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The Role of Laceback in Fixed Orthodontic Therapy

A Project Submitted to
The College of Dentistry, University of Baghdad, Department of Orthodontics in Partial Fulfillment for the Bachelor of Dental Surgery

By:
Shahad Hassan Abbas

Supervised by:
Professor Dr. Mohammed Nahidh
B.D.S., M.Sc., Ph.D.

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Certification of the Supervisor

I certify that this project entitled **"The Role of Laceback in Fixed Orthodontic Therapy"** was prepared by **Shahad Hassan Abbas** under my supervision at the College of Dentistry/University of Baghdad in partial fulfillment of the graduation requirements for the Bachelor degree in dentistry.

Professor

Dr. Mohammed Nahidh

B.D.S., M.Sc., Ph.D.

The supervisor

10-5-2023

DEDICATION

This work is dedicated to

My beloved parents

who have been my source of inspiration and gave me strength when I thought of giving up,

who continually provide moral, spiritual and emotional support.

To my sisters and my faithful friends

who always gave me the words of advice and encouragement to finish this work

Shahad

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List of abbreviations

et al.	et alia (and others)
i.e.	id est (In other words)
MBT	McLaughlin, Bennett, Trevisi
mm.	Millimeter
NiTi	Nickel Titanium

Introduction

One of the major disadvantages of incorporating second order values into the pre-adjusted edgewise bracket system was it created stress on anchorage in the initial stages of treatment. The tip was greater in the maxillary canine brackets that increased the tendency for the labial segment tip forward and created a significant drain on anteroposterior anchorage **(Meyer and Nelson, 1978)**.

McLaughlin and Bennett (1989) suggested lacebacks and bendbacks to control canine angulation and incisor proclination during leveling and aligning phase. Laceback is 0.009 or 0.010-inch soft stainless steel wire passively tied in a figure of 8 from the most distally incorporated molar to the canine bracket, minimized forward tipping of the canine crowns. Bendbacks, on the other hand, is bending the archwire back immediately behind the most distal banded or bonded molar, used to minimize forward tipping of the incisors.

McLaughlin and Bennett (1991) described the anchorage control in three planes of space for the anterior and posterior segments. They highlighted the effect of laceback for the first time on the molars and incisors movements based on the findings of **Robinson's study (1989)**.

In 1997, McLaughlin, Bennett, and Trevisi introduced the MBT system. In this system, the brackets were designed to provide enough torque and tip to the teeth to allow them to assume the correct inclination and angulation. During leveling and aligning phase, they suggested the use of lacebacks and bendbacks to control canine angulation and support posterior anchorage (**McLaughlin *et al.*, 2001**).

There is no study reviewing the advantages, disadvantages, modifications, and the effects of laceback ligatures on the incisors, canines, and molars movements during the course of fixed orthodontic therapy.

Aims of the study

This study aims to review the roles of laceback in fixed orthodontic therapy, its advantages, disadvantages, modifications, effects on the incisors, canines and molars movements and evidence about its use.

Chapter One
Review of Literature

1.1 Fixed orthodontic appliance

It is an orthodontic device that can not be removed or adjusted by the patient. It consists of attachments fixed on to the teeth surface, transmitted the force applied by archwires and/or other auxiliaries to the teeth **(Singh, 2015)**.

1.1.1 Indications of fixed orthodontic appliance

Fixed orthodontic appliance is indicated to treat variety of cases requiring multiple tooth movement like intrusion, extrusion, derotation, translation, and torquing movement in addition to controlled space closure that can not be achieved by other appliances **(Littlewood and Mitchell, 2019)**.

1.1.2 Contraindications of fixed orthodontic appliance

Singh (2015) and Phulari (2017) listed down the following contraindications:

1. Poor patient's motivation.
2. Poor dental and/or periodontal health patients.
3. Severe skeletal discrepancies beyond the scope of this appliance.
4. Inappropriately trained or inexperienced operator.

1.1.3 Advantages of fixed orthodontic appliance

Phulari (2017) summarized the advantages of this appliance as followed:

1. No problem in the retention of the appliance as it is bonded/cemented to the teeth.
2. It requires less skill and efforts from the patient in managing the appliance other than caring and cleaning.
3. Multiple tooth movements can be achieved at the same time.

1.1.4 Disadvantages of fixed orthodontic appliance

Singh (2015) and Phulari (2017) summarized the disadvantages of this appliance as followed:

1. Oral hygiene issue.
2. Damaging of the teeth and supporting structures by excessive force.
3. Adverse tooth movements are possible.
4. It can affect esthetics.
5. Needs well-trained operator.
6. Costly in comparison with the removable appliance.
7. Increased chair side time.
8. Anchorage control is not as easy as the removable appliance.
9. Long treatment time.

1.1.5 Components of fixed orthodontic appliance

Fixed orthodontic appliance broadly consists of active and passive components. The passive components are not force generating parts but help provide attachment for other auxiliaries to the teeth and included **(Phulari, 2017)**:

1. Attachments; bands, brackets, lingual button, lingual sheath, lingual cleat, eyelet.
2. Ligature wire
3. Lock pins

The active components are used to generate forces that cause tooth movement and included **(Singh, 2015; Phulari, 2017)**:

1. Separators; elastic separator and brass wire separator.
2. Archwires; gold, stainless steel, Nitinol, Beta Titanium, and multi-stranded.
3. Springs; uprighteing, torquing, rotation, open coil, closed coil spring.

