

**Research Article****The Impact of Canine Retraction on Anchorage Loss in Two Methods of Active Lace Back and NiTi Closed Coil Spring****Mehdi Araghdikashani<sup>1</sup>, Amir Hosseinkhatibi<sup>2\*</sup>,****Mohsen Merati,<sup>1</sup> Shiva Shivaie Kojoori<sup>2</sup>,****Mojtaba Sabzijate<sup>2</sup>, Mohammadreza Badiee<sup>4</sup> and Tahereh Ghiasian<sup>5</sup>**<sup>1</sup>Assistant Professor, Department of Orthodontic, School of dentistry,  
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**ABSTRACT**

**Introduction:** In orthodontics, tooth extraction is required in some cases. Anchorage would be better maintained, if extraction space is done into two-step and by rewinding the canine in first step alone. Given the importance of anchorage in orthodontics and by considering the contradictions and lack of report of anchorage loss in previous studies, the present study was conducted with aim to compare the active laceback with NiTi coil spring in distalizing the canine and anchorage loss in orthodontic patients requiring extraction of premolars.

**Materials and methods:** In this randomized controlled clinical trial (RCT), which was conducted as split-mouth on the patients referred to orthodontic department of Shahed School of Dentistry in 1395, 15 patients requiring extraction of first maxillary premolar for treatment were randomly selected. The canine retraction was performed on one side by lace back and on the other side by NiTi coil. After four months, treatment results were calculated by comparison with initial measurements. The rotation and tipping of teeth and finally the amount of teeth movement before and after the treatment were calculated. Data were analyzed by SPSS software.

**Findings:** Based on the results, the mean rotation of canine in groups of lace back and NiTi coil were 4.5 and 14.4 degree, respectively, and for molars, this values were 0.55 and 2.3 degree, respectively. The mean tipping of canine in groups of lace back and NiTi coil were 6.25 and 11.45 degree, respectively, and for molar were 1.5 and 5.75 degree, respectively. The mean movement of canine in groups of lace back and NiTi coil were 4.3 and 5.95 mm and for molar were 1.2 and 1.85 mm.

**Discussion and conclusion:** The results of present study showed that canine retraction by lace back is associated with lesser rotation and tipping of the canine and lesser tipping of molar compare to retraction by NiTi coil. The amount and rate of canine and molar movement (anchorage loss) in two techniques had little and insignificant differences.

**Keywords:** Canine retraction, NiTi closed coil, Active laceback, Anchorage loss

**INTRODUCTION:**

In orthodontic treatment, teeth extraction is commonly done for different cases, for example correcting the severe crowding, rewinding incisors, molar and canine relationship correction and improving the facial profile (1). Today, different methods for canine retraction are used.

Two common methods are using the active ligatures (or so-called active lace back) and NiTi coil spring. The use of lace back has been popularized based on McLaughlin et al. viewpoint (2). Laceback is extensively used in extraction of premolars in aligning and leveling step with the

main objective of canine retraction and creating space for sorting of anterior teeth. This application is known as active laceback

(3). Flaws that are mentioned for laceback are mesial tipping of molar and anchorage loss (4), which have been also shown in some clinical studies (5, 6). On the other hand, given that active ligatures strength slightly reduces over time, NiTi coil spring has been suggested as an alternative. It has been reported that NiTi coil spring closes the extraction space more quickly and more sustainable (7). The type of the force exerted on teeth caused by springs and active lace back is different. NiTi coils generally exert a lighter and more constant force, while lace back force is heavier with a short-range. Effectiveness and side effects of these two techniques of canine retraction have been compared in only a few studies (8, 9). Sueri and Turk (2006) conducted a clinical study entitled "Effectiveness of Laceback ligatures on Maxillary Canine Retraction" with the aim to evaluate the effect of lace back ligatures on canine retraction in teeth aligning and leveling steps and to compare it with NiTi coils. The results of their study showed that tipping and rotation of canine in NiTi coil group were significantly higher than lace back group. But, the amount of distalization in NiTi group was significantly higher than lace back group. The rate of canine movement in NiTi coil group was also significantly higher than lace back group. The anchorage loss (mesial movement of molar) in NiTi coil group was significantly higher than lace back group (8).

Norman et al. (2016) conducted a clinical study entitled "Nickel titanium springs versus stainless steel springs: A randomized clinical trial of two methods of space closure" with the aim to examine effectiveness of NiTi coils in comparison with stainless steel springs. The results of this study showed that stainless steel springs not only have high efficiency for space closure, but they can also serve better than NiTi coils (9).

