

# Comparison Between Laceback and Tieback in Sliding Mechanics (An in vitro study)

**Khawla M Awni**  
BDS, MSc (Lec)

**Dept of Pedod, orthod, and Prev Dentistry**  
College of Dentistry, University of Mosul

## الخلاصة

**الاهداف:** لتقييم معدل اغلاق المسافة، الميلان والدوران للنانب عند سحبه بطريقتي الربط الخلفية باستخدام حاصرة تقويمية نوع سيراميك قياسي عبر نوعين من القوس السلكي وذلك باستخدام مثل الاسنان التشاهي. **المواد وطرائق العمل:** لقد كانت المقاييس المعيارية ان كل الاسنان واقفة في مثل الاسنان التشاهي في افضل موقع للتراصف وانها مغطاة ومثبتة بواسطة العضة الاكريلية عدا الناب، طريقي الربط الخلفية استعملت لسحب الناب. **النتائج:** لقد اظهرت نتائج الدراسة أن انزلاق الناب على القوس السلكي المستطيل قياس (0,025×0,017 انج) اعطى تناقص معنوي في معدل اغلاق المسافة ودرجتي الميلان والدوران مقارنة بانزلاقه على القوس السلكي الدائري قياس (0,20 انج) وكذلك انزلاق الناب باستخدام الرباط الخلفي (Laceback) اعطى تناقص معنوي في معدل اغلاق المسافة ودرجتي الميلان والدوران عند مقارنته بالرباط الخلفي (Tieback) **الاستنتاجات:** نستنتج من ذلك ان عملية سحب الناب باستخدام الرباط الخلفي (Laceback) عبر القوس السلكي المستطيل قياس (0,025 × 0,017 انج) اعطى تناقص معنوي في معدل اغلاق المسافة ودرجتي الميلان والدوران.

## ABSTRACT

**Aims:** The current study aims to investigate the rate of space closure, tipping and rotation of canine during its retraction by laceback and tieback using standard ceramic brackets along 2 types of archwires using typodont simulation system (Ormco). **Materials and Methods:** The standardization criteria were all typodont teeth situated in well aligned position, covered and immobilized by the acrylic bite except canine, laceback and tieback were used to slide the canine. **Results:** The present study showed that when slide the canine on 0.017x 0.025 inch archwire gave rise to significant decrease in the rate of space closure, degree of tipping and rotation as compared when sliding it on 0.020 inch archwire, also sliding the canine using laceback as a method of retraction gave rise to a significant decrease in the rate of space closure, degree of tipping and rotation as compared with tieback. **Conclusions:** It was concluded that canine retraction using laceback retraction method along 0.017x0.025 inch archwire gave rise to a significant decrease in the rate of space closure, degree of tipping and rotation.

**Key Words:** Laceback, Tieback, Sliding mechanics.

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## INTRODUCTION

Sliding mechanics are commonly used orthodontic techniques to close interdental spaces in which the bracketed tooth, in effect, slide along an archwire.<sup>(1)</sup>

Elastic tieback: Using an elastomeric module, of the type used to hold archwires on to bracket, stretched to twice its normal size; this was found to give a force of 50-100gm if the module was pre-stretched before use.<sup>(2, 3)</sup>

Laceback: These are 0.010 or 0.009inch steel ligature in a figure of eight running from the canine to the premolar which hold back the canine crown whilst

uprighting occurs and at the same time lightly retracts the canine.<sup>(4)</sup>

The aims of this study were to investigate the rate of space closure, tipping and rotation of canine during its retraction by laceback and tieback methods.

## MATERIALS AND METHODS

The sample of this study consisted of 4 sets of standard ceramic brackets "0.022 inch" (only lower incisors, canines and second premolars), forty stainless steel archwires divided into 2 types (0.020inch and 0.017x0.025inch), twenty laceback and 20 tieback. This study was conducted using typodont model, the brackets were

fixed on metallic teeth using epoxy steel adhesive which is supplied into two tubes (hardener and resin). Each bracket is positioned in its proper position by the aid of bracket positioning gauge to ensure greater vertical accuracy.<sup>(5)</sup> This study was conducted using class III typodont wax form, so alignment of the teeth was required to obtain a well aligned tooth.<sup>(2, 6-8)</sup> This was done by placing the archwires in the lower arch that were progressively upgraded through leveling and aligning and finally to 0.019x0.025 inch stainless steel wire after immersing the typodont in a water bath at 54°C for 5 minutes.<sup>(2, 9)</sup> This

archwire was ligated to the bracket by using elastomeric ligature because the high variability of tying ligatures makes the use of elastic ligatures the most reproducible.<sup>(10)</sup> An active tieback (distal module), the elastomeric module is attached to the 1<sup>st</sup> molar hook, a 0.010 ligature is used with one arm beneath the archwire, this makes the active tieback more stable, and helps to keep the ligature wire away from the gingival tissues.<sup>(2)</sup> Laceback applied from molar hook to the canine bracket.<sup>(11)</sup> Bite plane extension bar and canine extension bar as shown in Figure (1)

