Effect of Lace Back on Amount of Anchorage Loss Using Labial and Lingual Technique. (An in vitro Study)

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INTRODUCTION

Some authors believe that the use of light continuous force consider the most effective way to move the teeth in early stage of treatment. This is due to comfortable for the patient and minimizing the threat to anchorage come from the influence anterior bracket tip that puts demand upon anterior posterior anchorage.\(^1\) The canines are key stones of occlusion so the canine intended to slide distally guided by continuous wire, lace back are used to control canines and retract them sufficiently to allow alignment of incisors. Canine retracted with lace back until anterior posterior crowding was resolved.\(^2\) Anchorage is an important consideration when planning tooth movement, un wanted tooth movement known as loss of anchorage can have determined effect on the treatment outcome.\(^3\) Optimal anchorage control is essential for successful orthodontic treatment.\(^4\) Anchorage loss is one of the side effects of orthotherapy.\(^5\) To obtain the desired results of closing spaces within

ABSTRACT

Aims: Evaluate the amount of anchorage loss of the lower posterior teeth 2nd premolar and first molar when used as anchorage teeth for retraction of canine bilaterally by using lace back technique after extraction of first premolar in seven crowding cases. Materials and Methods: Two groups of brackets, one of them labial (conventional) were bonded on the labial aspect of metal teeth except one of them labial (conventional) were bonded on the labial aspect of metal teeth except extraction of first premolar and second premolar. The canines are key stones of occlusion so the canine intended to slide distally guided by continuous wire, lace back are used to control canines and retract them sufficiently to allow alignment of incisors. Canine retracted with lace back until anterior posterior crowding was resolved.\(^2\) Anchorage is an important consideration when planning tooth movement, un wanted tooth movement known as loss of anchorage can have determined effect on the treatment outcome.\(^3\) Optimal anchorage control is essential for successful orthodontic treatment.\(^4\) Anchorage loss is one of the side effects of orthotherapy.\(^5\) To obtain the desired results of closing spaces within

Key Words: Typodont, Friction, Anchorage, Lingual, crowding.

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It is essential to control the amount of incisors retraction versus premolar and molar protraction. The orthodontist must plan how to close any space that is not devoted to relief severe crowding whether anterior teeth retraction and posterior teeth protraction. Canine retraction is one of the basic techniques in orthodontic treatment. Successful retraction requires conflict control of force magnitude. Researchers have always been interested in determining efficient methods of retraction canines. Canines can be retracted by sliding, sliding mechanics involve moving bracket along arch wire, so friction plays a role in sliding. In sliding system, the canine is intended to slide distally guided by continuous wire. Disadvantages are represented by lack of vertical incisors control and need for increase anchorage. Typodont system can be use in orthodontic practice to show possible effects of variable factors on canine position and rate of movement during the retraction.

MATERIALS AND METHODS

Materials and Supplies:
I- Typodont components Oramco, Japan. metal teeth except 4 | 4, 8 | 8, wax form mandibular arch with sever crowding and articulators.
II- Brackets
Stainless steel brackets Roth 0.018 inch labial conventional (Dentaurum- Germany). Stainless steel brackets Roth 0.018 inch lingual (Forestadent Germany).
III- Tubes
Buccal bondable tube (Hallimex- Germany). Lingual bondable tube (Forestadent Germany).
IV- Wires
Twisted multi strand 0.015 inch [IOS, USA]. Niti 0.012 [Hallimex, Germany]. Ligature wire 0.010 [IOS, USA]. Extension bar of rectangular wire 0.016 * 0.022 inch [Hallimex, Germany].
V- Elastomeric model (Orthomatrix – USA).
VI- Epoxy adhesive (USA).
VII- Digital camera (Sony – china).
VIII- Digital vernia (china).
IX- Digital water bath (MAAKE K-France)
X- Needle holder, Tucker, Bracket clamp, Dentaurum – Germany.
XI- Tension Gauge (France).
XII- Thermometer (China).

Methods:
Preparation of Typodont

Insert the preformed wax arch within the metal plate through pressing the waxform firmly. Then the lower mandibular teeth inserted into wax form except 4 | 4, 8 | 8 Where the socket of 4 | 4 filled with sticky wax, apply small amount of sticky wax around the roots of teeth, warm the roots and replace the teeth into wax form in a way to prevent unwanted tooth movement. All teeth should be fixed in a wax form according to palmer tooth no. system water bath have controlled tempature (54 °C) typodont was immersed in the digital water bath for about (5 minute), typodont immerst in cool water about (5 °C) (Ogura et al; 1996) the measurement and numerical value was recorded after each step of tooth movement were recorded.

Step I: Labial technique

The stainless steel Roth bracket 0.018 inch were bonded on all lower mandibular metal teeth form lower 5 to 5 except 4 | 4 which already extracted by special adhesive and buccal bondable tube were bonded to 6 | 6. Incisors ligated by ligature wire figure eight and make as single unit and canine become free then two extension bar by using stainless steel wire (0.016 * 0.022) inch one of them welded on arch metal parallel to the distal aspect of canine (fixed extension bar) and other on mesial aspect of lower first molar (movable extension bar) as in Figure (1) and the distance between two extension bars measured by digital vernia and considered the control value.
**Step II: Lingual Technique**

After bonding of lingual Roth 0.018 inch from 5 | 5 except 4 | 4 and replace in their wax socket of typodont according to the manufacture instruction (Oramco) in such way the typodont class III with sever crowding malocclusion and the socket of 4 | 4 were filled with wax and 6 | 6 bonded with lingual bondable tube two extension bars by using stainless steel rectangular wire (0.016 * 0.022) inch one of them welded in the arch metal parallel to distal aspect of canine (fixed extension bar) and other on mesial aspect of the lower first molar as in Figure (2) and the distance between extension bar measure and consider control numerical value.