Despite reporting of the amount and rate of canine retraction in both methods, the amount of anchorage loss in these two methods has not been reported in previous studies. Given the importance

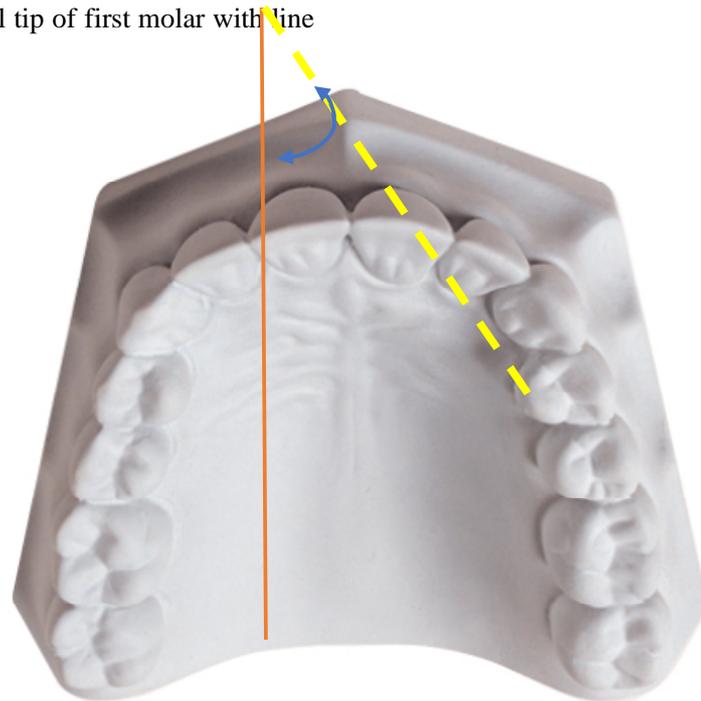
of anchorage in orthodontics and considering the contradictions and lack of report of anchorage loss in previous studies, the present study was conducted with aim to compare the active laceback with NiTi coil spring in distalizing the canine and anchorage loss in orthodontic patients requiring extraction of premolars.

#### **MATERIALS AND METHODS:**

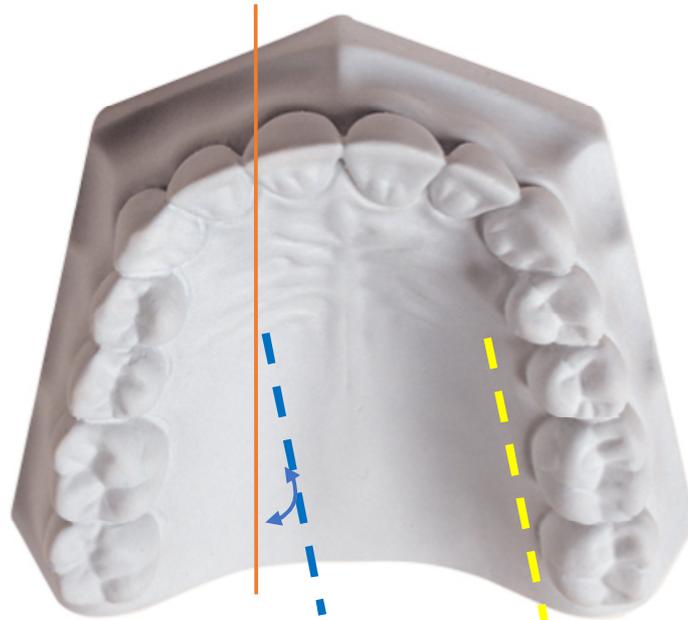
This randomized controlled clinical trial (RCT) was conducted as split-mouth. The study population were patients referred to orthodontic department of Shahed School of Dentistry in 1395. 15 patients who were candid for removing of first maxillary premolars for orthodontic treatment, based on inclusion criteria and informed consent were enrolled and treated randomly with split-mouth method. Inclusion criteria included the need for fixed orthodontic treatment, the need for first maxillary premolars for orthodontic treatment, age of 13 to 25 years, maxillary canine teeth should be grown and all permanent teeth (excluding third molars) should be present, and exclusion criteria included systemic disease affecting the metabolism of bone and tooth movement, craniofacial syndrome, pregnancy and consumption of drugs that affect tooth movement. In the first stage of treatment, for aligning and leveling the teeth, 14 SS 14, NiTi and SS 16 wires were used. The step of space closure of extracted tooth in both methods began at the beginning of treatment on NiTi 14 wire. Space closure on each side was performed with lace back and NiTi coil methods. 0.009 inch ligature wire was used on one side of the mouth for closing the first molar to canine as active (active lace back). NiTi closed coil was used on the other side, which was connected to canine and first molar with ligature wire. Patients were visited at 4-week intervals for 4 months. After 4 months, new casts and panoramic radiographs were obtained from patients and to evaluate the amount of rotation, tipping and movement of canine teeth and molars in two side of the mouth measured from previous cast and radiograph before treatment of patient were compared. To measure the rotation of teeth, the angle of the line connecting mesial and

