spring using a modified Nance as an additional means of anchorage reinforcement. N. Erverdi, O. Koyuturk conducted a comparative study between Niti coil springs and repelling magnets using 225gm force per side. They concluded that molar distalization with coil spring was 1.6mm greater than the magnets.

The most recent approach for molar distalization is the palatal distalizer system being most effective, aesthetic and easy to insert. Moreover an added advantage with this appliance is that active Nance can be easily converted into passive one to hold and stabilize the distalized molar. Aldo Carano, Giuseppe Sciciliani presented two case reports, illustrating bodily distalization of the maxillary molars, without the loss of anchorage, using palatal distalizer. The active components were 0.9mm stainless steel wire segments containing stainless steel coil spring and a clamp. The force exerted by the spring was 150gm and reactivation of the appliance was done by sliding the clamp closer to the molar once in a month. The mean distal movement attained was 4mm in four months duration. The rate of distalization was reported to equal the magnets or the Jone’s Jig, without any tip or rotation.

Tracy J Reiner conducted a study on 12 patients to see the effect of modified Nance for unilateral molar distalization. The results were comparable to that produced by Gianelly et al using magnets and modified Nance, and there was no clinical evidence of increased over jet. Joy Deep Gosh, R. Nanda conducted a study on 41 subjects to determine the effects of the pendulum appliance on distalization of maxillary first molars and reciprocal effects on the premolars and incisors. The pendulum spring was constructed from 0.032 inch T.M.A wire with one time activation of 60°. The mean molar distalization attained was 3.37mm with a distal tip of 8.36°. The mean reciprocal mesial movement of the first premolar was 2.55mm with the mesial tip of 1.29° and extrusion of 1.7mm the pendulum appliance was found to be an effective and reliable method of distalizing maxillary first molars.

Arturo Fortini, Massimo Lupoli and Massimiliano Parri, Conducted a study on 62 class II patients (37 female, 25 males) using First class appliance for rapid molar distalization. Age of the sample size ranged from 8.7 to 14.5 year. The average period for distalization was 42 days with a range of 28 to 95 days and the mean distal movement attained was 4.8 mm. The study concluded that the first class appliance produced rapid distalization of the maxillary first and second molars with out anterior anchorage loss or changes in vertical dimension. The appliance can be used both in deciduous as well as permanent dentition. Moreover the device can be left in place as a passive Nance to hold the distalized molars.

A. Keles, K. Sayinsu conducted a study on 15 patients to see the effects of intra oral bodily molar distalizer (I.B.M.D) appliance on distalization of maxillary first molars. The distalizing spring was modified using square section 0.032 X 0.032 inch T.M.A wire with one time activation of 60° built into the spring design. The Nance however did not include second premolars in anchorage unit. The results showed that maxillary first molars distalized bodily an average of 5.23mm with out any tip or rotation. Extrusion was negligible. Anchorage loss with this appliance was however greater, that was relapsed in two month during stabilization period of holding the distalized molars, with out any orthodontic mechanics. The study concluded that IBMD achieved bodily distal movement of the maxillary first molars and did not require head gear wear for up righting of the roots of the distalized first molars.

Ahmet Keles, Abida Izaz conducted a comparative study between two molar distalization appliances on 29 patients. The IBMD (Intra oral bodily molar distalizer) which is a fixed appliance was applied to 14 patients. The ACCO (Acrylic Cervical Occipital Anchorage) appliance which is a combination of removable and fixed appliance, was used in 15 patients. The results showed that with IBMD, maxillary molars distalized bodily an average of 4.5mm and an anchorage loss was found to be 4.5mm. Whereas with ACCO the mean distal movement of the maxillary first molars was 4.38mm.
with a mesial tip of 3.03 degree. However the anchor-
age loss with ACCO appliance was 2.11mm, due to the
use of head gear and anchorage reinforcement means
provided in the device. Moreover, the IBMD was not
patient dependent device. On the other hand in ACCO,
patient's compliance was found to be a must. This study
suggested involving second premolars in the anchorage
unit for IBMD and adjusting vertical position of the
outer bow in case of ACCO appliance.

