INNOVATIVE APPROACHES TO INCREASE ARCH LENGTH

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Abstract:
Non-extraction treatment modalities rely upon anterior proclination and molar distalization for gaining space in post adolescent patients. Proclination of anteriors can be done using various methods like advancing loop, protraction utility arch and anchor bends. These methods may cause root resorption as heavy forces are involved and these techniques may also result in intrusive forces which may not be desirable for all cases. Gaining space by molar distalization can be achieved by Wilson’s arch, head-gear, pendulum appliance, K-loop. However, they require high patient co-operation and some may cause soft tissue irritation and pose problems for the operator to continue using.

This article presents two innovative techniques to increase arch length by anterior proclination and molar distalization. Two case reports demonstrates the effectiveness of the modalities.

Key-words: arch length, anterior proclination, molar distalization.
INTRODUCTION

One of the primary concerns for an orthodontist is the modality of gaining space and the subsequent management of the same. Orthodontists are free to consider any method of gaining space as long as it helps to achieve ideal goals. However, adult patients dictate the clinician to spare the teeth the taste of “cold steel and provide a breath of fresh air.” Common methods for gaining space by increasing arch length in borderline cases have been by proclining the anterior teeth and distalizing the maxillary posterior dentition. Proclination of anterior teeth can be done using various methods like advancing loop, protraction utility arch and anchor bends. These methods may cause root resorption as heavy forces are involved and these techniques may also result in intrusive forces which may not be desirable for all cases. Gaining space by molar distalization can be achieved by Wilson’s arch, head-gear, pendulum appliance, K-loop. However, they require high patient co-operation and some may cause soft tissue irritation and pose problems for the operator to continue using.

Two simple innovative techniques were developed in the Department of Orthodontics at D. J. College of Dental Sciences and Research to increase arch length by anterior proclination and by molar distalization.

Innovative Technique 1 - To Increase Arch Length by Proclination of Anterior Teeth

The resultant effect of retroclined anteriors is decreased arch length which can cause space issues for eruption of permanent canine and premolar and may provoke a deflected path of mandibular closure. Routinely used 0.016" NiTi wires have been innovatively modified to cause proclination of the anterior teeth.

Steps in fabrication of anterior proclination technique:

1. Position the 0.016" NiTi wire in bracket slot and mark points bilaterally immediately mesial to the molar tubes.
2. Adjustments are done while positioning such that there is adequate amount of wire labial to the incisor brackets.
3. Engage Guerin locks on the wire 2mm distal to the marks. (Figure-1)
4. Sequential ligation of the wire is done with the premolars being the first followed by canines and lastly the incisors.
5. The extra length of wire which lies in the anterior segment is formed into small loops in the process of wire engagement. (Figure-2)
6. Reactivation can be done by adjusting the position of the Guerin locks.

Figure 1. Ligate sequentially starting from the premolars and moving to central incisors.

Figure 2. Extra length of wire forms small loops.

Biomechanical Consideration

Lingually tipped incisors need to be flared by uncontrolled tipping using light forces which are provided by 0.016" NiTi wires.

Protraction utility arch and wires with anchor bends when engaged result in both proclination and intrusion simultaneously. However, ideally the inclination of teeth should be corrected before any intrusive forces are applied as severely lingually tipped incisors would have the opposite moment (as compared to normal or labially tipped incisors) due to the line of force being lingual to the center of resistance of the incisors. This would result in deepening of the bite and worsening of the inclination (Figure-3).

Advantages of the present technique:

- Effective way to procline anterior teeth and gain arch length.
- Presence of Guerin lock secures the system and prevents mesial drift of the molar.
• Easy intra-oral reactivation by adjusting the position of the Guerin lock.
• Aligning and proclination can be done with the same wire.