4. Elastic modules; intra-oral and extra-oral elastic bands, elastic chain, elastic thread, elastic ligature.
5. Magnets.

1.2 The transition from standard edgewise to preadjusted appliance systems

Edward Angle's position as the "father of modern orthodontics" is based not only on his contributions to classification and diagnosis of malocclusions but also on his creativity in developing several orthodontic appliances starting with the E-arch and ending with the edgewise appliance which was invented to overcome the deficiencies of the previous appliances. By edgewise appliance, he treated his cases with non-extraction method and introduced the three order bends to get individual ideal tooth position because he used the same bracket on all teeth **(Angle, 1928; Phulari, 2013)**.

In **1972, Andrews** introduced his six keys for normal occlusion based on a data obtained from 120 study models of non-orthodontic subjects with normal occlusion. Then after, he invented the Straight-Wire Appliance with new features of the brackets that were specified for each tooth. He transferred the three order bends to the bracket base and slot to minimize the wire bending. Moreover, he developed different prescriptions to manage cases with class I, II and III and extraction and non-extraction **(Andrews, 1976, 1989)**.

Roth (1985) introduced further modifications in an attempt to reduce the number of bracket types required using Andrews' prescription. Roth introduced a prescription for a set of brackets that would be applicable to most cases, so reducing the bracket inventory. However, Roth also proposed increasing the tip for the canine brackets to facilitate canine guidance and added distal crown tip on the lower buccal segments because he felt his prescription would be more anchorage demanding. Finally, the Roth prescription, in addition to having more tip and torque in the anterior region, was also intended to increase upper molar torque to prevent the palatal cusps dropping.

The variations proposed by MBT system aimed to further improve the results of completed cases. These clinicians suggested a reduction in the anterior tip found in the Andrews and Roth prescriptions to values much closer to Andrews' original data. The aim was to reduce the strain on molar anchorage and to avoid arch length increases that can occur in treatment. In addition, a reduction in tip of the canines has also been introduced in the MBT prescription to reduce the risk of cuspid and bicuspid roots coming in close proximity, and to allow the crowns to be placed in a slightly more upright position, thus reducing the anchorage demand. The tip on the upper posterior teeth is also reduced in the MBT system further reducing anchorage demands **(McLaughlin *et al.*, 2001)**.

The MBT prescription was introduced in 1997 and quickly established itself as one of the most popular bracket prescriptions on the market. The main differences with other bracket prescriptions are **(Khan, 2015)**:

1. Increased palatal root torque in the upper central incisor brackets (Andrews: 7 degrees, Roth: 12 degrees, and MBT: 17 degrees)
2. Increased palatal root torque in the upper lateral incisor brackets (Andrews: 3 degrees, Roth: 8 degrees, and MBT: 10 degrees)
3. Increased lingual crown torque in the lower incisor brackets (Andrews: −1 degrees, Roth: −1 degrees, and MBT: −6 degrees)
4. Decreased tip in the upper canine brackets (Andrews: 11 degrees, Roth: 13 degrees, and MBT: 8 degrees).

The transition from standard edgewise to preadjusted appliances has allowed orthodontists to treat patients efficiently and with consistent quality of results. The first difference a clinician noticed in changing to a preadjusted appliance system was the tendency for anterior teeth to incline forward during the initial phase. This result from the tip built into the anterior brackets, and it is more pronounced in the upper arch, where the built-in tip is greater **(Khan, 2015)**.

1.3. Laceback

1.3.1 Definition

Stainless steel ligature placed in a figure-eight mode usually from the terminal molar to the canine of the same quadrant (Figure 1), as part of the leveling and alignment stage of treatment with the straight-wire appliance **(McLaughlin and Bennett, 1989)**.

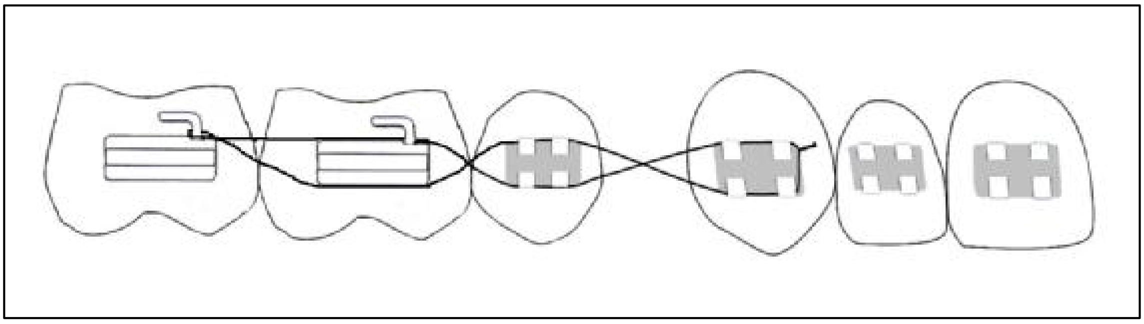

Figure 1. Laceback **(McLaughlin *et al.*, 2001)**

1.3.2 Types of laceback

There are two types of laceback; passive and active.

