

## Rate of Canine Retraction and Anchor Loss During Individual Canine Retraction

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### ABSTRACT

**Aim:**The aim of this study is to evaluate the rate of bodily movement of canine during individual canine retraction and the amount of anchor loss with two different methods- elastomeric chains and NiTi coil spring. **Materials And Methods:** Sample size calculated using GPower software was 14. The patient was randomised according to the lottery method and divided into two groups. Group A had elastomeric chains on the right side and NiTi coil spring on the left and Group B has elastomeric chain on the left and NiTi coil spring on the right side of the quadrant. Elastomeric chain was extended from the molar tube to the canine hook on one side. A 9 mm NiTi closed coil spring was extended from the first molar to the canine hook on the other side. The rate of canine movement and the anchor loss was measured from the intraoral scan done by 3Shape scanner. The scanned images were superimposed and the distance between the pre and post mesial tip of canine gave the distance moved by the canine. This divided by the number of months gives the rate of retraction. The pre and post canine retraction scanned models were overlapped over each other to measure the amount of anchor loss that occurred during the canine retraction. **Results:** The rate of canine retraction for elastomeric chains is  $3.94 \pm 0.73$ mm and that for NiTi coil spring is  $4.69 \pm 0.13$ mm. There was a statistical significant difference in the rate of canine retraction between NiTi coil spring and elastomeric chains at T0 and T3 (P value=0.02). The amount of mean anchor loss for elastomeric chain was 2.45mm with a standard deviation of 0.27 and the mean anchor loss for NiTi coil spring was 1.99mm with a standard deviation of 0.19 and was statistically significant between them. **Conclusion:** NiTi produced a faster rate of tooth movement than elastomeric chains. Elastomeric chains produced a significant amount of anchor loss when compared to NiTi coil spring.

**KEY WORDS:** CANINE RETRACTION, NITI COIL SPRING, ELASTOMERIC CHAINS, ANCHOR LOSS.

### ARTICLE INFORMATION

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## INTRODUCTION

In orthodontic treatment extraction is frequently required to correct crowding and to improve the facial profile and to retract the anterior teeth. The most frequently tooth extracted and the most ideal tooth for correction of bimaxillary protrusion is the first bicuspid. The 7mm gained after extraction in each quadrant is utilised for correction of crowding, proclination or for protraction of posterior teeth (Güray and Orhan, 1997). There are two methods of space closure: individual canine retraction followed by retraction of the incisors and en-masse retraction of the entire anterior segment. In individual canine retraction the canine in each quadrant is retracted to make full contact with the tooth distal to the extraction space and fastened to the posterior segment and made as one unit. This is followed by the retraction of the anterior incisor segment. With this method the load on the posterior segment is reduced, thus reducing any undesirable changes to the posterior teeth and reduces the chances of molars moving forward. However, the time needed for space closure is longer and the canines tend to tip and rotate more, thus requiring additional time and effort to relieve and realign the teeth.

Another school of thought is en-masse retraction where the entire anterior segment is retracted as a single unit. Application of optimal force values, continuously and simultaneously over the due threshold is sufficient to retract the canines and the incisors without causing any excessive anchor loss. It can be suggested that the force required to retract the anterior segment dissipates and are below the biological threshold level to cause substantial movement of any posterior segment (Graber et al., 1994). NiTi is a very common auxiliary used for retraction of anterior segment and can be activated to a much greater extent before permanent deformation and they are specially indicated in cases of large extraction spaces or if there are infrequent adjustment opportunities are present (Sharma et al., 2015). They deliver a continuous force till the end of the deactivation stage is reached. The advantage of these spring is that they can be easily placed and removed and do not need reactivation every appointment. But they are relatively unhygienic as compared to elastic modules (Sharma et al., 2015).

Our extensive research expertise ranged from epidemiological studies to randomised clinical trials that have been published in reputed journals (Charles et al., 2018; Chinnasamy et al., 2019; Felicita, 2017a, 2017b, 2018; Felicita et al., 2017; Korath et al., 2017; Krishnan et al., 2017; Pandian et al., 2018; Reddy et al., 2018). This knowledge was instrumental for us to study the rate of canine retraction and anchor loss during individual canine retraction. The aim of this study is to evaluate the rate of bodily movement of canine during individual canine retraction and the amount of anchor loss with two different methods: elastomeric chains and NiTi coil spring.

## MATERIALS AND METHODS

Sample size calculated using GPower software was 14. Patients who were undergoing fixed orthodontic treatment in the department of orthodontics at Saveetha Dental College and Hospital, Chennai were taken for the study. The study was designed to be a split mouth randomised control trial. Patients selected for the study were undergoing fixed orthodontic treatment with 0.022 MBT bracket prescription who needed upper first premolar extraction as part of their treatment plan, and were on 0.019 x 0.025 inch stainless steel wire with second molar included and was at the end of levelling and aligning stage. Intra-oral scans were taken using a MEDIT scanner and digital models were analyzed using ORTHOANALYSER software.

**Methodology:** The patient was randomised according to the lottery method and divided into two groups. Group A had elastomeric chains on the right side and NiTi coil spring on the left and Group B has elastomeric chain on the left and NiTi coil spring on the right side of the quadrant. Elastomeric chains was extended from the molar tube to the canine hook on one quadrant and a 9 mm NiTi closed coil spring was extended from the first molar to the canine hook on the other side. The posterior segments were held together as one unit by ligating them together. The force generated was calibrated to 200Gms using a dontrix gauge.

