Advances in Bioscience and Clinical Medicine
ISSN: 2203-1413
www.abcmed.aiac.org.au

Original Article

# A Novel Spring for Impacted Canine Traction: A New Method presentation

Mojgan Kachoei[1], Milad Ghanizadeh[2], Mahdieh Esmailzadeh[3], Parastou Nastarin[4]*

[1]*Professor, Department of Orthodontics, Faculty of Dentistry, Tabriz University of Medical Sciences, Tabriz, Iran*
[2]*Postgraduate Student of oral and maxillofacial surgery, Students' Research Committee, Tabriz University of Medical Sciences, Tabriz, Iran*
[3]*Dentistry Student, Faculty of Dentistry, Tabriz University of Medical Sciences, Tabriz, Iran*
[4]*Assistant Professor, Department of Orthodontics, Faculty of Dentistry, Tabriz University of Medical Sciences, Tabriz, Iran*

**Corresponding author:** Parastou Nastarin, E-mail: p.nastarin@gmail.com

**ARTICLE INFO**

*Article history*
Received: January 22, 2019
Accepted: March 06, 2019
Published: April 30, 2019
Volume: 7 Issue: 2

Conflicts of interest: The authors declare that there is no conflict of interest regarding the publication of this article.
Funding: The study was self-funded by the authors and their institution.

**Key words:**
Biomechanics,
Orthodontic Appliance,
Tooth Impaction

**ABSTRACT**

Impacted canines are prevalent and most of the time palatally positioned. Traction of impacted canine is performed by various methods. The aim of this study is to present a new method for impacted canines' traction which is safe, hygienic and also applying light continuous force. This novel cantilever spring which is made of 0.014-inch stainless steel wire, is beneficial to be used in cases of canine impaction because of its safety and low force/deflection ratio.

## INTRODUCTION

It is common in daily orthodontic practice to encounter impacted canines which occur in approximately 2 percent of the population (1,2). The prevalence of canine impaction is ranked second after third molars impaction and is more prevalent in females than males (1,3,4). Impaction of mandibular canines occur 20 times less than maxillary ones. Maxillary impacted canines are palatally positioned in 85% of cases. Buccally impacted canines are usually related to space deficiency (2,4-6).

Signs of canine impaction are: 1. Over-retention of deciduous canines 2. Delayed eruption of permanent canines 3. Absence of vestibular bulging or presence of palatally bulge. 4. Distal tipping of maxillary lateral incisor crown (2). The first phase in treatment of impacted canines is achieving sufficient space in the related arch followed by exposure of canine by either opened or closed periodontal surgery approach. Traction of canine after bonding an attachment on the crown is the last stage before final alignment (2,7,8).

Various mechanisms have been introduced for moving impacted teeth such as: 1.Elastomeric chain traction and Cantilever springs (9,10).

Fischer and colleagues presented a cantilever spring for traction of impacted teeth and stated benefits of low load/deflection rate and less activation visits(11). Bowman and Carano utilized Kilory spring for impacted canines which is a removable auxiliary spring and its advantages are: easy adjustment, continuous laterally and vertically forces exertion and needless of patient cooperation(12). One of the most well-known springs for impacted canines is Ballista spring by Jacoby, which is a cantilever spring inserted in molar tube and first premolar bracket. He expressed continuous force application, easy insertion and no requirement for aggressive surgical procedure as its advantages(13). Kornhauser introduced buccal auxiliary spring which was inserted in teeth along with the main arch wire, as a continuous spring. Avoidance of additional laboratory procedures and application of measurable forces are its described advantages(14). The aim of this article is to represent a new method for impacted canine traction, which is hygienic, applying light-continuous force, and less hazardous for arch form even in cases of ankylosis.

Published by Australian International Academic Centre PTY.LTD.

http://dx.doi.org/10.7575/aiac.abcmed.v.7n.2p.25

## MATERIALS AND METHODS

Before beginning impacted tooth traction, required space for the impacted tooth should be obtained in the arch and a proper, continuous stiff main arch wire passively inserted in the arch.

Upon each individual's unique impaction condition, the tooth is exposed by opened or closed technique and a bracket, which is tied by a twisted ligature wire, is being bonded on the crown. This twisted ligature wire is the connector between the tooth and spring.

The spring is formed of 0.014-inch stainless steel wire comprising of 4-6 helices which are formed by 139 pliers for creating essential flexibility (depending on the amount of flexibility desired, the number of helices could vary). The main arch wire passes through mentioned helices.