A. Passive laceback

The arch length between the canine and first molar are fixed. Without a laceback the expression of the straight-wire force system (through the prescription and level and aligning) results in increasing the arch length between canine and molar, which proclines the incisors. This is most notable during the initial stages of leveling and aligning. In extraction cases, this results in round tripping with potential detriment to the gingival health and greater root resorption. Through a passive laceback the arch length is fixed, therefore the arch length cannot increase and the force system results in distal root tipping of the canine which is usually desirable **(McLaughlin and Bennett, 1989 and 1991)**.

B. Active laceback

The laceback is tightened to produce an active force between the canine and first molar. This produces a high initial force (interrupted force) which reduces over the appointment interval. The canine is retracted during this process and the molars mesialize due to the reciprocal forces **(Naini and Gill, 2022)**.

1.3.3 Uses of laceback

The uses of each type can be summarized here **(McLaughlin and Bennett, 1991; Naini and Gill, 2022)**:

A. Uses of a passive laceback

1. Limits incisor proclination during alignment by controlling mesial tip of canines.
2. Fixes the distance between molar and canine teeth.
3. Protects the span of unsupported wire in the early stages of alignment.

B. Uses of an active laceback

1. Retracts canines
2. Mesializes molars
3. Aids in dental centre line correction by applying unilaterally.

McLaughlin and Bennett (1991), **Naini and Gill (2022)**, and **AlHakeem *et al.* (2022)** explained the uses of laceback as followed:

1. **Prevention or reduction of canine mesial crown tip**

If the canine tooth is either upright or distally angulated, the engagement of the initial archwire into the canine bracket will lead to mesial crown angulation as the mesial tip in the canine bracket is expressed. Inevitably, these will also procline incisors engaged with the same wire. To counteract this effect, the laceback serves to tie the canine crown back to the terminal molar, maintaining its sagittal position such that the change in angulation of the canine is encouraged to occur by distal root movement rather than mesial crown tip. Whether this occurs in practice to the desired theoretical extent is subject to debate.

2. **Dental midline correction**

Unilateral lacebacks may be used to restrict mesial canine crown movement on one side, thereby allowing the expression of the mesial tip of the contra-lateral canine to aid in dental midline correction. The dental midline will thereby move towards the side with the laceback.

3. **Archwire protection from masticatory forces**

Masticatory forces, particularly over a bolus of food, may lead to vertical forces on thin initial archwires causing them to disengage from the brackets or molar tubes. The laceback provides some protection against this occurring, particularly in premolar extraction sites where the initial archwire is unsupported for a greater interbracket span.

4. **Canine retraction and mesial molar movement**

Theoretically, tight lacebacks may be used to begin canine retraction in cases with severe lower incisor crowding. However, they are unlikely to be very effective as they will not be active over anything more than a very short range. Conversely, mesial molar movement is expected endangering the anchorage of posterior teeth.

1.3.4 Mechanisms of action

The mechanism of action of the laceback can be taken from three aspects **(McLaughlin and Bennett, 1991; Naini and Gill, 2022; AlHakeem *et al.*, 2022)**:

Firstly, it acts on arch length fixation between the molar and canine by preventing the canine crown mesializing, as a result, the canine center of rotation will change by moving to the canine bracket with the moment expressing itself at mainly the apical region (Figure 2).

Secondly, canine retraction by laceback can be explained by the initial slight distal tipping of the crown of the canine followed by a period of rebound due to the effect of archwire in aligning the teeth during which distal movement of the root of canine is achieved (Figure 3).

Thirdly, through the trampoline effect, the passive laceback can retract a canine through the effect of occlusal forces. Biting forces result in micro vertical movement of the dentition (trampoline), which results in the laceback bending momentarily. The bending of the laceback reduced the anteroposterior length of the laceback and retracts the canine. This process repeats many times with chewing/function.

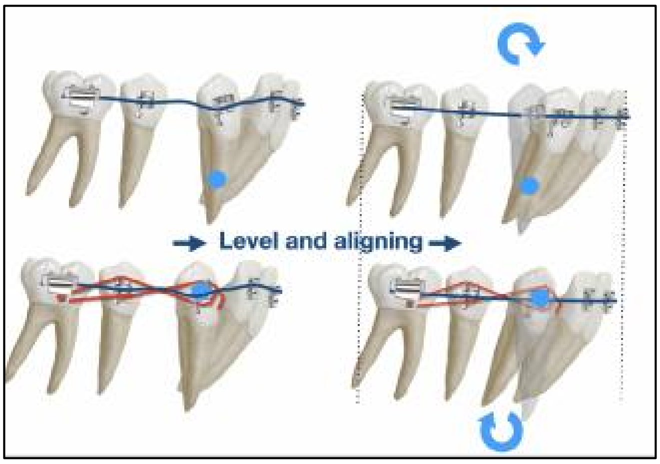

Figure 2. Effect of laceback ligature on canine in leveling and aligning stage **(AlHakeem *et al.*, 2022)**

