

Shaili Shah* Deepali Agarwal**, Neha Assudani***, Sonali Mahadevia****

ABSTRACT

Rotations of teeth have long been known to be one of the most difficult aspects of malocclusions to correct. Even after correction, they often require permanent retention.

Ideally tooth rotation correction can be achieved by producing pure moment without any force which leads to derotation of teeth around its long axis.

To produce pure moment couple mechanics is the ideal method in which two attachments placed buccally and lingually exact opposite and parallel to each other and two equal and opposite forces are given to these attachments.

In this article, we are discussing various methods to correct this malocclusion with their own advantages and disadvantages.

KEYWORDS: Derotation, Couple Mechanics, Monkey Hook Auxiliaries, Lingual Buttons.

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INTRODUCTION:

• Tooth rotation, is defined as observable mesiolingual or distolingual intra-alveolar displacement of the tooth around its longitudinal axis. Rotation of teeth can be caused by number of factors like space availability for tooth alignment, tooth eruption order, and functional influences exerted by the tongue and lips.

• Rotations of teeth are one of the most difficult aspects of malocclusions to correct. Even after correction they often require permanent retention¹.

DE-ROTATION:

• Ideally tooth rotation correction can be achieved by producing pure moment without any force which leads to de-rotation of teeth around its long axis.

• To produce pure moment couple mechanics is the ideal method in which two attachments placed buccally and lingually exact opposite and parallel to each other and two equal and opposite forces are given to these attachments.

• In most cases, derotation of anterior teeth requires space, whereas derotation of posterior teeth creates space.

METHODS OF DE-ROTATION:

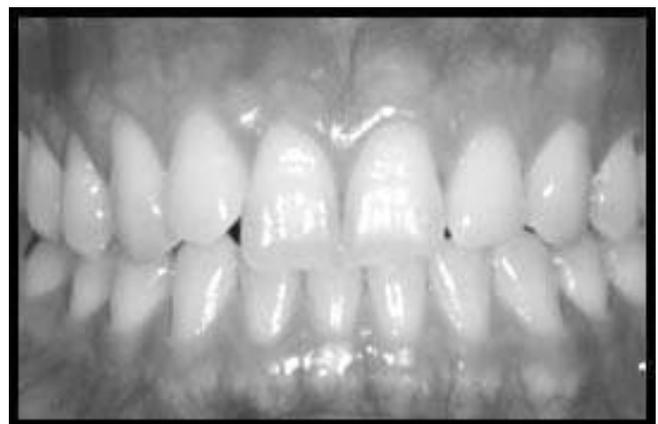
Various methods of derotation include:

• Removable appliances - for single tooth rotations

- Double cantilever spring
- Labial bow
- Fixed appliances - for multiple rotation
 - Derotation springs
 - Derotation wedges
 - Monkey hook auxiliaries
 - Lingual buttons
 - Rotation ties
 - Elastomeric ligatures and E-chains
 - Resilient arch wire – Ni-Ti
 - Transpalatal arch (TPA)
 - Multi Purpose Attachment (MPA)
 - Mini molds
 - Invisalign/ clear aligners

REMOVABLE APPLIANCES:

• Double cantilever springs (z-springs) along with labial bows can be used for buccal movement or derotation of single teeth².



* PG Student, ** PG Student, *** Senior Lecturer, **** Professor And Hod

DEPARTMENT OF ORTHOBONTHCH AND DENTOFACIAL ORTHOPAEDICS
AHMEDABAD DENTAL COLLEGE AND HOSPITAL.

ADDRESS FOR AUTHOR CORROSPONDENCE : Dr. DEEPALI AGARWAL, TEL: +91 9904313133

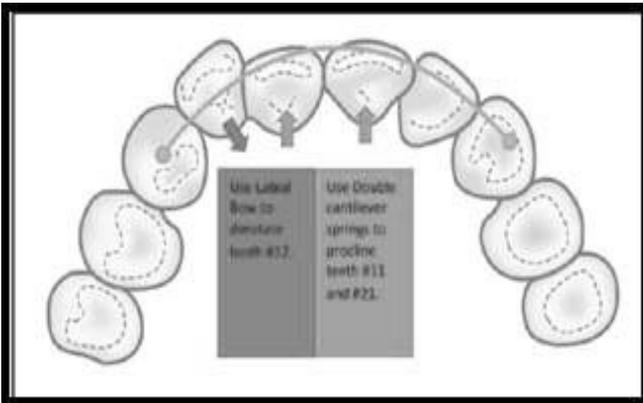
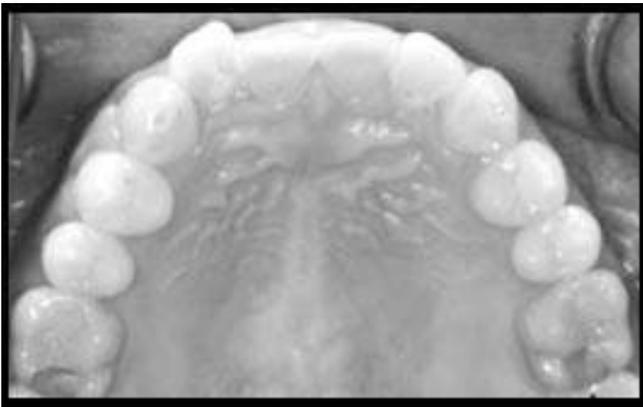


