

## Various methods of ligation ties

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### Abstract

During fixed orthodontic treatment, ligation is used to keep the arch wire in the slot of the bracket. It can also be used to move the tooth in a particular direction depending upon the type of ligature used and its method of ligation. Ligation can be done using Stainless steel (SS) ligatures or elastomeric modules. SS ligature wire provides secured tie of arch wire to bracket slot, lesser friction and slower rate of force decay compared to elastomeric modules. Elastomeric modules are easier to place and take lesser chair side time. Elastic ligature does not have sharp edges and they exert lesser force on the bracket. So, they are preferred in those situations where there is higher tendency for debonding of brackets. Elastic ligature may be a substitute for the wire ligatures in most situations. In various treatment mechanics ligation ties are modified to accomplish variable tooth movement or to maintain arch form integrity during finishing of an orthodontic case. This article will highlight different ligation ties used in different bracket systems and their indications as well.

**Keywords:** Ligation Ties, Stainless steel Ligation, Elastic modules, Rotation ties.

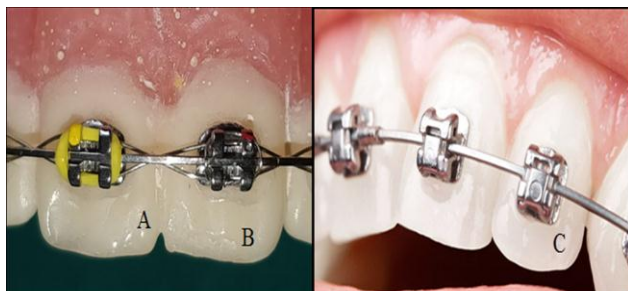
### Introduction

The method of tying archwire to the bracket slot is as old as the Orthodontic speciality. Pin and tube and E arch brackets with vertical slots were precursor to edgewise appliances. pre-adjusted edgewise brackets, a transverse slot was given for receiving a conventional orthodontic arch wire. A resilient tie ligature was used to retain the arch wire in the slot to achieve Orthodontic tooth movement.

Generally metal or elastic ligatures are used for this purpose, and the way they are tied affected the tooth movement.<sup>1</sup> As twin brackets have 4 tie wings, hence wire can be tied to brackets in variety of ways. Ligation ties play an important role not only in twin brackets (Edgewise, MBT, Roth) but also in different bracket prescription like Begg, Tip edge and Lingual Orthodontics. In this review article, we will be discussing the various types of ligation techniques, their indication and contraindication as well as their application in Orthodontics.

### Ligation in twin bracket system

During orthodontic tooth movement, archwires are tied to the bracket slots with metal ligatures, elastic ties or self-ligating brackets can be used that do not incorporate any ligation method.<sup>1,2</sup>



**Fig. 1: (A) Elastic ligature (B) Metal ligature (C) Self ligating Brackets**

### Classification of ligation ties

#### Based on material used

#### Metal Ligature

The vast majority of fixed orthodontic appliances have stored tooth-moving forces in archwire, which are deformed within their elastic limit. For this force to be transmitted to a tooth, wires need a form of connection to the bracket.

1. Stainless steel alloy wires of varying gauge (.009 to .014 inch) are used.
2. Tips are twisted together to ensure firmness.
3. Twisted end is folded back under the archwire.

#### Elastic ligature

1. Substitute for metal ligatures.
2. Easier to apply
3. Lesser strength
4. Available in different colours
5. As fluoride releasing agent
6. To reduce the white spot lesions

#### No ligation System

Self-ligating brackets do not use any ligation method and can be divided into 2 main categories, active and passive, according to their mechanisms of closure. Active self-ligating brackets have a spring clip that stores energy to press against the archwire for rotation and torque control. On the other hand, passive self-ligating brackets usually have a slide that can be closed which does not encroach on the slot lumen, thus exerting no active force on the archwire<sup>2</sup>.