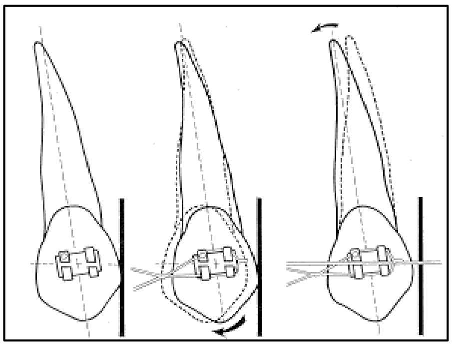

Figure 3. Effect of laceback ligature on canine in leveling and aligning stage **(McLaughlin and Bennett, 1989)**

1.3.5 Advantages of laceback

1. Easy to perform **(McLaughlin and Bennett, 1989**).
2. Not need patient cooperation **(McLaughlin and Bennett, 1989**).
3. Inexpensive **(McLaughlin and Bennett, 1989**).
4. Less chair-side time **(McLaughlin and Bennett, 1989**).
5. It produced more controlled canine movement in the sagittal, vertical, and transverse planes **(Sueri and Turk, 2006)**.
6. It can accept many modifications **(Jongbundan, 2010; Chain *et al.*, 2017; Naini and Gill, 2022)**.

1.3.6 Disadvantages of laceback

Fleming *et al.* (2013) and Naini and Gill (2022) summarized the following disadvantages of the laceback:

1. The amount and rate of canine movement are less than the NiTi closed coil spring or power chain.
2. Wire breakage, detachment and looseness.
3. Force of ligation is difficult to be determined.
4. Need activation each visit.
5. It may affect the anchorage of posterior teeth.
6. It may hamper the oral hygiene measures.

1.3.7 Modifications of laceback

Reviewing the literature indicated that there are three modifications for the laceback. The first one developed by **Jongbundan (2010)** when he created a knot closed to mesial side of second premolar bracket and studied this modification with the conventional one in controlling the posterior anchorage loss (Figure 4). This modification offered an advantage of decreased loss of posterior anchorage compared with regular laceback.

Figure 4. Modified laceback technique with a knot closed to mesial side of second premolar **(Jongbundan, 2010).**

The second modification was done by **Chain *et al.* (2017)** when they used a modified laceback for canine retraction with the aid of push coil spring. The procedure involved inserting conventional laceback in addition to a second one with the ends crossed mesial to the canine before placing the archwire. An open coil spring of 8 mm is placed in the archwire and the archwire is placed in the brackets and the canine bracket is ligated with the metal ligatures. Mesial to the canine, the open ends of the ligatures are brought forward and the coil spring is compressed with the ligature winding it onto the wire and closing the spring. When the open coil spring unwinds itself, it pushes the canine distally. This modification had the advantages of immediate reactivation of the laceback, low force ratio and constant force application (Figure 5).