Active arm of spring, is the mesial extension of helices that a loop is formed in the extremity to connect the ligature wire on the tooth with the spring. The distal end of spring is inserted in auxiliary molar tube and a tiny vertical stop is formed at mesial of molar tube to prevent rotating of spring. (Figure 1)

Before activation, the active arm of spring is positioned in a way that at least 90 degrees rotation occurs inward after engagement with ligature wire on tooth (in palatal impactions).

10 days after exposure of the tooth, first activation is applied and the rate of tooth movement is indicated by the amount of ligature wire emerged from mucosa. Bulging of mucosa is another sign of tooth movement toward oral cavity. The need for activation is checked monthly and is determined by reduction in active arm angulation and amount of ligature wire emergence. Reactivation is done by tightening the ligature wire and cutting its excess.

In this method average time after application of force until complete exposure of the tooth takes 3-4 months. After sufficient tooth eruption, clinician is capable of using overlay for final alignment.

## CASE PRESENTATION

For a 31 years old female, impacted canine was exposed and a bracket, which was tied by a twisted ligature wire, was bonded on the crown during surgery. 10 days after exposure, the spring was inserted and activated as mentioned in methods section. After 3 months the tooth had been erupted enough to be engaged in a continuous arch wire (Figures 2 and 3).

## DISCUSSION

Impacted canine treatment is a challenging issue in orthodontics(15, 16). Several methods have been introduced for impacted canine traction and each method has some advantages described by authors.

Some clinicians use elastomeric chains for force application to impacted teeth. The main advantage is the ease of use, less bulk and patient comfort(17). In contrast, chains have some drawbacks such as: inability of producing light-continuous force which is the ideal force for tooth movement; and force decay(18). Degradation, rupture and force cut off are always probable(19) and one of the main problems is the periodontal and gingival concerns because of poor hygiene (20).

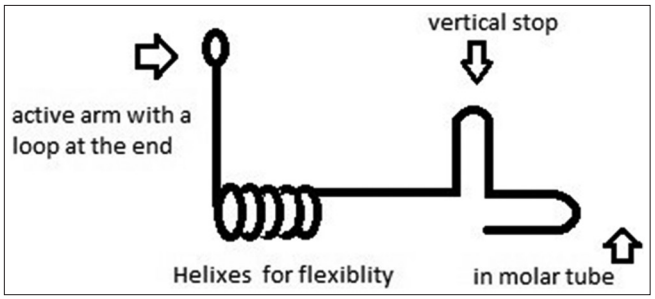


**Figure 1.** Schematic illustration of spring for impacted canine traction

**Figure 2.** Impacted canine was exposed and a bracket, which was tied by a twisted ligature wire, was bonded on the crown. 10 days after exposure, the spring was inserted and activated

**Spring activation**

**Figure 3.** Two months after first activation

The method described in this article has superiority over elastomeric chains such as: being hygienic due to stainless steel material, ability to produce light-continuous force, and flexibility adjustment by altering number of helices. The risk of force cut off is also lower in this method.

Several orthodontists like Kornhauser used continuous springs for impacted teeth traction which is connected to the arch at two extremities. Therefore, the load/deflection rate is higher than cantilever springs, and the ability of producing light

forces and range of action is lower than cantilever springs(14). The risk of arch deformation resulted from excessive forces or ankylosis of tooth exists. However, this risk is low in cantilever springs such as in the method described in the present article. Advantages of continuous springs are their fail safe action and lower risk of deformity by external forces due to their short length (14).

Another method for traction of impacted teeth is using long cantilever springs described by Tausche (21), Jacoby(13), and Fischer(11). In this method, load/deflection rate is low due to its long active arm length which produces light-continuous favorable force. In addition, these springs need less activation visits compared to other methods. Another advantage is less bulk and hygienic design (11,13,21).

Despite all advantages described above for Long cantilevers, they have some drawbacks compared to our method including: susceptibility to deformation by mastication or patient manipulation that can alter the amount of forces applied by the spring. In contrast, the method described here is a short cantilever spring that its deformation risk is low.

## CONCLUSIONS

Current method has valuable advantages for traction of impacted teeth such as:

1- Low load/deflection rate due to its cantilever design, and the ability to apply light-continuous force
2- Hygienic design due to less bulk and stainless-steel material
3- No adverse effect on the arch form even in cases of ankylosis, because spring engagement is done only in the molar tubes
4- Low risk of spring deformation resulted from its short active arm
5- Capability to adjust flexibility by altering helix numbers

Therefore, it seems that using this spring is a proper method for traction of impacted teeth with good efficacy and minimal adverse effect.