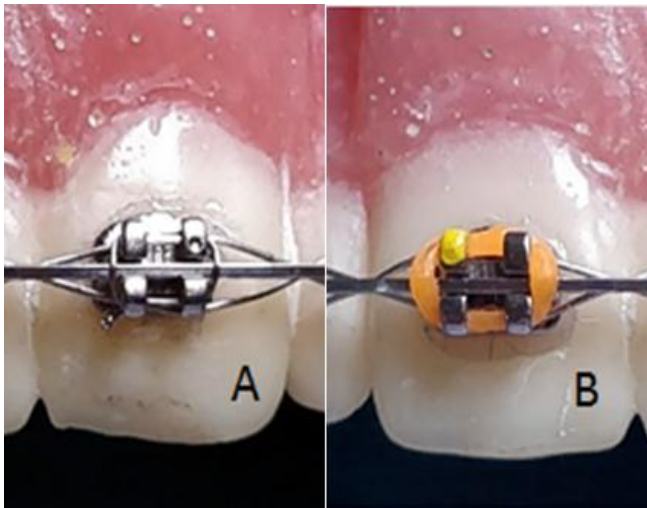
#### Based on the modes of tying archwire to the slot

1. Basic ligation ties
  - a. Straight tie
  - b. Double tie
2. Isolated tie

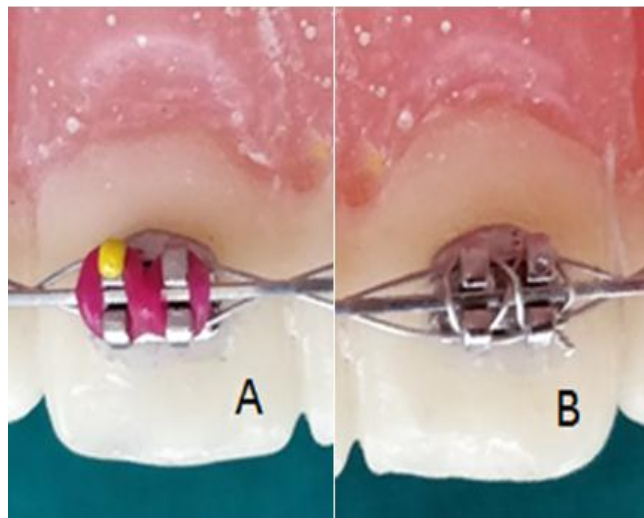
3. Rotation tie
  - a. Circumferential tie
  - b. Anti-rotation tie
  - c. Coil Spring Ligature
4. Extrusion tie
5. Stabilization tie
6. Double ligation tie
7. Tie Together or figure of 8
  - a. Anterior region
  - b. Posterior region
  - c. Lace back tie

**Basic Ligation ties**

Basic ligation ties secure the wire into the bracket slot firmly. This could be done in normal (straight tie) pattern (Fig. 2) or double tie pattern (Fig. 3) with elastic as well as metal ligatures.



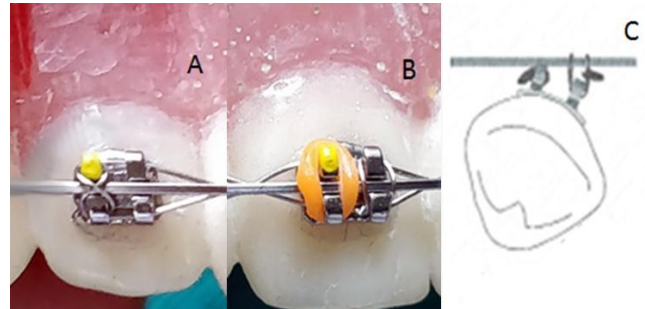
**Fig. 2: Straight tie with elastic module and metal ligature.**



**Fig. 3: Double tie in fig. of 8 pattern with elastic module and metal ligature.**

**Isolated tie**

For rotation correction, single wing of one bracket is tied to pull the tooth into the arch form using either elastomeric modules or metallic ligature..