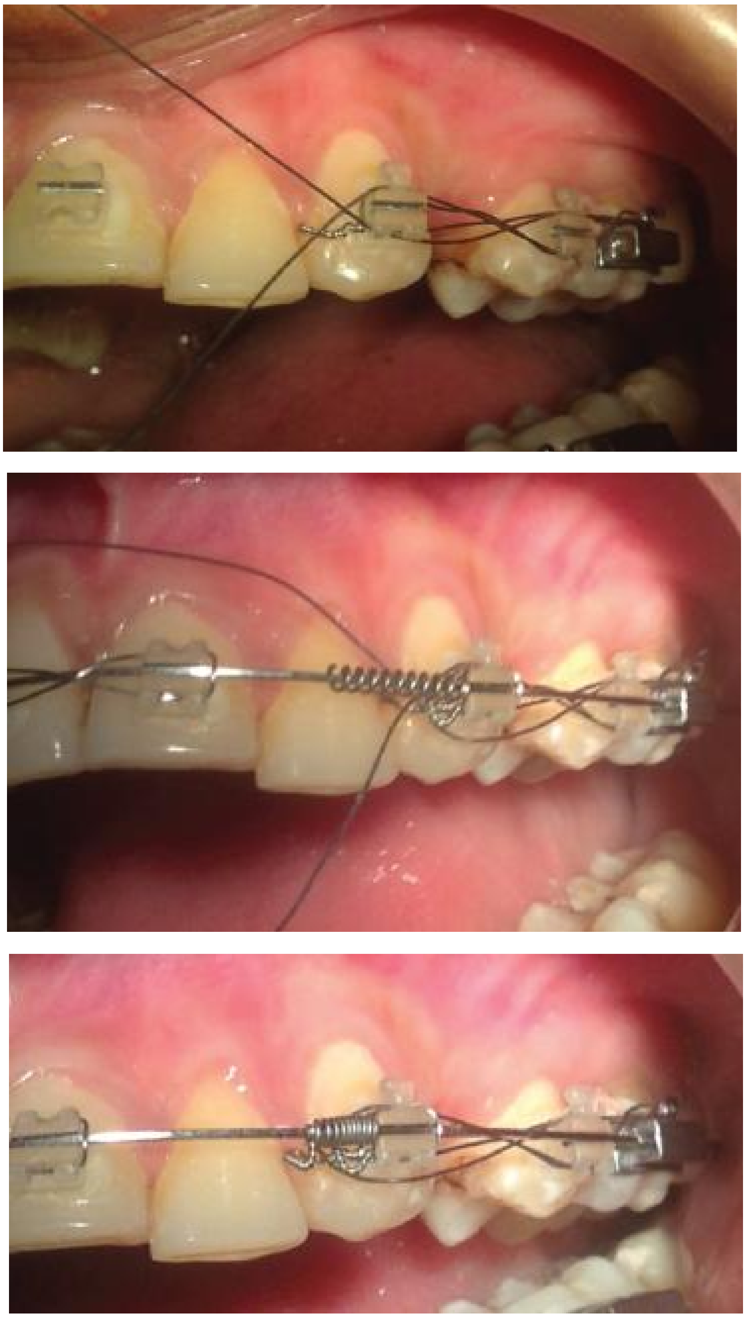

Figure 5. Modified active laceback for canine distalization **(Chain *et al.*, 2017).**

The third modification was described by **Naini and Gill (2022)** which was the fully twisted laceback. When the requirement to avoid mesial tipping of the canine crown is greater, the laceback may be placed as a fully twisted form. The molar, premolar(s) and canine are tied together tightly by twisting the stainless steel ligature continuously between the interbracket spans (Figure 6).

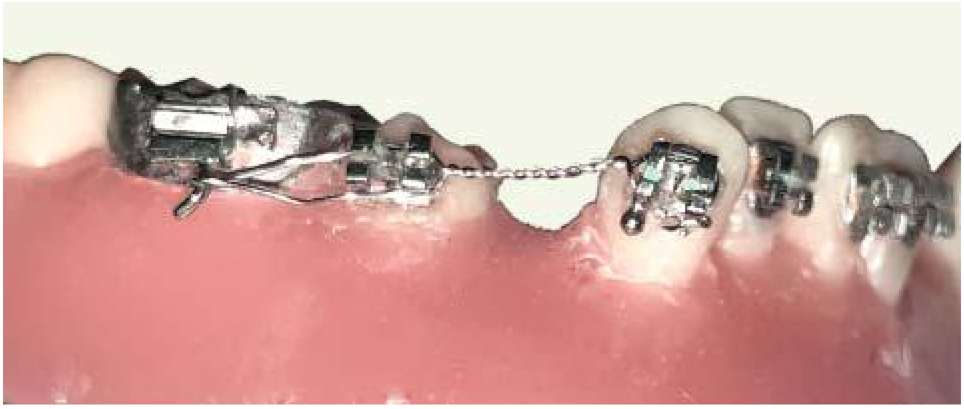

Figure 6. Fully twisted laceback **(Naini and Gill, 2022).**

1.3.8 Evidence about laceback

There are several studies that investigate the effect of laceback collected from 1989 till 2023.

The first study was conducted by **Robinson in 1989** to investigate the effectiveness of lacebacks in leveling and aligning stage on the lower arches of 57 extraction cases. They reported that in about half of the treated cases without lacebacks, the lower molars moved forward an average of 1.53mm and the lower incisors moved forward an average of 1.47mm. In the patients with lacebacks, the lower molars moved forward an average of 1.76mm, but the lower incisors moved distally an average of 1mm. This means that there is more anchorage molar loss in addition to the distal incisors movement. This study is limited to the mandibular teeth and no data were available for the maxillary teeth, it had never been published and there are concerns regarding the scope of this trial as it was prospective study not randomized clinical trial that subjected to bias. In addition, the possible large variation in forces generated by clinicians during laceback placement was not addressed.

Usmani *et al.* (2002) tried to assess the effectiveness of canine laceback on the proclination of the maxillary incisors with reference to pre-treatment canine tip in a randomized clinical trial using Roth prescription. They concluded that the effect of canine laceback on preventing upper incisor proclination at the start of treatment is in the order of 1 mm and their effect on mesial molar movement is insignificant i.e. laceback caused some retroclination of upper incisors and prevent increase in overjet during the initial aligning phase of Edgewise fixed appliance treatment. However, this effect is small and may not be of clinical significance. Furthermore, canine lacebacks have similar effects that are independent of pre-treatment canine angulation, i.e. if the canine was distally tipped, the overjet was still likely to increase regardless of the use of canine lacebacks. This study is limited to the maxillary teeth and no data were available for the mandibular teeth as there were no points in the mandible that could be used as fiducial points. Another weak point was the sample size which was relatively low for such a trial and the possible large variation in forces generated by clinicians during laceback placement was not addressed.