This case reports on a healthy female of 15 years
with permanent dentition who presented with bonded
upper arch. Her presenting complaint was crooked,
irregular and prominent upper teeth. The history
described hereditary etiology and an interview with the
parents revealed father with convex profile and a very
prominent nose. On Extra oral Examination her face
was symmetrical with a tendency towards high angle.
Midface was found to be the longest of the equal
thirds. The lips were competent and the most promi-
nent feature on her face was the nose, which was quite
conspicuous both from the front as well as from the
side view.

INTRA ORAL EXAMINATION

The interarch relationship showed both right and
left class II molars and class II canines. The front view
showed mildly crowded upper arch, increased over jet
(8mm) and excessive overbite (5mm). Both upper and
lower mid lines were shifted to the left (upper shift
2.5mm, lower shift 1.5mm). The lower dental arch was
more or less aligned. On occlusal view, the upper
buccal segments were slightly constricted where as the
lower dental arch was ovoid in shape.

CEPHALOMETRIC ANALYSIS

The Sagittal elements of the cephalometric analysis
revealed normal maxillary apical base and mildly
deficient mandible (table 1) whereas the vertical analy-
sis determined a border line case. On the basis of the
data, the patient was classified as a mild Skeletal Class
II, because of hypoplastic mandible, Dental class II and
a tendency towards high angle.

PROBLEM LIST

- Crowded and Proclined upper Incisors
- Constricted upper buccal segments
- Gross Overjet
- Increased Overbite
- Mid line Shift
- Mildly convex profile

TREATMENT OBJECTIVES

The objectives of the camouflage treatment were
based on the problem list and were as follows.

- Resolution of crowding
- Improvement in antero posterior jaw and occlusal
  relationships.
- Correction of the mid line discrepancy

TREATMENT PLAN

Her prominent large sized nose and consequently,
the profile and relatively well aligned Mandibular
dental arch did not allow any extractions. Therefore
the treatment plan was rapid palatal expansion fol-
lowed by molar distalization.

APPLIANCE DESIGN

The cast was poured with bands on maxillary first
premolars, second premolars and first molars on both
sides. Wire segments from 0.9mm stainless steel wire
were soldered to the first pre molar bands and head
gear tube was soldered to second premolar and first
molar bands on both sides keeping it parallel to the
occlusal plane. First molar band along with the tooth
was detached form the cast and then 0.9mm stainless
steel wire (about 80mm long) containing NiTi coil
(0.012 x 0.032 inches) one inch long , was passed
through second premolar band and the proximal end
was given a terminal bend in the apical region. First
molar band along with contained plaster tooth was slid
from the distal end of the wire anteriorly to its original
position, compressing the coil spring between second
premolar and first molar. The extra hard plaster was
then placed to fix up the first molar band along with
the plaster tooth. On setting of the plaster, posteri-
or bending of the wire frame work was started distal to
the second molar, curving the wire anteriorly to
terminate in the apical region of the maxillary first
molar. The acrylic fabrication comprised Nance
modified from conventional Nance that was originally
designed in the form of a button of 1/2 inch
diameter soldered to first molars as well as from Gianelly’s Nance that covered anterior aspect of the palate till cinguli of the anterior teeth to provide Occlusal clearance and involved first premolars for anchorage purpose.

In this custom made appliance acrylic covered anterior palate but not the cingular area as disocclusion was not planned in this design. Posterioly the acrylic of the Nance extended as far backward as the maxillary second molar area, making this appliance more rigid anchorage reinforcement device. The appliance on full compression generated 277gm of force on each side.

**TREATMENT PROGRESSION**

According to the treatment plan her treatment was started with soldered hyrax and expansion was done at the rate of two turns of 45° each, twice daily for 10 days. Occlusal radiograph was taken before insertion of expander and on seventh day of expansion that revealed opening of mid palatal suture. The expanded hyrax was fixed and retained for three months.