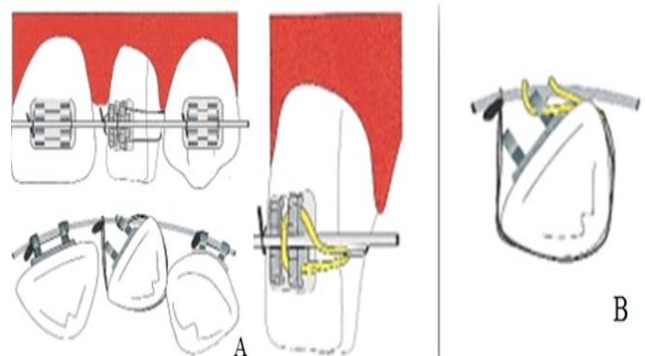
**Fig. 4: (A,B) Isolated tie with elastic module and metal ligature for correction of rotated tooth. C. Occlusal view of isolated tie for derotation of tooth**

**Rotation tie**

Rotation ties used for de rotation of tooth to get the desired inclination of the tooth on its axis, is further divided into three types:

**Circumferential tie**

A elastic module attached to the ligature wire is tied to the bracket slot and tightly tied to the main arch wire, to deliver a force for longer period of time in both anterior and posterior teeth.<sup>1</sup>



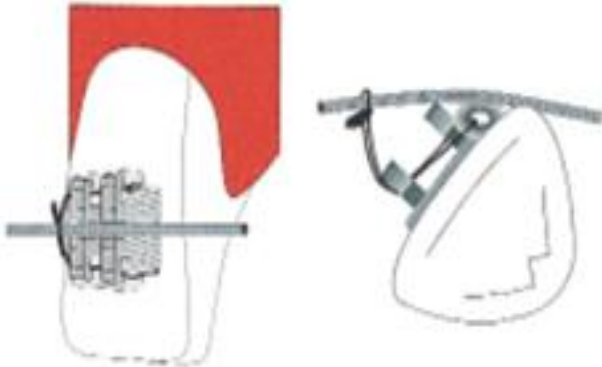
**Fig. 5: Circumferential tie with elastic module and metal ligature for correction of rotated tooth.**

To improve the mechanical efficiency of circumferential ligations a combination of ligature wires and elastomeric ligatures is used. In this case (Fig. 5 B), the ligature thread passes through the elastomeric ligature previously fitted into the part of the twin bracket closest to the archwire. When the metal ligature is tied to the archwire, the elastomeric ligature will be activated. An additional advantage of this type of tie is that it provides prolonged action of the force applied.

**Coil Spring Ligature**

Another technique for correcting tooth rotation consists of using a coil spring ligature. To start with, a stainless-steel

ligature is threaded through a segment of closed coil spring the length of the height of the bracket tie wings. The spring is positioned under the archwire by the bracket closest to the wire. The ligature is threaded under the tie wings and is tied to the archwire by the wings of the bracket farthest away from it, prefabricated systems that operate in a similar fashion are available; the spring is replaced by an elastic wedge.<sup>1</sup>



**Fig. 6: Coil Spring Ligation**

#### Antirotation ties

A probe is inserted while ligation to ensure slack to reduce friction and reduce rotation during space closure.

#### Extrusion ties

In a number of situations, the orthodontist needs to make an extrusion tie for a tooth positioned cervically to such an extent that the archwire cannot be properly bent for insertion in the bracket slot even if loops are made or memory shape alloys are used. The ties are repeated as often as necessary until sufficient extrusion has been obtained for

the archwire to be slotted and a basic tie performed. There are three techniques for extrusion ties.<sup>6</sup>

1. The ligature thread is looped around the archwire, wrapped around the cervical portion of the bracket's wings and attached to the archwire (Fig. 8A).
2. The ligature loops around the cervical wing of one bracket, wraps around the archwire, T
3. The ligature thread is looped around the cervical bracket wings, pulled toward the archwire, which also loops around, and then threaded back to the wing where the tie was initiated. At this point, it is twisted until the archwire becomes slightly deflected (Fig. 8 C).