Irvine *et al.* (2004) conducted a randomized clinical trial to evaluate the effects of laceback ligatures on the anteroposterior and vertical position of lower incisors and the mesial position of the mandibular first molars for 3M Unitek Dyna Lock pre-adjusted edgewise brackets with Andrews' prescription. They found that the lower first molars showed 0.75 mm greater mesial movement in the study group, which was statistically significant. Hence, the use of laceback ligatures created a statistically and clinically significant increase in the loss of posterior anchorage through mesial movement of the lower first molars. On the other hand, in both groups, the lower incisors retroclined and extruded during experimental period with no statistical significance differences between the two groups in the anteroposterior or vertical position of the lower labial segment or in the relief of labial segment crowding. The possible large variation in forces generated by clinicians during laceback placement and the effect on the upper teeth were not addressed too.

Sueri and Turk (2006) evaluated the effect of laceback ligatures on maxillary canine distalization and mesial molar movement compared with NiTi closed coil spring during the leveling and aligning phase using Roth prescription in a split-mouth clinical trial. They found that in the laceback group, the canine moved and tipped distally (1.67 mm and 4.50 degree) and the molar moved and tipped mesially (0.70 mm and 3.90 degree). In the coil group, the canine moved and tipped distally (4.07 mm and 11.63 degree) and the molar moved and tipped mesially (1.93 mm and 3.10 degree). They concluded that laceback ligatures proved to be effective for canine distalization. However, the amount and rate of canine movement were less, but it offered a more controlled canine movement in the sagittal, vertical and transverse planes. They explained the characteristics of laceback ligatures on the canine laceback by the applying a slight tipping of the canine with the compression of the periodontal ligament. The movement of the canine crown is limited by the width of periodontal ligament and the elastic capacity of the alveolar crest. The problems with this study were it was non-randomized with small sample size and it did not evaluate the mandibular teeth. Moreover, it is impossible to attribute the posterior movement of the upper incisors to a particular force system, i.e., laceback or NiTi coil spring. It can be argued that the pulling back of the canines has a retraction effect on the upper incisors. The force was not quantified and the effect on the mandibular teeth was not studied.

Khambay *et al.* (2006) determined the magnitude and reproducibility of forces generated by 10 clinicians during laceback placement using a force-measuring typodont. They found that the forces generated by clinicians ranged from 0 to 11.1 Newton with few operators applied similar forces when placing lacebacks on two separate occasions. During laceback placement, it is not possible for a clinician to use any methods to determine the force by which the laceback is tightened. Some clinicians may wish to leave the laceback ‘passive’ which explains why a force of 0 Newton was recorded for two operators in this study, but others may deem a greater force to be ‘necessary’. There is little immediate feedback from the patient regarding the force generated by a laceback, since any discomfort will arise sometimes later and may be compounded by the forces created by an accompanying archwire change.

Jongbundan (2010) compared the effect of laceback ligatures and its modification on anchorage loss in MBT system. He found that the modified laceback technique with an additional twist mesial to the second premolar bracket creates a statistically significant decreased in the loss of posterior anchorage, through less mesial movement of the maxillary second premolars and first molars compared with regular laceback technique. The modified laceback will incorporate the posterior anchorage as one unit, different from the regular laceback which was tied the ligature wire in a figure of 8 from upper second molar tube to canine bracket, so could not control the mesial movement of second premolars. The mesial movement of second premolars in regular laceback group may be the result of physiologic tooth movement and the extraction wound contraction. This study was non-randomized and included small sample size and did not account the lower teeth.

Moresca *et al.* (2012) compared the effects of active and passive lacebacks on anteroposterior position of maxillary first molars and central incisors during leveling phase using MBT prescription. The sample was divided into two groups. The first group received active lacebacks that were reactivated monthly until the canines were retracted, allowing incisors alignment. In the second group, lacebacks were installed passively (no retraction force over canine brackets) and were changed just in case of wire fractures. They found that active laceback produced anchorage loss of maxillary first molars whereas passive laceback did not affect the position of these teeth. Active and passive lacebacks were effective in preventing central incisor proclination. Again, this study was non-randomized and included small sample size and mandibular teeth were not studied too.

Awni (2012) investigated the rate of space closure, tipping and rotation of canines during their retraction by laceback and tieback using standard ceramic brackets along two types of archwires (0.020 and 0.017×0.025-inch) using typodont simulation system. They found that laceback ligatures proved to be effective for canine distalization and sliding the canines over an archwire of round cross section significantly increased with a higher rate of space closure, degree of tipping and rotation. Moreover, sliding the canines by tieback retraction method gave rise to the highest mean value for the rate of space closure in comparison with the laceback.

Fleming *et al.* (2013) conducted a systematic review to appraise the evidence in relation to the effectiveness of lacebacks in controlling incisor position during initial alignment. They stated that on the basis of the available evidence, the use of lacebacks had neither a clinically nor a statistically significant effect on the sagittal position of the incisors and molars during initial orthodontic alignment. There is no evidence concerning the use of lacebacks on chair side time or periodontal health.