After retention of the expanded arch, molar distalization was proceeded which could otherwise be possible immediately after expansion. Gianelly’s wider Nance was further modified by involving second premolars into the anchorage unit as recommended by Gosh and Nanda. The Nance was cemented and on the buccal segments, a heavy rectangular stainless steel segmental, arch containing Niti open coil (0.012x0.032") compressed to one third of its length was applied to both sides. The appliance was monitored every three weeks. The activation was done at the rate of six weekly addition of the piece of tubing or compressed coil equal to the amount of distalized molar. This treatment continued for about seven months but could not produce effective results. The molars did not distalize more than 1.5 mm on an average. Considering age of the patient being 16 years at that time, it was presumed that bone might have become more or less matured. More over position of the third molars might also be a source of hindrance. Maxillary third molars were therefore extracted and open coil springs were further used for another three months or so, yet the treatment was not responsive.

The next option was to design such an appliance that could be reliable and effective and of course cost effective and independent of patients compliance. The ultimate appliance designed was the bilateral palatal distalizer. The idea for this device was borrowed from the first class Leone Molar Distalizer designed by Dr. A. Fortini and Dr. M. Lupoli. The Leone distalizer consisted of a wire frame work bent from 0.045mm stainless steel that extended anteriorly to the mesial of first premolars and posteriorly to the distal of upper second molars. This wire frame work contained 10mm long Niti open coil (0.010x 0.045 inch). Teeth involved in the anchorage unit are second premolars and first molars. On the buccal surface of this appliance system, the screw rod is tightened to the soldered tube to the second premolars. The screw activation is recommended in counterclockwise direction at the rate of 45 degree opening of the screw twice daily .The Nance in first class distalizer is modified by extending backwards till distal of first molars Anteriorly however, it does not extend till cingular area nor does it incorporate vertical addition of the acrylic.

In the custom made appliance both efficacy and cost effectiveness were considered. The appliance design was modified from Leone first class distalizer firstly by reinforcing anchorage unit with inclusion of first premolars into the Nance, and secondly by incorporating Ni-Ti open coil on the buccal sides instead of screw attachments. One time activation was incorporated into the appliance. The appliance was monitored every three weeks. Distal movement of the molars was productive with this device.

**TREATMENT COMPLETION**

On completion of this phase the molars were distalized to super class I relationship, in about seven months duration. The results were based on the measurements from the pretreatment and post distalization cast photocopies and cephalometric analysis (Table 1). On the cast photocopies, the reference plane (RP) was drawn (from the mark on the most prominent rugae), perpendicular to the midline drawn over the mid palatal suture. Linear and angular measurements were then drawn as described by Champagne (1992).

For the cephalometric analysis, Sella-Nasion plane from the pre treatment cephalogram was superim-
Fig 1. Pre treatment front view

Fig 2. Pre treatment profile

Fig 3. Intra oral front view

Fig 4. Custom made bilateral palatal distalizer

Fig 5. Appliance on insertion 227 grams each side

Fig 6. Completion stage. Molar distalized to super class I (7 months)

Fig 7. Treatment progression (8 months after distalization of molars)

Fig 8. Final stage of comprehensive fixed mechanics

Fig 9. Post treatment front view

Fig 10. Post treatment profile
TABLE 1: PRE AND POST TREATMENT CEPHALOMETRIC ANALYSIS LINEAR MEASUREMENTS IN MILLIMETERS ANGULAR MEASUREMENTS IN DEGREES

<table>
<thead>
<tr>
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<th>Age/Sex</th>
<th>15 years</th>
<th>Female</th>
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<td></td>
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<tr>
<td>Sagittal</td>
<td>Pre</td>
<td>Prog</td>
<td>Diff</td>
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<td>SNA</td>
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<td>82</td>
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<tr>
<td>ANB</td>
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<td>5</td>
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<tr>
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<tr>
<td>Facial Angle</td>
<td>76</td>
<td>78</td>
<td>2</td>
</tr>
<tr>
<td>Vertical</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SN Mand</td>
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<td>32</td>
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<tr>
<td>FMA</td>
<td>29</td>
<td>26</td>
<td>-3</td>
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<tr>
<td>Sum of Posterior</td>
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<td>393</td>
<td>-2</td>
</tr>
<tr>
<td>Angles</td>
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<td></td>
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<tr>
<td>Ratio of PFH to AFH</td>
<td>67%</td>
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<td>0.93</td>
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<tr>
<td>Ratio of TFH to LFH</td>
<td>58.26%</td>
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Dental Analysis