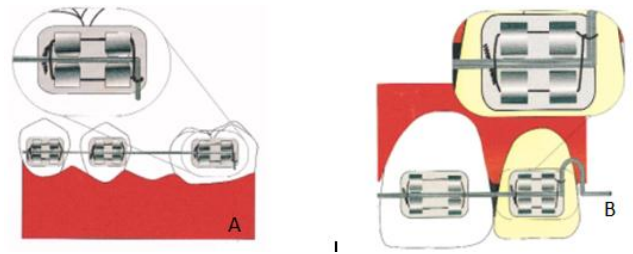
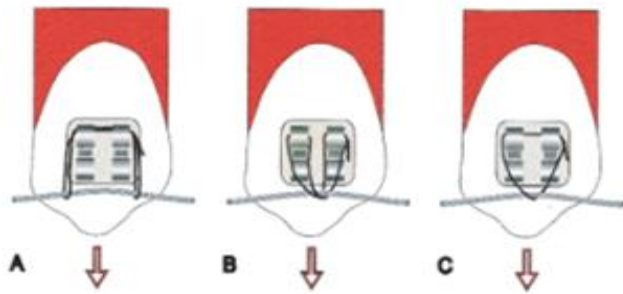
It should be ensured, that the twist is made as close as possible to the bracket as it is susceptible to displacement, which can evoke trauma to the buccal and labial mucosa.<sup>6</sup>

#### Stabilization tie

Some orthodontic cases require the use of segmented round archwires. One common problem that arises in such cases is the rotation of the archwire in the bracket slots because of a combination of the curve of Spee and the shape of the archwire. To prevent such rotation stabilization ties are used (Fig. 8). This can be done by introducing a vertical bend at one end of the archwire. The technique consists of using the ligature wire to bind the vertical section of the archwire so that the loop tightens even more when the tie is made. The same principle allows one to attach artificial teeth to round archwires in the initial phases of treatment for patients with missing teeth. This requires incorporation of a simple loop on the archwire, slightly larger than the height of the bracket and at the mesial or distal. The loop must be located next to the bracket.<sup>1</sup>



**Fig. 7: Anti rotation tie prevents unwanted rotation during orthodontic treatment.**



**Fig. 9: Stabilization tie, A. Stabilization tie for Segmental round wire, B. Stabilization tie for artificial tooth**



**Fig. 8: Various types of extrusion ties**

**Double ligation tie**

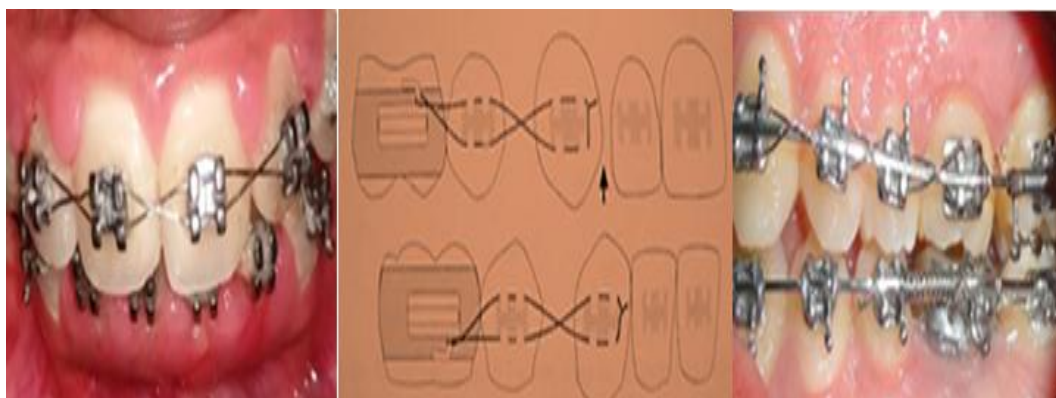
This technique uses a stainless steel ligature instead of elastic O rings. First, place the ligature under both the bracket wings and the archwire (A). Cross the ligature over itself on the gingival side (B). Next, bring the ligature over the wire on the less rotated side, seating it loosely into the bracket slot. Lastly, tie the ligature under the bracket wings and into a pigtail on the more rotated side of the tooth (C). This allows full engagement of the wire and thus a complete expression of its properties.<sup>4</sup>



**Fig. 10: Double ligation tie**

**Tie Together or Figure of 8 ligation**

1. Anterior segment
2. Laceback tie
3. Posterior segment



**Fig. 11: (A, B, C) Fig. of 8 ligation**

### Anterior segment

Figure of 8 ligation in anterior segment can be done to make anterior 6 or 4 teeth as a unit, this prevents unnecessary tooth movement during retraction or intrusion.