Intra-oral models and photographs were taken every month till the canine space closed on either one side. The rate of canine movement and the anchor loss was measured from the intraoral scan done by 3Shape scanner. The scanned images were superimposed and the distance between the pre and post mesial tip of canine gave the distance moved by the canine (Fig 1&2). This divided by the number of months gives the rate of retraction. The pre and post canine retraction scanned models were overlapped over each other to measure the amount of anchor loss that occurred during the canine retraction (FIG 3&4).

Figure 1: Superimposition of pre and post canine retraction models

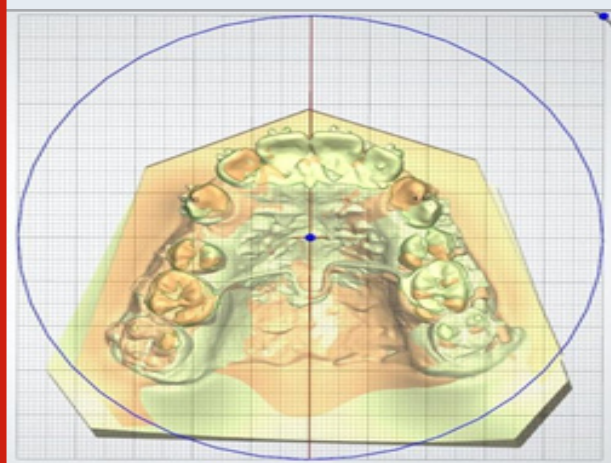


Figure 2: Measurement of canine movement



Figure 3: overlapping of pre and post canine retraction models for anchor loss on NiTi spring quadrant

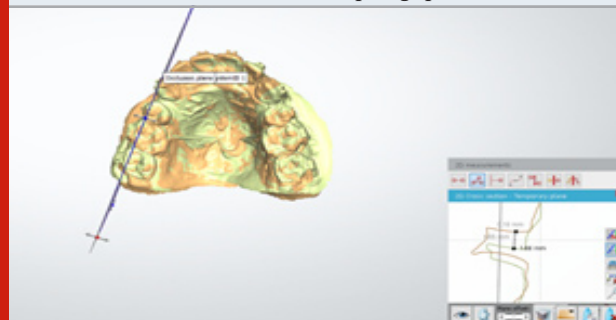
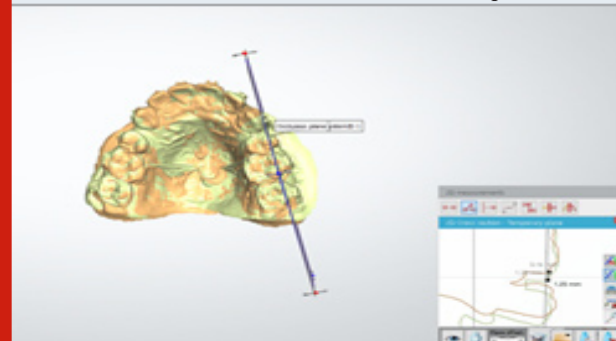


Figure 4: Overlapping of pre and post canine retraction models for anchor loss on elastomeric chain quadrant



## RESULTS

The rate of canine retraction for elastomeric chains is  $3.94 \pm 0.73$  mm and that for NiTi coil spring is  $4.69 \pm 0.13$  mm. There was a statistical significant difference in the rate of canine retraction between NiTi coil spring and elastomeric chains at T0 and T3 (P value=0.02) (Table I). The amount of mean anchor loss

for elastomeric chains was 2.45 mm with a standard deviation of 0.27 and the mean anchor loss for NiTi coil spring was 1.99 mm with a standard deviation of 0.19 and was statistically significant between them (P value=0.04) (Table II).

Table 1. Mean and standard deviation of the rate of canine retraction with elastomeric chains and NiTi coil spring

variable	group	N	Mean in mm	Std dev	P
Distal mov	elastomeric chains	7	3.94	0.73	0.02
	NiTi	7	4.69	0.13	

P value less than 0.05 is significant

Table 2: Mean and standard deviation of the anchor loss with elastomeric chain and NiTi coil spring

variable	group	N	Mean in mm	Std dev	P
Anchor loss	elastomeric chains	7	2.45 mm	0.27	0.04
	NiTi	7	1.99 mm	0.19	

P value less than 0.05 is significant

## DISCUSSION

In this study, statistically significant difference was noted in the two groups (elastomeric chains and NiTi coil spring) in the rate of canine retraction between T0 and T3 with the rate of canine retraction being more for NiTi coil spring compared to elastomeric chain (Table I). NiTi coil spring produced a faster rate of canine movement than elastomeric chains (Mohammed et al., 2018) which is in agreement to the present study. A faster tooth movement and a constant force applied by NiTi coil spring was also reported by Barlow et al in his systematic review (Barlow and Kula, 2008).

On evaluating the pre and post retraction records, a definite anchor loss was noted for both the groups with the statistically significant more anchor loss for elastomeric chains (p value of 0.04). However Chaudhari et al reported more anchor loss for NiTi coil spring compared to that of elastomeric chains (Chaudhari and Daokar, 2015). Various anchorage considerations like transpalatal arch and also the latest method of using TAD's to minimise anchor loss. Studies done by Davis et al showed that implant supported retraction produced more canine retraction than conventional methods (Davis et al., 2018). Borsos et al suggested that anchorage can be reinforced by making the implant and the molars as one unit (Sharma et al., 2012).

## CONCLUSION

- NiTi produced a faster rate of tooth movement than elastomeric chains
- elastomeric chains produced a significant amount of anchor loss when compared to NiTi coil spring.

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