Case Report - I

HISTORY AND DIAGNOSIS

A 16-year-old, post pubertal female reported to the department, with the chief complaint of unaesthetic appearance. Patient had a convex profile with competent lips, no gross asymmetry and no relevant dental and medical history (Figure-4). Intraoral examination revealed bilateral Class I molar relationship with an over-bite of 8 mm and a minimal over-jet of 0.5 mm with matching midlines (Figure-5). Functional examination revealed no mandibular shift on closure. Bolton analysis showed an overall mandibular excess of 3 mm and 2.7 mm of mandibular anterior excess.
TREATMENT OBJECTIVES
The goals of orthodontic treatment were -
(1) Establishment of ideal over jet and overbite.
(2) Maintain a Class I molar and canine relationship.
(3) Provide space for alignment of the maxillary and mandibular teeth for aesthetics, function and hygiene.
(4) Maintain the acceptable facial balance and muscle tone.
(5) Compensate for the relative excess mandibular tooth mass.

TREATMENT PROGRESS
1. 0.022" Roth prescription brackets were bonded and triple tubes were placed on molars.

2. 0.016" NiTi wire was modified as described previously and engaged to bring about proclination of upper anteriors to increase arch length (Figure-8).
Results

The case was assessed after two months and Class I molar and canine relationships were maintained with satisfactory inter-digitations of posterior teeth. The over-jet was increased to 2mm and the overbite was improved by 2mm (Figure-8) Post treatment radiographs (Figure-9) showed minimal root resorption had occurred. Cephalometric evaluation (Figure-10) revealed that the upper incisors were proclined to 2mm, and the inter-incisal angle was reduced to 135°.

Space gained due to change in inclination of the incisors was planned for utilization to achieve intrusion of anteriors using an utility arch while the remaining space would be used to build-up the lateral incisors to match the Bolton's discrepancy.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Cephalometric measurements of pre and intra treatment (after anterior proclination)</th>
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<tbody>
<tr>
<td></td>
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<tr>
<td>Pre-Rx</td>
<td>83°</td>
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<tr>
<td>Intra-Rx</td>
<td>83.5°</td>
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</table>

(Anterior proclination)

Conclusion

This innovative modification of a conventionally used 0.016" NiTi arch wire can be effectively used to procline the anteriors in labial orthodontics. This technique can be a used in lingual orthodontics as a useful method to bring about proclination, which is routinely difficult to achieve in the lingual technique. Wiechmann recommends a similar modification using stops and sequential ligation to gain space for teeth that are crowded out of the arch and difficult to engage. The simplicity of reactivation intra-orally makes an interesting advantage.
Innovative Technique II:
— To Increase Arch Length by Molar Distalization

INTRODUCTION:

Molar distalization appliances like Wilson’s arch, headgear, magnets, coil spring, pendulum appliance and K-loop are used in practice. However, some require high patient compliance, some are unable to achieve bodily movement of the molars, and others may cause soft tissue irritation.

An ideal appliance for molar distalization should have effective force control permitting manipulation of moment to force ratio to achieve bodily movement with minimal anchor loss, besides ease of operator use and patient comfort.

This article describes an innovative appliance for molar distalization in accordance with ideal requisite listed above.

Molar Distalizing Technique:

1. Anchorage preparation done by fabricating a soldered Nance with bands on first bicuspids.

2. O.022” Preadjusted Edge-Wise brackets bonded from canine to canine and molar bands with upper triple tubes cemented.

3. Leveling and aligning was done using 0.016” NiTi, 0.016” stainless steel followed by 0.018” stainless steel. Aligning of palatally placed laterals and highly placed canines ideally should be done post distalization.

Steps in the Fabrication of Distalizing wire:

- Place a 0.017” × 0.025” TMA wire and make the following marks intraorally:
  
  First mark – mesial to the first molar tube (on the side distalization is needed)

  Second mark- distal to premolar bracket (Figure-1)

- Remove the wire and place Guerin lock (hook facing occlusally) 4mm distal to the first mark. (Figure-2)

- Make a 20° ‘V’ bend at the center of premolar mark and Guerin lock with the open end of the V in the occlusal direction (Figure-3).

- Bend the wire gingivally at premolar mark to act as stop and to enable placing the wire passively in the premolar bracket. (Figure-4)

- Consolidate from first premolar to first premolar with 0.010” ligature wire for additional anchorage preservation.