### Laceback Tie

This Fig. of 8 pattern ligation is done from first molar to canine during and before retraction as well, to tip the canine distally and to relief the crowding in anterior segment as well.

### Posterior segment

This Fig. of 8 pattern ligation is done to make posterior unit as a segment and to provide better anchorage during canine retraction.

### Ligation in Lingual Orthodontics

#### Double over tie

Standard ligation is not sufficient to seat and hold the bracket into the lingual slot, The ligation method in Lingual Orthodontics is double over tie, and it is done with both metal and elastic ligatures. This tie improves the rotation and torque control. The bicuspids are ligated with a conventional tie. To accomplish a double over tie ligation three unit power chain is mounted on each anterior bracket. The wire is then inserted and chain is stretched over wire. The excessive two pieces of chain is cut with scissors. (Fig. 12). It is very effective at controlling tip in Lingual brackets using a variety of arch wires.<sup>9</sup>



Fig. 12: Double over tie

Steel double over tie: Same procedure done with ligature wire. (Fig. 13)

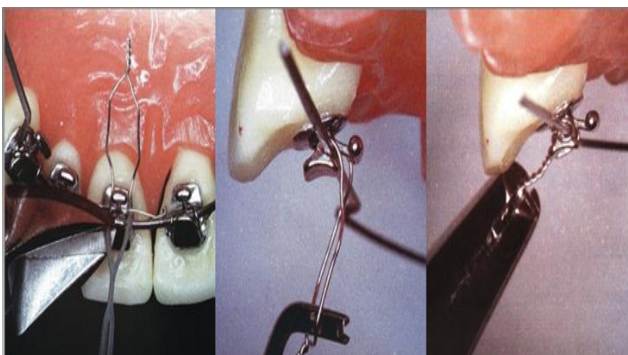


Fig. 13: Steel double over tie

### Modified Double Over tie

It is used in lingual Orthodontics to secure the wire under occlusal wing. (Fig. 14)



Fig. 14: Modified Double Over tie

### Smith's Rotation tie

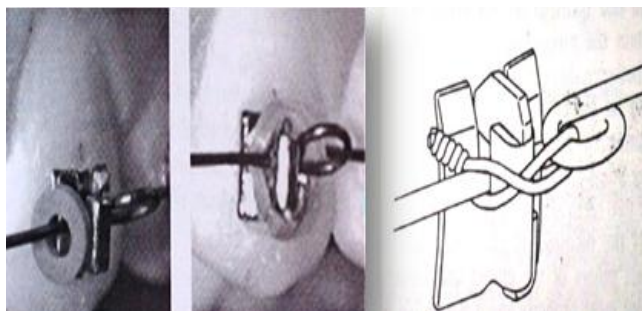
This is the most effective method to correct a rotated tooth in lingual Orthodontics. A Five to seven unit power e chain is first tied to the archwire at the interproximal junction in direction in which the tooth is rotated. The last lumen of the chain is slipped over the end of the archwire if it was removed from the mouth. A slipknot may be formed over the archwire, by passing one end of the chain through the expanded lumen at the other end of the chain. The chain is then brought around the labial surface, through the interproximal contact using a floss threader, under the archwire, and attached to the ball hook. (Fig. 15)<sup>9</sup>



Fig. 15: Smith's Rotation tie

### Ligation Ties in Begg Cuspid tie

This type of ligation is usually done in begg bracket system and this maintains anterior teeth as a unit and causes closure of generalized spacing in anterior segment this could be done with elastic module or ligature wire.



**Fig. 16: Ligation Ties in Begg**

Conclusion: This review article will help us in selecting appropriate tie as per the clinical requirements for easy and stable accomplishment of fixed orthodontic treatment.

**Conflict of Interest:** None.

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