<table>
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<tr>
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<th>104</th>
<th>-3</th>
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<td>U1-PAL</td>
<td>114</td>
<td>112</td>
<td>-2</td>
</tr>
<tr>
<td>IMPA</td>
<td>92</td>
<td>100</td>
<td>8</td>
</tr>
<tr>
<td>HA</td>
<td>125</td>
<td>122</td>
<td>3</td>
</tr>
<tr>
<td>U1-NA Distance</td>
<td>4</td>
<td>4</td>
<td>0</td>
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<tr>
<td>U1-NA Angle</td>
<td>27</td>
<td>22</td>
<td>-5</td>
</tr>
<tr>
<td>L1-NB Distance</td>
<td>5</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>L1-NB Angle</td>
<td>22</td>
<td>30</td>
<td>8</td>
</tr>
</tbody>
</table>

Soft Tissue Analysis

| UL to E Line | -7 | -7 | 0  |
| LL to E Line | -2 | -1 | 1  |
| UL to S Line | -2 | -3.5 | -1.5 |
| LL to S Line | 1.5 | 1 | 0.5 |
| Nasolabial Angle | 113 | 117 | 4  |

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<td>8</td>
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then the true vertical were drawn. Linear measurements from the true horizontal were made to measure extrusion or intrusion of the involved teeth. Angular measurements were made to show the tip whether mesial or distal of the concerned teeth from the anterior angle between long axis of the tooth and the true horizontal. The maxillary first molars distalized 5.5mm on an average (table 2) and extruded 2mm (table 3). The mesiobuccal rotation seen was 14 degree on average.
TABLE 4: THE ANGULAR MEASUREMENTS IN DEGREES FROM THE TRUE HORIZONTAL. DISTAL TIP (+), MESIAL TIP (-)

<table>
<thead>
<tr>
<th></th>
<th>Pre</th>
<th>Post</th>
<th>Diff</th>
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<tbody>
<tr>
<td>Maxillary first molars</td>
<td>102</td>
<td>100</td>
<td>-2</td>
</tr>
<tr>
<td>Maxillary second premolars</td>
<td>91</td>
<td>105</td>
<td>14</td>
</tr>
<tr>
<td>Maxillary first premolars</td>
<td>88</td>
<td>98</td>
<td>10</td>
</tr>
<tr>
<td>Maxillary right central incisor</td>
<td>68</td>
<td>70</td>
<td>2</td>
</tr>
</tbody>
</table>

(table 5) along with the mesial tip of 2 degree (table 4) unlike the usual distal tip with molar distalizers. The maxillary second premolars however showed a distal movement of 1mm and measured the distal tip of 14 degree, unlike the usual anchorage loss. It did not show any extrusion nor intrusion movements. The first premolars did not show any linear movement whether mesial or distal. The mean extrusion found was 0.5 mm (table 3) and the distal tip measured on average was 10 degree (table 4). The maxillary central incisor measured a distal movement of 1mm (table 2), unlike the usual anchorage loss. Rather it showed a distal tip of 2 degree (table 4) and a distal tipping movement of 10 degree was observed with this appliance, which again determines over correction and indicates the need of regulating the distalization forces in the device. The mean extrusion measured of this tooth was 0.5mm. The maxillary central incisor too, did not measure any anchorage loss unlike conventional distalizers. Instead it showed a distal movement of 1mm and a distal tip of 2 degrees there by improving axial inclination of the tooth from pretreatment 107 to 104 degree (table 1). This tooth showed an extrusive movement of 1mm. As mentioned earlier it may partly be the effect of expander as well as an effect of expanded molar distalizers. Rather a distal tipping movement of 10 degree was observed with this appliance, which again determines over correction and indicates the need of regulating the distalization forces in the device. The mean extrusion measured of this tooth was 0.5mm. The maxillary central incisor too, did not measure any anchorage loss unlike conventional distalizers. Instead it showed a distal movement of 1mm and a distal tip of 2 degrees there by improving axial inclination of the tooth from pretreatment 107 to 104 degree (table 1). This tooth showed an extrusive movement of 1mm. As mentioned earlier it may partly be the effect of distalizer as well as an effect of expander. The median space created by expansion device might have accommodated the proclined and crowded incisors to improved sagittal and axial position of these teeth. As a matter of fact cast and cephalogram would have been recorded immediately before molar distalization after the retention phase of expansion, so as to rule out dental effects of expansion.