Chetan *et al.* (2014) compared the efficiency and effectiveness of active laceback ligatures with that of Mulligan bypass arch for the amount of retraction, tipping and rotation of maxillary canine using MBT prescription. They found that both active laceback ligature and Mulligan bypass arch provide enough amount of canine retraction. When compared to the active laceback group, tooth movement in a given period of time was greater with Mulligan bypass arch, i.e. rate of tooth movement was faster and amount of distal tipping and distopalatal rotation was significantly less. Active laceback ligature is advantageous only when canine is mesially tipped and space required is 2-3mm only. This study was non-randomized with small sample size and canines were retracted with completely different means (laceback with NiTi archwire versus power chain with stainless steel archwire) and with unknown amount of retraction force in addition to the unreliable method of assessment.

Rajesh *et al.* (2014) utilized the study models and cephalometric analysis to evaluate the amount and percentage of anchorage loss after initial leveling and aligning using a Roth and MBT prescriptions. They concluded that the use of laceback and cinch back created a statistically and clinically significant increase in the anchorage loss specifically when the posterior anchorage is not enhanced. This appeared to be more with Roth prescription than with MBT because of increased tip of the anterior segment in Roth prescription. Again the study was non-randomized with small sample size.

Chapter Two

Discussion/ Comments

The initial phase of orthodontic treatment is directed at orthodontic alignment in the horizontal and vertical plane involving arch alignment and rotational control. This is typically accomplished with NiTi archwires, which afford sufficient flexibility to engage multiple displaced teeth, and exhibit shape memory **(Riley and Bearn, 2009; Wang *et al.*, 2018)**.

Generally, orthodontic extractions are advocated to facilitate stable relief of crowding by generating space, limiting unwanted advancement of the anterior segments and arch dimensional change. The mesial angulation in-built in canine brackets predisposes to forward movement of the incisors during alleviation of crowding in the initial alignment phase **(McLaughlin *et al.*, 2001)**. While the incisors may be recaptured later in treatment, particularly during space closure, reciprocal movement of this nature (round tripping) is considered undesirable. In particular, round tripping is believed to predispose to root resorption, periodontal attachment loss, and prolonged treatment **(Fleming and Seehra, 2019)**.

Lacebacks have been widely used as auxiliary during the aligning phase, with the main purpose of performing initial retraction of the canines in extraction cases with anterior crowding providing space to incisors alignment and avoiding their proclination. Another use is just to avoid incisors proclination by fixing the arch length. These situations may include non-extraction or extraction cases associated with facial protrusion **(Naini and Gill, 2022)**.

Many arguments have been raised about the clinical effectiveness of laceback and the findings were controversial regarding the amount of force and the effect on the incisors and molars. It also has to be taken into account a systematic review of two papers was not ideal. A Cochrane systematic review was considered into lacebacks in 2016 however it was discontinued due to a lack of randomized clinical trials **(Kozel *et al.*, 2016)**.

Although has several disadvantages, laceback is still beneficial in some cases at early stage of treatment taken in consideration the anchorage control of posterior teeth.

Chapter Three
Conclusions and Suggestions

3.1 Conclusions

1. The effect of laceback on the canine retraction had been reviewed and it seems beneficial during the early stages of treatment to provide a space for aligning the incisors with controlled retraction, however, measures for anchorage control of the posterior teeth should be applied.
2. Effect of laceback on the incisors and molars movement is still controversial and needs more controlled randomized clinical trials.

3.2 Suggestions for Further Studies

1. A national survey among Iraqi orthodontists is required to investigate how wide spread is the use of the laceback, the preferred type and how to determine the amount of the force applied.
2. Further work is required to examine the levels of plaque accumulation with and without laceback.
3. Randomized clinical trials are needed to verify the clinical effectiveness of the laceback in retracting canines, besides assessing the distal movement of the incisors and mesial movement of the molars using different forms (modifications) of laceback with different prescriptions and bracket slot sizes, various canine angulations, measurable amount of force, and for both the maxillary and mandibular arches.

References

A

- AlHakeem, K., Andrews, J., and Ahmed, F. (2022) To laceback or not to laceback- that is the question. A blog. https://orthoinsummary.com/blog/to-laceback-or-not-to-laceback-that-is-the question/?fbclid=IwAR0LJ2CQOPQOgjnRm8b27adG1moA3Jp1CiJfFhUkYJ6AYxcTsNum47u4W1g. Accessed in 23-4-2023.
- Andrews, L.F. (1972) The six keys to normal occlusion. *American Journal of Orthodontics*, 62, 296-309.
- Andrews, L.F. (1976) The straight-wire appliance: Origin, controversy, commentary. *Journal of Clinical Orthodontics,* 10, 99-114.
- Andrews, L.F. (1989) *Straight wire. The concept and application*. 1st ed. San Diego L.A.: Wells Company.
- Angle, E.H. (1928) The latest and best in orthodontic mechanism. *Dental Cosmos,* 70, 1143-1158.
- Awni, K.M. (2012) Comparison between laceback and tieback in sliding mechanics (an in vitro study). *Al–Rafidain Dental Journal*, 12, 148-152.

C

- Chain, S., Shinghal, M., Tan, K., and Chabbra, M. (2017) Modified laceback for canine retraction. *APOS Trends in Orthodontics*, 7, 52-53.
- Chetan, S., Krishna, G.B.R., Shamnur, N., and Singhvi, A. (2014) Individual canine retraction: RCT comparing Mulligan bypasses arch and active laceback ligatures. *IOSR Journal of Dental and Medical Sciences*, 13, 34-37.