distal height of contour of canine and molar teeth with midpalatal raphe in casts before and after the treatment was measured. Then, tooth tipping was measured by measuring the angle of the line connecting cusp tip of canine to the tip of the root of this tooth with the line connecting the most inferior point of orbits (infraorbital line) in radiography, and the movement of the tooth was measured by measuring the distance of cusp tip of canine and mesiobuccal tip of first molar with line

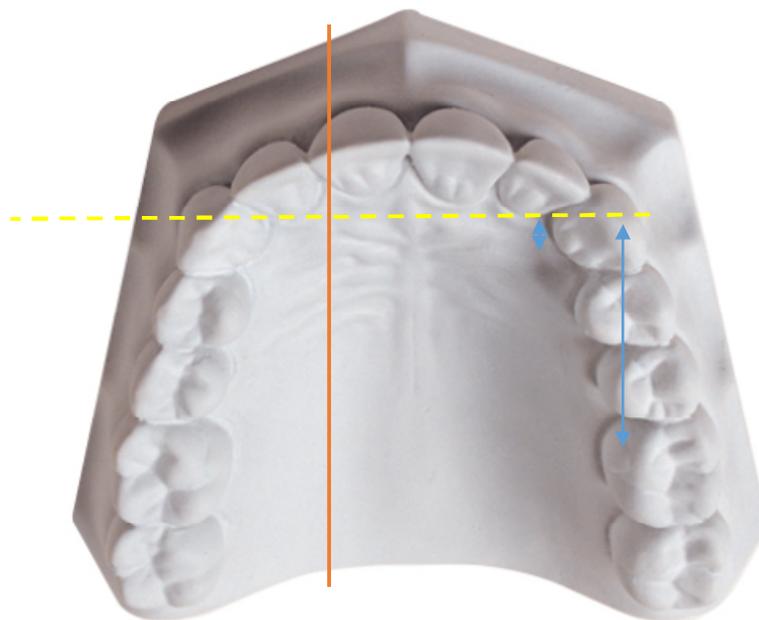
perpendicular to the midpalatal raphe at first rogay. To measure the tipping of the first molar, the angle of the line connecting the mesial cusp tips to tip of the palatal root of this tooth with infraorbital line in panoramic radiograph was measured. (figure 1, 2, 3). The information obtained from measurements on radiography and dental casts before and after treatment were recorded and analyzed by SPSS software.



**Figure 1.** Measuring the angle of canine relative to the midpalatal raphe



**Figure 2.** Measuring the angle of molar relative to midpalatal raphe (the blue line is drawn parallel to the yellow line (mesiodistal molar))



**Figure 3.** Measuring the distance of teeth relative to midpalatal raphe perpendicular at first rogay.

**FINDINGS:**

In this study, 15 patients (6 males and 9 females) were enrolled with average age of  $14.3 \pm 5.6$ . Table 1 shows the rotation of canine and molar teeth in two techniques used. The rotation range of canine in lace back group was between -10 and 0 degrees and in NiTi coil group was between -42 and -7 degrees and for molar, the rotation range of tooth in lace back group was between -6 and 5 degrees and in NiTi coil group was between -8 and 10 degrees. As shown in Figure 5, the rotation of canine in NiTi coil group was more than lace back group ( $P=0.005$ ), but this difference was not significant for rotation of molar ( $p = 0.359$ ).

**Table 1.** The amount of canine and molar teeth rotation in both methods used

	Lace back		NiTi coil		
	The mean	Standard deviation	The mean	Standard deviation	

Canine	-4.50	3.44	-14.40	11.02	0.005
molar	0.55	3.04	2.30	6.22	0.359

The results showed that tipping range of canine in lace back group was between 0 and 10 degrees and in NiTi coil group was between 1 and 19 degrees. For molar tooth, tipping range of tooth in lace back group was between -15 and 5.5 degrees and in NiTi coil group was between -17 and 2.5 degrees. As shown in Figure 6, the amount of canine and molar tipping in NiTi coil group was more than lace back group ( $P < 0.05$ ).