## ACKNOWLEDGEMENT

We would like to thank the authorities in the Tabriz Dentistry Faculty for their support of this research.

## REFERENCES

1. Bedoya MM, Park JH. A review of the diagnosis and management of impacted maxillary canines. The Journal of the American Dental Association. 2009;140(12):1485-93.
2. Manne R, Gandikota C, Juvvadi SR, Rama HRM, Anche S. Impacted canines: Etiology, diagnosis, and orthodontic management. J Pharm Bioallied Sci. 2012;4(Suppl 2):S234-S8.
3. Celikoglu M, Miloglu O, Kazanci F. Frequency of agenesis, impaction, angulation, and related pathologic changes of third molar teeth in orthodontic patients. Journal of Oral and Maxillofacial Surgery. 2010;68(5):990-5.
4. Gisakis IG, Palamidakis FD, Farmakis ETR, Kamberos G, Kamberos S. Prevalence of impacted teeth in a Greek population. Journal of Investigative and Clinical Dentistry. 2011;2(2):102-9.
5. Ngan P, Hombrook R, Weaver B. Early Timely Management of Ectopically Eruption Maxillary Canines. Semin Orthod. 2005;11:152-63.
6. Goel A, Loomba A, Goel P, Sharma N. Interdisciplinary approach to palatally impacted canine. Nat J of Maxillofac Surg. 2010;1(1):53-7.
7. Becker A. General principles related to the diagnosis and treatment of impacted teeth. Orthodontic Treatment of Impacted Teeth. 2012:1-9.
8. Katiyar R, Tandon P, Singh GP, Agrawal A, Chaturvedi T. Management of impacted all canines with surgical exposure and alignment by orthodontic treatment. Contemporary clinical dentistry. 2013;4(3):371.
9. Chawla H, Kapur A. Orthodontic management of faciolingual horizontally impacted maxillary central incisor. Journal of Indian Society of Pedodontics and Preventive Dentistry. 2009;27(1):65.
10. Yadav S, Chen J, Upadhyay M, Roberts E, Nanda R. Three-dimensional quantification of the force system involved in a palatally impacted canine using a cantilever spring design. ORTHODONTICS: The Art & Practice of Dentofacial Enhancement. 2012;13(1).
11. fischer TJ, Ziegler F, Lundberg C. Cantilever mechanics for treatment of impacted canines. J Clin Orthod. 2000;34(11):647-50.
12. Bowman SJ, Carano A. The Kilory Spring for Impacted Teeth. J Clin Orthod. 2003;37(12):683-8.
13. Jacoby H. The "ballista spring" system for impacted teeth. Am J Orthod. 1979;75:143-51.
14. Kornhauser S, Abed Y, Harari D, Becker A. The resolution of palatally impacted canines using palatal-occlusal force from a buccal auxiliary. Am J Orthod Dentfac Orthop. 1996;110(5):528-34.
15. Shirazi S, Kachoei M, Shahvaghar-Asl N, Shirazi S, Sharghi R. Arch width changes in patients with Class II division 1 malocclusion treated with maxillary first premolar extraction and non-extraction method. J Clin Exp Dent. 2016;8(4):e403-e8.
16. Bedoya MM, Park JH. A Review of Diagnosis and Management of Impacted Maxillary Canines. J Am Dent Assoc. 2009;140:1485-93.
17. Sinha PK, Nanda Rs. Management of impacted maxillary canines using mandibular anchorage. Am J Orthod Dentfac Orthop. 1999;25(3):254-7.
18. Losito KAB, Lucato AS, Tubel CAM, Correa CA, Santos JCBd. Force decay in orthodontic elastomeric chains after immersion in disinfection solutions. Braz J Oral Sci. 2014;13:266-9.
19. Kanuru RK, Azaneen M, Narayana V, Kolasani B, Indukuri RR, Babu PF. Comparison of canine retraction by in vivo method using four brands of elastomeric power chain. J Int Soc Prev Community Dent. 2014;4(Suppl 1):S32-S7.
20. Casaccia GR, Gomes JC, Alviano DS, Ruellas ACdO, Anna EFS. Microbiological Evaluation of Elastomeric Chains. Angle Orthod. 2007;77(5):890-3.
21. Tausche E, Harzer W. Treatment of a patient with Class II malocclusion, impacted maxillary canine with a dilacerated root, and peg-shaped lateral incisors. Am J Orthod Dentfac Orthop. 2008;133(5):762-70.