F

- Fleming, P. and Seehra, J. (2019) *Fixed orthodontic appliances a practical guide*. 1st ed. Switzerland: Springer.

- Fleming, P.S., Johal, A., and Pandis, N. (2013) The effectiveness of laceback ligatures during initial orthodontic alignment: a systematic review and meta-analysis. *European Journal of Orthodontics*, 35, 539-546.

I

- Irvine, R., Power, S., and McDonald, F. (2004) The effectiveness of laceback ligatures: a randomized controlled clinical trial. *Journal of Orthodontics*, 31, 303-311.

J

- Jongbundan, S. (2010) A comparison of effect of regular laceback technique and its modification on anchorage loss. A master thesis, Prince of Songkla University.

K

- Khan, H. (2015) *Orthodontic brackets selection, placement and debonding*. 1st ed. North Charleston: Create Space Independent Publishing Platform.
- Khambay, B.S., McHugh, S., and Millett, D.T. (2006) Magnitude and reproducibility of forces generated by clinicians during laceback placement. *Journal of Orthodontics*, 33, 270–275.
- Kozel, J.A., Macedo, C.R., and Atallah, Á.N. (2016) Laceback ligatures for controlling anchorage in patients undergoing fixed orthodontic treatment. *Cochrane Database of Systematic Reviews*, 10, Art. No. CD010014.

L

- Littlewood, S.J. and Mitchell, L. (2019) *An introduction to orthodontics*. 5th ed. Oxford: Oxford university press.

M

- McLaughlin, R.P. and Bennett, J.C. (1989) The transition from standard edgewise to preadjusted appliance systems. *Journal of Clinical Orthodontics*, 23, 142-153.
- McLaughlin, R.P. and Bennett, J.C. (1991) Anchorage control during leveling and aligning with a preadjusted appliance system. *Journal of Clinical Orthodontics*, 25, 687-696.
- McLaughlin RP, Bennett JC, Trevisi H. (2001) *Systemized orthodontic treatment mechanics*. 1st ed. St. Louis: Mosby International Ltd.
- Meyer, M. and Nelson, G. (1978) Preadjusted edgewise appliances: theory and practice. *American Journal of Orthodontics,* 73, 485-498.
- Moresca, R.C., Vigorito, J.W., Dominguez, G.C., Tortamano, A., Moraes, D.R., Moro, A., and Correr, G.M. (2012) Effects of active and passive lacebacks on antero-posterior position of maxillary first molars and central incisors. *Brazilian Dental Journal*, 23, 433-437.

N

- Naini, F.B. and Gill, D.S. (2022) *Preadjusted edgewise fixed orthodontic appliances principles and practice*. 1st ed. Hoboken: John Wiley & Sons Ltd.

P

- Phulari, B.S. (2013) *History of orthodontics*. 1st ed. New Delhi: Jaypee Brothers Medical Publishers.
- Phulari, B.S. (2017) *Orthodontics principles and practice*. 2nd ed. New Delhi: Jaypee Brothers Medical Publishers.

R

- Rajesh, M., Kishore, M.S., and Shetty, K.S. (2014) Comparison of anchorage loss following initial leveling and aligning using Roth and MBT Prescription- A clinical prospective study. *Journal of International Oral Health*, 6, 16-21.

- Riley, M. and Bearn, D.R. (2009) A systematic review of clinical trials of aligning archwires. *Journal of Orthodontics*, 36, 42-51.
- Robinson, S.N. (1989) An evaluation of the changes in lower incisor position during the initial stages of clinical treatment using a preadjusted edgewise appliance. A master thesis, University of London. Cited by: McLaughlin, R.P. and Bennett, J.C. (1991) Anchorage control during leveling and aligning with a preadjusted appliance system. *Journal of Clinical Orthodontics*, 25, 687-696.
- Roth, R.H. (1985) Treatment mechanics for the straight wire appliance. In: Graber, T.M. and Swain, B.F. (eds). *Orthodontics: Current principles and techniques*. 1st ed. St. Louis: Mosby.

S

- Singh, G. (2015) *Textbook of orthodontics*. 3rd ed. New Delhi: Jaypee Brothers medical publishers (P) Ltd.
- Sueri, M.Y. and Turk, T. (2006) Effectiveness of laceback ligatures on maxillary canine retraction. *The Angle Orthodontist,* 76, 1010-1014.

U

- Usmani, T., O'Brien, K.D., Worthington, H.V., Derwent, S., Fox, D., Harrison, S., Sandler, P.J., and Mandall, N.A. (2002) A randomized clinical trial to compare the effectiveness of canine lacebacks with reference to canine tip. *Journal of Orthodontics*, 29, 281-286.

W

- Wang, Y., Liu, C., Jian, F., McIntyre, G.T., Millett, D.T., Hickman, J. and Lai, W. (2018) Initial arch wires used in orthodontic treatment with fixed appliances. *Cochrane Database of Systematic Reviews*, 7, Art. No. CD007859.