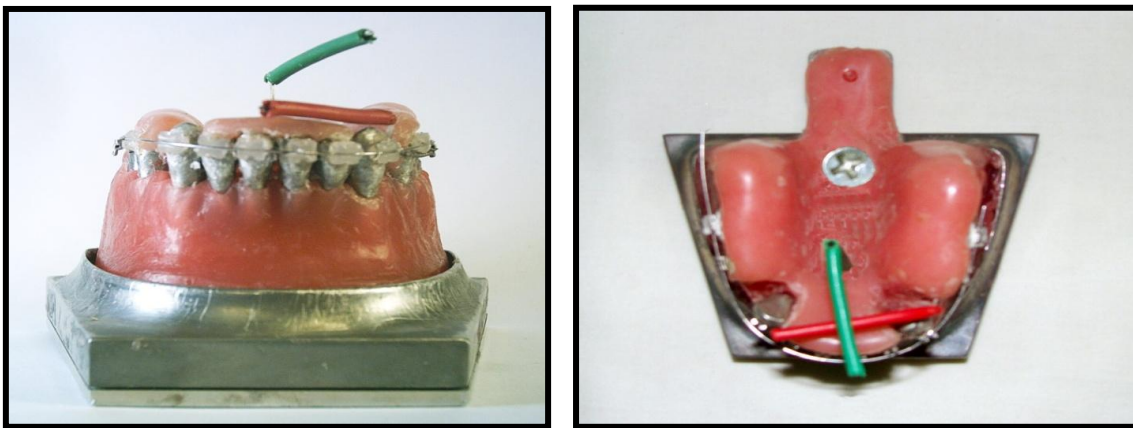


Figure (1): Bite plane extension bar and canine extension bar.

were used, bite plane extension bar is an (L-shape) bar made of stainless steel rectangular wire of size (0.018x0.022 inch). The short arm is inserted in a groove which is made in the simulated lingual area of the acrylic bite. This bar emerges upward for (10mm) distance then it bends at right angle to extend facially (20mm) in a canine direction making right angle with (canine extension bar) which is an (L-shape) bar made of stainless steel rectangular wire of size (0.018x0.022inch). The short arm is soldered to the distal aspect of canine by the use of electronic iron soldering device that extend incisally for (10 mm) distance then it bends at right angle to extend anteriorly (20 mm), and (5 mm) over canine cusp tip. These two bars are used as a guide for determining degree of tipping and rotation of canine following sliding movement<sup>(12)</sup> Before starting movement of canine (left canine only) the distance between distal

wing of canine's bracket and the mesial wing of second premolar's bracket was 13.5mm. This distance considered as the available space and measured by digital vernier.<sup>(13, 14)</sup> After movement of canine the distance between distal wing of canine's bracket and the mesial wing of second premolar's bracket is measured and considered as the remaining space.<sup>(15)</sup> Rate of space closure = available space - remaining space. Degree of canine's tipping is measured when the typodont is photographed using digital camera,<sup>(7, 16)</sup> with transverse projection from right side of typodont directly toward left canine where the angle between canine extension bar and bite plane extension bar is exposed and then it can be measured directly on the photograph using protractor, this angle is considered as canine's bar inclination angle, so degree of canine tipping = canine's bar original angle (90°) - canine's bar inclination angle. Degree of canine rotation is

measured when the typodont is photographed with vertical projection from occlusal side of typodont (Figure 2), this angle is considered as canine's bar rotation

angle so degree of canine rotation = canine's bar original angle (90°)-canine's bar rotationangle.



Figure (2): Measurements of canine rotation and tipping.

### RESULTS

Data were analysed by using (SPSS version 11.0 Inc., program).

1. Descriptive statistics: Mean and Standard Deviation.

2. Student's t-test: To compare the mean value between the two types of arch wires (Table 1) and between the two methods of retraction (Table 2). (t- is significant at  $p \leq 0.05$ ).

