CLINICAL INNOVATION

Dual Force Cuspid Retractor

Matrishva B Vyas, Neeraj Alladwar

ABSTRACT

The most time consuming stage of bicuspid extraction-based treatment is cuspid retraction. Cuspid retraction with both types of conventional methods, i.e. friction and non-friction method has inherent disadvantages. To overcome these disadvantages and to retract the cuspid in the shortest possible time, an innovative retraction design was conceived. Maxillary cuspids are retracted using power arms on buccal as well as palatal aspects. Clinical results are quite promising, with reduction in retraction time along reasonable three-dimensional control over cuspid.

Keywords: Canine retraction, Center of resistance, Bodily movement.

How to cite this article: Vyas MB, Alladwar N. Dual Force Cuspid Retractor. J of Ind Ortho Soc 2011;45(1):33-39.

INTRODUCTION

Time is the biggest constraint in orthodontic treatment, not only from the patient’s perspective but also from the standpoint of an orthodontist. Prolonged treatment duration carries with it the risk of reduced patient’s compliance, tissue damage, loss of anchorage, and psychological discomfort to the patient.

The most time consuming stage in a bicuspid extraction-based treatment plan is cuspid retraction. Any procedure which reduces the time required to perform this stage will eventually serve to decrease the overall treatment time.

Broadly, cuspids could be retracted by frictional, i.e. sliding method or non-frictional, i.e. segmental approach.

It has been demonstrated that more time is required to accomplish cuspid retraction with friction mechanics. Moreover, more force application is imperative as majority of force is consumed to overcome friction, thus, ultimately reducing the available force for retraction.1 This may result in periodontal damage and anchorage loss, and the continuous arch in sliding mechanics produces extrusion of incisors, the so called “roller coaster” effect.2,3

Proponents of nonfrictional approach with segmental mechanics claim to overcome the disadvantages inherent to frictional method. Nevertheless, three-dimensional control of cuspid during retraction with segmental approach remains a challenge.4,5

With this background an indigenous cuspid retractor for maxillary cuspid (dual force cuspid retractor) was designed, with an intention to retract the cuspid in the shortest possible time and exercise three-dimensional control over it.

Fabrication and Insertion

Preformed bands for the first molars were selected and triple tube with 0.018 inch slot (Roth) were welded on the buccal aspect in conventional manner. Bands were prepared on the cuspids. Seated bands were transferred to the cast via alginate impression material and a working model was obtained (Figs 1A to C).

Total six power-arms of equal length (10 mm) with built-in hooks were prepared using 0.017 × 0.025 stainless steel wire. Four for palatal and buccal aspect of cuspid were prepared in a ribbon-arch mode whereas two power-arms to be inserted in the auxiliary tube of molar were prepared in an edgewise mode. A transverse offset was given to avoid gingival impingement (Fig. 1D). Transpalatal arch (TPA) with central omega loop and bilateral distally directed hooks at the level of palatal power arm of cuspid was prepared (Fig. 1E).

TPA and power-arms of cuspids were affixed on the working model for soldering. Acrylic button was built in the TPA for further augmenting the anchorage. The appliance was then finished, polished and cold sterilized.

Elastic chain was engaged between the hooks of power-arms of cuspid and molar on buccal aspect and hooks of TPA and power-arm of cuspid on palatal aspect (Figs 1F to H).
Figs 1A to H: Fabrication and insertion steps
The elastic chain exerted an initial force of 150 gm each. Thus, each cuspid experienced a total of 300 gm initial force.6

Objectives

Objective behind fabrication of this design was:
1. To exert force from near the center of resistance of cuspid for controlled tipping retraction
2. Prevent cuspid rotation during retraction with dual force application (i.e. both from buccal and palatal aspect)
3. Avoid any untoward reactions on incisors by keeping them free of any appliance at this stage
4. Stabilize molars with TPA and Nance button, and create stationary anchorage with application of force near to the center of resistance of the molars.