TABLE 5: ANGULAR MEASUREMENT FROM THE CAST PHOTOCOPIES USING MIDLINE REFERENCE PLANE.

<table>
<thead>
<tr>
<th></th>
<th>Pre</th>
<th>Post</th>
<th>Diff</th>
<th>Normal</th>
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<tr>
<td>Maxillary right first molar</td>
<td>14</td>
<td>28</td>
<td>14</td>
<td>20</td>
</tr>
<tr>
<td>Maxillary left first molar</td>
<td>15</td>
<td>29</td>
<td>14</td>
<td>20</td>
</tr>
</tbody>
</table>

coil spring. Extrusion of the molars observed with this appliance was however 2mm which may partly be the result of hyrax expander as well as the effect of Distalizer. Second premolars did not show any extrusion, nor did they show any anchorage loss. Rather it measured a distal movement of 1mm along with 14 degree distal tip. This again shows over correction due to excessive force from the force system and suggests regulating the distalizing forces. Maxillary first premolars did not show any mesial movement and mesial tip that other wise appears with conventional molar distalizers. Rather a distal tipping movement of 10 degree was observed with this appliance, which again determines over correction and indicates the need of regulating the distalization forces in the device. The mean extrusion measured of this tooth was 0.5mm. The maxillary central incisor too, did not measure any anchorage loss unlike conventional distalizers. Instead it showed a distal movement of 1mm and a distal tip of 2 degrees there by improving axial inclination of the tooth from pretreatment 107 to 104 degree (table 1). This tooth showed an extrusive movement of 1mm. As mentioned earlier it may partly be the effect of distalizer as well as an effect of expander. The median space created by expansion device might have accommodated the proclined and crowded incisors to improved sagittal and axial position of these teeth. As a matter of fact cast and cephalogram would have been recorded immediately before molar distalization after the retention phase of expansion, so as to rule out dental effects of expansion.

DISCUSSION

Goal of this phase of treatment was to distalize molars to class I relationship in order to create space and accommodate crowded anteriors. This article describes the effect of Bilateral Palatal Distalizer, which was fixed to the upper buccal segments involving first and second premolars and the first molars.

Molars were distalized to class I relationship in 7 months period. The molar distal movement attained was 5.5mm, on an average. The mean mesiobuccal rotation observed with this tooth was 14 degree that resulted in improvement of the rotational position of this tooth, rather these angular measurements showed an over correction of 6 degrees on an average that could be managedGianelly'smprehensive fixed mechanics. With this appliance, the mesial molar tip of 2 degree was seen, unlike the distal tip of molar with pendulum appliance or Gianelly's Distalizers. This mesial tip may reflect over correction, due to reaction from the open

CONCLUSION

The custom made bilateral palatal Distalizer was given in a female patient at the age sixteen and half years. Successful results were attained with this device and on the basis of these results; following conclusions may be drawn;
This appliance is an effective and reliable method of distalizing the maxillary first molars. It induced negative anchorage loss. It incorporates one time activation. It is esthetic and easy to insert. It is independent of patient's compliance. It can be easily converted into passive Nance. The appliance can be used in the late teens.

Further modifications are suggested in the appliance fabrication by involving two-step impression technique in order to eliminate errors because of dimensional changes. Moreover force system needs to be regulated in this device to get bodily distal movement of maxillary first molar.

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