Comparison between 0.017x0.025 inch and 0.020inch arch wires by two methods of retraction (Table 1) revealed that sliding the canine along 0.020inch arch

wire showed highest mean value for the rate of space closure, degree of tipping and rotation than sliding it along 0.017x0.025inch arch wire except by tieback retraction method which showed no significant differences in the rate of space closure.

Comparison between laceback and tieback retraction methods (Table 2) revealed that sliding the canine using tieback gave rise to the highest mean value for the rate of space closure, degree of tipping and rotation than using laceback.

Table (1): Comparison of the space closure rate, tipping and rotation between two types of arch wires by laceback and tieback methods.

	Methods of retraction	0.017x0.025 inch arch wire		0.020 inch arch wire		t-value	p-value
		Mean	SD	Mean	SD		
<b>Rate of space closure</b>	Laceback	1.51	0.017	1.62	0.016	-14.38	0.000
	Tieback	2.55	0.015	2.50	0.14	1.22	0.237
<b>Tipping</b>	Laceback	1.10	0.51	3.00	0.33	-9.77	0.000
	Tieback	3.95	0.64	6.00	0.66	-6.99	0.000
<b>Rotation</b>	Laceback	1.05	0.43	2.00	0.33	-5.46	0.000
	Tieback	4.30	0.63	5.00	0.66	-2.4	0.027

Rate of space closure measurements in millimeter. Tipping and Rotation measurements in millimeter. Number of each group =10. t- is significant at  $p \leq 0.05$ .

Table (2): Comparison of the space closure rate, tipping and rotation between two methods of retraction along two types of archwires.

		Laceback		Tieback		t-value	p-value
		Mean	SD	Mean	SD		
<b>Rate of space closure</b>	0.017x0.025 inch	1.51	0.017	2.55	0.015	-138.96	0.000
	0.020 inch	1.62	0.016	2.50	0.14	-19.50	0.000
<b>Tipping</b>	0.017x0.025 inch	1.10	0.51	3.95	0.64	-10.92	0.000
	0.020 inch	3.0	0.33	6.00	0.66	-12.72	0.000
<b>Rotation</b>	0.017x0.025 inch	1.05	0.43	4.30	0.63	-13.36	0.000
	0.020 inch	2.00	0.33	5.00	0.66	-12.72	0.000

Rate of space closure measurements in millimeter. Tipping and Rotation measurements in millimeter. Number of each group =10. t- is significant at  $p \leq 0.05$ .

## DISCUSSION

### \*Rate of space closure

1. Arch Wire Shape: In the present study, the rate of space closure with round arch wire was greater than rectangular one. This is in agreement with Frank and Nikolai<sup>(17)</sup> who cited that the distribution of normal force may be a significant factor, where the round wire makes only point contact with a bracket slot.

2. Methods of Retraction: The present study showed that using tieback show highest mean value for the rate of space closure because it applies a defined force to the arch wire and teeth.<sup>(3)</sup> In laceback group the amount of canine movement were smaller this can be explained by the force characteristics of laceback ligatures which cause a slight tipping of the canine, the canine's root have enough rebound time to move upright into its correct position as the main arch wire takes effect.<sup>(18)</sup>

### \*Degree of Tipping and Rotation

1. Arch wire shape: Rectangular arch wire produces little degree of tipping and rotation, this in agreement with Ziegler and Ingerval,<sup>(19)</sup> also rectangular wires usually used to achieve three-dimensional controlled tooth movement.<sup>(20)</sup>

2. Methods of retraction: Distopalatal rotation and tipping of the canine was observed because of the relationship between the force application and center of resistance.<sup>(11)</sup> The laceback group showed lowest degree of tipping and rotation than tie-

back group because of the interrupted force of laceback the canine is given enough "rebound time" to upright and rotate distobuccaly into correct position as the main arch wire takes effect.<sup>(12)</sup> while the tieback group showed highest degree of tipping and rotation because rapid space closure might produce loss of tipping and rotational control adjacent to the extraction site.<sup>(21)</sup> Also excessive force at the start of treatment leads to tipping and rotation of canine in the extraction spaces.<sup>(3)</sup>

## CONCLUSIONS

1. Laceback ligatures proved to be effective for canine distalization.
2. Sliding the canine over archwire of round cross section significantly increases the rate of space closure, degree of tipping and rotation.
3. Sliding the canine by tieback retraction method gave rise to the highest mean value for the rate of space closure.

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