- Place the distalizing wire and ligate sequentially starting from the central incisors and moving to premolars. (Figure-5)
• When the wire is ligated in the premolar bracket, extra wire will appear between first premolar and molar which will create a loop in that location. Forces generated by this loop will move the molar distally approximately by 2.5 mm in 6-7 weeks.

• Reactivation can be done intraorally after 6-7 weeks by pushing the wire 3mm mesially from distal of molar tube and by readjusting the Guerin lock in close approximation to the molar tube.

**Biomechanics:**

The loop formed due to the extra length of wire in between the first molar and premolar will create a force of approximately 180 Gms which will move the molar distally. To ensure bodily movement of molar a 20° V bend is given which will create counter-clockwise moments to prevent tipping of the crown. However, if tipping is desirable the intensity of the bend may be altered. The loop formed will have some amount of extrusive and intrusive components on the adjacent teeth. In order to negate these effects a 20° V bend was placed in the centre (in accordance to centre V bend principle of Burstone). In cases which require extrusive and intrusive components the bend can be located at off centre positions.

**CASE REPORT:**

An 18 year old female patient reported to the Department with the chief complaint of forwardly placed upper teeth. The patient showed a mild convex profile (Figure-6) with bilateral end-on molar relationship (Figure-7). Carey's analysis indicated the need for 5 mm of space. Panoramic radiograph (Figure-8) revealed upright first molars and missing third
molars. Cephalometric analysis (Figure-9) showed an ANB angle of 5° with upper incisor proclined to NA at 32° and 5 mm and lower incisor to NB being 20° and 8 mm with a mandibular plane angle of 30°.

**Treatment Plan** for space gaining included Molar Distalization using the innovative technique.

**Treatment Mechanics:** After bonding 0.022” Pre-adjusted Edge wise brackets (Roth prescription) leveling and aligning was done with 0.016” NiTi. It was subsequently changed to 0.016” Australian wires (for a month). 0.017”×0.025” TMA distalizing wire was fabricated and engaged (Figure-10) as described previously.

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*Figure 8. Pre-treatment OPG.*

*Figure 9. Pre-treatment Lateral Cephalogram.*

*Figure 10. Pre-distalization.*
Figure 11. Post-distalization Extra & intra-oral.

Figure 12. Post-distalization OPG.

Figure 13. Post-distalization Lateral Cephalogram.
Treatment Results from the cephalogram (Figure-13) are tabulated in Table I. It is evident that the sagittal skeletal positions were not affected by distalization. Mandibular plane angle (Sn-GoGn) increased by 1° post distalization. Maxillary molar distalization and proclination of the anteriors were evaluated from the perpendicular to ptm on palatal plane and it was found that the molars were distalized by 2.5mm to class I molar relationship over a period of 3 months while there was an anchor loss of 0.5mm.

Post distalization, the Nance button was removed and a new one fabricated between first molars while the anteriors will be retracted using NiTi coil spring into the space gained by distalization.

Discussion:
Though the first molars can be distalized with this technique (without much loss of anchorage) even after the eruption of the second molars, however they would be easier to move prior to the eruption of the second molars.

This innovative molar distalizing appliance has the advantages of design simplicity, being relatively inexpensive, yet efficient with good control on the moment-to-force ratio to produce bodily movement, controlled tipping, or uncontrolled tipping (as desired). It is hygienic, easy to fabricate and engage with patient comfort and minimal requirements of patient cooperation.

CONCLUSION:
The above two case reports demonstrates the ease with which a clinician may modify the routinely used 0.016" NiTi and 0.017" X 0.025" TMA wires with a simple, versatile and easily available Guerin lock to bring about effective space gain by increasing arch length (by anterior proclination and molar distalization) without any special armamentarium.

REFERENCES:

Table I:
Cephalometric measurements of pre and post distalization

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<th></th>
<th>SNA</th>
<th>SNB</th>
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<th>1to NA degree</th>
<th>1 to NB mm</th>
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<tr>
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<td>4°</td>
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