CASE REPORT

A 17-year-old girl reported with a chief complaint of proclined anteriors. She had undergone extractions of first bicuspid in all quadrants for orthodontic purpose three months back by a local dentist and then she was given a removable appliances in both the upper and lower archs. Upon clinical examination and perusal of her diagnostic records, decision to close the first bicuspid spaces and retract anteriors for correction of Class I bimaxillary dentoalveolar protrusion was taken (Figs 2A to H).

A 0.018 inch Roth appliance was bonded in lower arch followed by cementation of dual force cuspid retractor in the upper arch. E-chains were applied as described previously. E-chains were changed at an interval of every four weeks.

After 78 days, cuspids were totally retracted (Figs 3A and B).

At this stage, lateral cephalogram and occlusal photograph were taken.

Cephalometric appraisal revealed movement of molar (1.0 mm in sagittal and 1.5 mm in vertical direction) suggesting some anchorage loss in both vertical and sagittal plane (Figs 4A to C). Although anchorage loss was evident; however it was clinically acceptable. The reasonable control exhibited on the molars can be attributed to two factors: (1) TPA with acrylic button used as reinforcement, and (2) Mechanical advantage provided by elastic pull from the buccal power arm of molar which tends to distally tip the molar, thus augmenting the anchorage (Fig. 5).
Further, vertical control over cuspid was assessed using nasal floor as a reference. The change in vertical position was 1 mm. The vertical control was due to the fact that the power-arms for molar and cuspids were prepared of equal lengths (Table 1).

Rotational changes in cuspids were measured from the occlusal photograph using the method of “Ziegler and Ingervall”. The angle formed between the line through the distal and mesial point angles of the cuspid and the mid-palatal raphe was measured in both pre- and post-retraction photograph (Figs 6A and B). The result revealed 20° change on right side and 6.5° change on left side. Reasonably acceptable axial control on left side was due to the equal force application from both buccal and palatal aspect. However, on right side, an unequal force; more on the buccal aspect was applied deliberately in an attempt to derotate the cuspid.

The encouraging result for cuspid derotation leads to another possibility of intentionally applying unequal magnitude of force to derotate the cuspid in case such a movement is desired. This

### Table 1: Sagittal and vertical anchor loss

<table>
<thead>
<tr>
<th></th>
<th>Pretreatment</th>
<th>Postcuspid retraction</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>U6 to PtV</td>
<td>16.0 mm</td>
<td>17.0 mm</td>
<td>+1.0 mm</td>
</tr>
<tr>
<td>U6 to NF</td>
<td>21.0 mm</td>
<td>22.5 mm</td>
<td>+1.5 mm</td>
</tr>
<tr>
<td>U3 to NF</td>
<td>27.0 mm</td>
<td>28.0 mm</td>
<td>+1.0 mm</td>
</tr>
</tbody>
</table>
Figs 4A to C: Pre- and post-cuspid retraction cephalogram and superimposition

Fig. 5: Mechanical advantage of pull from the power arm

Figs 6A and B: Change in cuspid rotation measured with Ziegler and Ingervall’s method
Figs 7A and B: Pre- and post-cuspid retraction occlusal view of case 2 with attempted derotation of cuspids

Figs 8A to C: Upper arch bonded and aligning archwire ligated

Figs 9A to C: Incisor retraction with the help of molar power arm

Figs 10A to C: Post-treatment extraoral photographs
finding was applied in yet another case where cuspid needed derotation along with retraction (Figs 7A and B).

Another opportune finding was distal drift of lateral incisors due to the pull of trans-septal fibers.

Upon retraction of cuspids, both cuspid units were debanded leaving only the molar unit in the oral cavity. Upper arch was bonded with 0.018 inch Roth brackets and aligning archwire was placed (Figs 8A to C).

Subsequent to the alignment, retraction of incisors was initiated. Please notice how the benefit of this innovative design continues with power-arms on molar assisting the simultaneous intrusion and retraction of incisors (Figs 9A to C).

The appliance was deboned after 19 months of treatment and upper Hawley’s retainer was placed (Figs 10A to H).

CONCLUSION

The initial clinical results obtained with ‘dual force cuspid retractor’ are quite promising. It can provide a simple, economic and effective alternative for rapid retraction of cuspid.

REFERENCES