**Table 2.** The amount of canine and molar teeth tipping in both methods used

	Lace back		NiTi coil		
	The mean	Standard deviation	The mean	Standard deviation	
Canine	6.25	3.40	11.45	5.01	0.028
molar	-1.50	5.75	-5.75	6.20	0.046

Based on the results of the study, the movement range of canine in lace back group was between 1.5 and 10.5 mm and in NiTi group was between 5 and 8.5 mm. For molar tooth, the movement range of tooth in lace back group was between 0.5 and 2 mm and in NiTi coil group was 0 and 5.5 mm. As shown in Figure 7, The amount of the movement of canine and molar in NiTi coil group and lace back group was not significant ( $P > 0.05$ ).

**Table 3.** The movement of canine and molar teeth in two methods used

	Lace back		NiTi coil		
	The mean	Standard deviation	The mean	Standard deviation	
Canine	4.30	3.27	5.95	1.19	0.239
molar	1.20	0.48	1.85	1.76	0.438

Finally, the average rate of canine movement in lace back group was  $1.075 \pm 0.82$  mm per month (range of 2.63 and 0.37) and in NiTi coil group was  $1.49 \pm 0.30$  mm per month (range of 2.12 and 1.25). Based on statistical analysis, this difference was not significant ( $p = 0.239$ ).

**DISCUSSION AND CONCLUSION:**

This study was a randomized clinical trial with a split-mouth design to evaluate and compare the effectiveness of active ligatures (Lace back) and NiTi coil for canine retraction. In the present study, in the group that canine retraction was done by NiTi coil, canine rotation was 14.4 degree (mesiobuccal rotation), canine tipping was 11.45 degree (distal tip), and the mean movement of canine was 5.95 mm (the rate of 1.49 mm per month). Also, the amount of anchorage loss in this group was 1.85 mm. In the study by Samuels et al. (1998) (10) on 18 patients, it was shown that average rate of canine retraction by NiTi with 150g force is 0.16 mm per week. In the study by Nightingale and Jones (2003) (11), the average

rate of canine retraction in 22 patients by NiTi coil with the force of 149-300g was 0.21 mm per week. In the study by Cacciafesta et al. (2003) (12), the average rate of canine retraction by NiTi coil with the rate of 1 Newton in 8 patients was 1.41 mm. In the present study, in the group that canine retraction had been done by lace back, canine rotation was 4.5 degree (mesiobuccal rotation), canine tipping was 6.25 degree (distal tip), and the average movement of canine in four months was 4.3 mm (rate of 1.07 mm per month). Also, the amount of anchorage loss in this group was 1.2 mm. Chetan et al. in a RCT study on 20 patients who needed extraction of first maxillary premolar tooth, they showed that canine retraction by lace back within three months, canine moves distal 1.74 mm (0.58 mm per month). In this study also has been showed that average canine rotation within three months was 5 degree and average tipping of it was 5.9 degree (13). In this study, canine retraction by lace back was associated with lesser rotation and tipping of the canine and lesser tipping of the molar compare

to retraction by NiTi coil. The amount and rate of canine and molar movement (anchorage loss) in these two techniques had little and insignificant differences. Despite the results of present study, Dixon et al. (7) in a RCT study, compared the three methods of space closure including active ligatures (lace back), polyurethane powerchains and nickel titanium coils, they showed that the rate of space closure by NiTi is more than lace back. In this study, 33 patients were enrolled and randomly received one of the methods of space closure. The results of the study showed that the rate of space closure by lace back was 0.35 mm per month, by powerchain was 0.58 mm per month and by NiTi coil was 0.81 mm per month. Based on statistical analysis, the rate of space closure by NiTi was significantly higher than the rate of space closure by lace back (7). In a laboratory study, regardless of PDL and dental movement and the role it might have on reducing the force, they compare and calculated the loss of strength in active ligature and NiTi coil over time (14). The results of that study showed that more than half of the lace back strength loses after 4 weeks, while NiTi coil showed no loss of strength over time (14). Overall, the results of the present study showed that canine retraction by lace back is associated with lesser tipping and rotation of the canine and lesser tipping of the molar compare to retraction by NiTi coil. The amount and rate of canine and molar movement (anchorage loss) in two techniques had less and no significant differences.

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