**Measuring Procedure**

**Labial technique**

canine was retracted bilaterally with active lace back (elastomeric ring with ligature wire once with twisted multi strand wire 0.015 and other with Niti wire 0.012 inch). The twisted multi strand wire adjusted to labial brackets and ligated with ligature and the distance between two extension bars measured by vernia was recorded and considered the control value. The canine were retracted by placing elastomeric ring model in the hook of buccal bondable tube as in Figure (1) and then stretched by ligature wire toward the hook of canine. The force were evaluated by tension gauge 100 gm (1). Then, the typodont was immersed in water bath (54°C) for 5 minutes. Then immersed in cooling water for 5 minutes. The new distance between two extension bars were measured. The same procedure was repeated after reposition of teeth in typodont and new waxing of teeth.
Lingual Technique
Retraction of canine bilaterally with active lace back once with twisted multi strand 0.015 and another with Niti. Same steps of labial technique except the elastomeric ring adjusted lingually.

RESULTS
The descriptive analysis (minimum, maximum, mean and SD) for the four group are listed in Table (1) and Figure (3).

Table (1): Descriptive statistics demonstrating the effect of four groups on the amount of anchorage loss (mm).

<table>
<thead>
<tr>
<th>groups</th>
<th>N</th>
<th>Mean</th>
<th>std</th>
<th>Std. error</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>LT</td>
<td>6</td>
<td>0.6667</td>
<td>0.13663</td>
<td>0.0558</td>
<td>0.50</td>
<td>0.80</td>
</tr>
<tr>
<td>LN</td>
<td>6</td>
<td>1.3500</td>
<td>0.13784</td>
<td>0.0563</td>
<td>1.20</td>
<td>1.50</td>
</tr>
<tr>
<td>BT</td>
<td>6</td>
<td>0.4333</td>
<td>0.8165</td>
<td>0.0333</td>
<td>0.30</td>
<td>0.50</td>
</tr>
<tr>
<td>BN</td>
<td>6</td>
<td>0.3667</td>
<td>0.8165</td>
<td>0.0333</td>
<td>0.30</td>
<td>0.50</td>
</tr>
</tbody>
</table>

L = lingual, B = buccal, N = nickel titanium, T = twisted arch wire

Figure (3): The amount of loss of anchorage in millimeters.

The finding of this study showed the mean of Niti wire that applied in lingual and labial technique had the highest percentage of anchorage loss was a followed by twisted multi strand that applied in the same technique, while twisted multi strand that applied in labial technique also showed the lowest value when compared with remaining groups as shown in Table (1).

Analysis of Variance (ANOVA) for the four groups showed significant difference at p< 0.01 among them, as in the Table (2).

Table (2): ANOVA for determining difference between the effect of four groups on anchorage loss F.

<table>
<thead>
<tr>
<th></th>
<th>Sum of squares</th>
<th>df</th>
<th>Mean of square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>3.635</td>
<td>3</td>
<td>1.212</td>
<td>95.022</td>
<td>000</td>
</tr>
<tr>
<td>Within groups</td>
<td>0.255</td>
<td>20</td>
<td>0.013</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>3.890</td>
<td>23</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The results of Duncan multiple range test Table (3) showed that the Niti arch wire that applied with lingual had highest rate of anchorage loss with a significant difference at $P \leq 0.05$ from other arch wire, meanwhile the Niti arch wire that applied in labial technique and twisted multi strand arch wire that applied in the same technique showed a significant difference between them, but showed no significant difference at $P > 0.05$ between them.

<table>
<thead>
<tr>
<th>gps</th>
<th>N</th>
<th>Mean± SEM</th>
<th>Duncan’s gpsi</th>
</tr>
</thead>
<tbody>
<tr>
<td>BN</td>
<td>6</td>
<td>0.366±0.033</td>
<td>a</td>
</tr>
<tr>
<td>BT</td>
<td>6</td>
<td>0.433±0.333</td>
<td>a</td>
</tr>
<tr>
<td>LT</td>
<td>6</td>
<td>0.800±0.666</td>
<td>b</td>
</tr>
<tr>
<td>LN</td>
<td>6</td>
<td>1.350±0.056</td>
<td>c</td>
</tr>
</tbody>
</table>

Difference litters mean significant $p \leq 0.05$.

DISCUSSION

Active lace back technique enhanced the tipping and retraction of canine specially in sever crowded cases and made the adjustment of light or low gauge wire very easily into slot of bracket in retraction of one or more upper or lower incisors teeth. This made the orthodontist reach to a preliminary canine retraction. The result of this study showed statically difference between lingual and labial technique and showed the twisted multi strand cause loss amount of anchorage of posterior teeth. This may be relate with friction between twisted multi strand wire and the slot of bracket because large contact area between slot and surface area of wire. This agreed with Gjessn,18 and Hart et al.,19 who showed successful anchorage control and the Niti base arch wire that applied in lingual technique showed high risk of anchorage loss. This agreed with Rajcich and Sadosky,20 and disagreed with Dawing et al.;17 Vaughan et al.,21 Ogata et al.,22 and pizzoni et al..23 Southard et al.,24

In labial technique, the right molar rotate anticlockwise while left side rotate with clockwise.

In lingual technique, anchor teeth lower right molar rotate with clockwise while left molar rotate anticlockwise.

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