Fig 1: Pretreatment Intraoral Photographs Showing Mesiolabial Rotation of 12

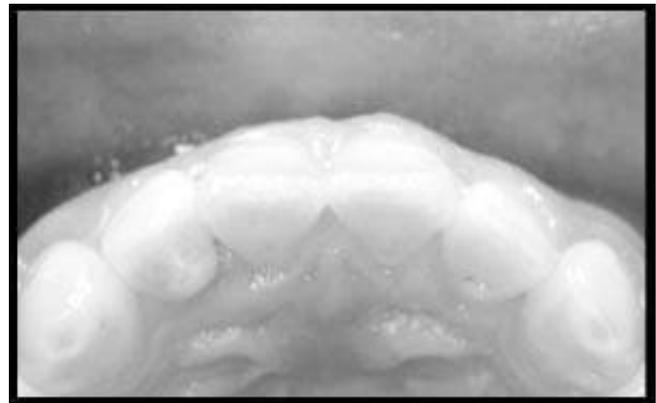
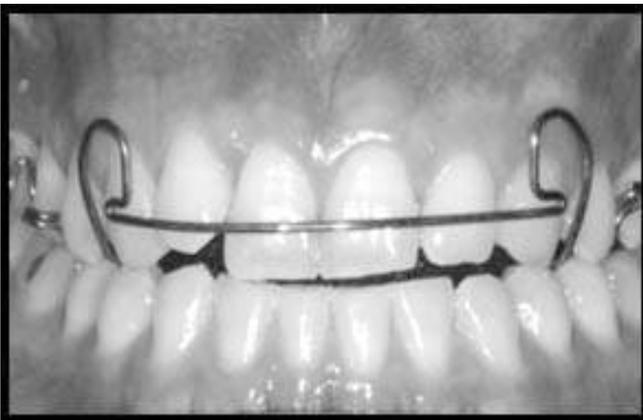


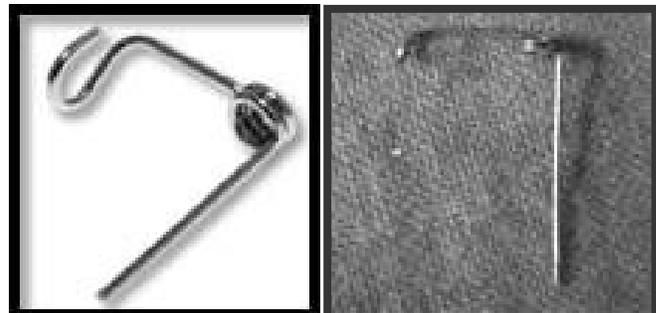
Fig 2: Removable Appliance With Labial Bow And Double Cantilever Springs And Posttreatment Intraoral Photographs Showing Rotation Correction



FIXED APPLIANCES:

DEROTATION SPRINGS:

- They are used in the Begg's Technique³. They are made from 0.014" or 0.016" wire. The vertical arm is inserted into the vertical slot of the bracket, and the loop slides in between the archwire and the tooth surface. The spring is activated by hooking the horizontal arm onto the main archwire. To avoid dislodgement, the horizontal arm can also be ligatured to the archwire.



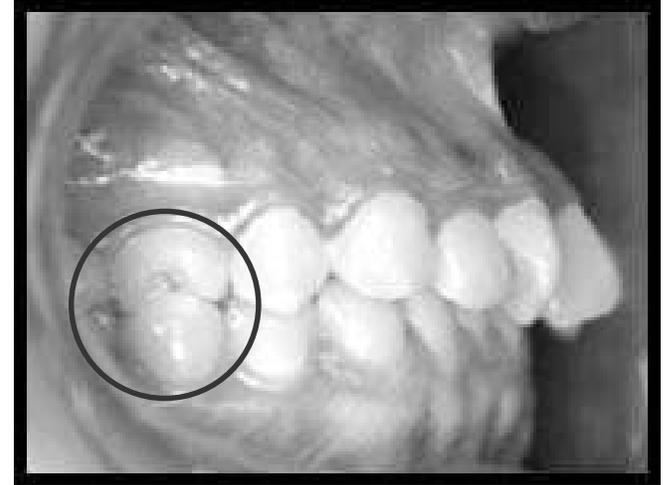
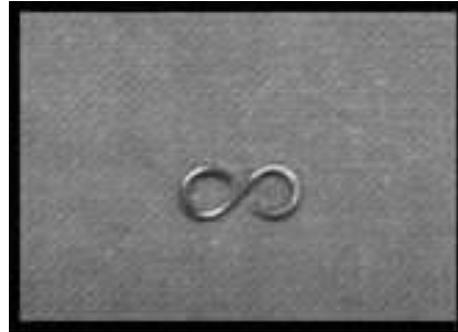
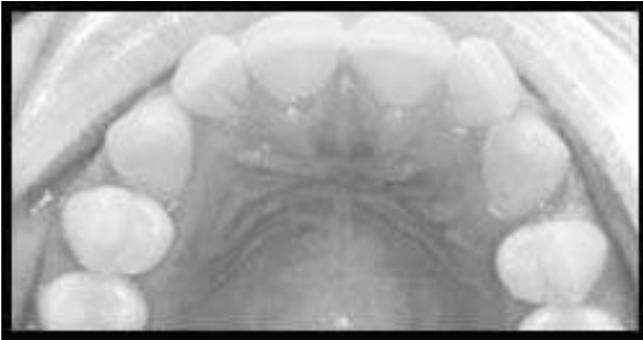


Fig 3: Begg's Derotation Springs

Problems:

- Should not be used more than 6 weeks (2 point contact) restrict free mesiodistal tipping
- Exerts more lateral force on arch wire move the molar more readily than less powerful elastic thread ties

MONKEY HOOK AUXILLARIES:

- The Monkey Hook is a simple auxiliary with an open loop on each end for the attachment of intraoral elastics or elastomeric chain, or for connecting to a bondable loop-button⁴.

Rotational Couples:

More than one Monkey Hook and loop-button may be attached to a single tooth to correct a severe rotation. If a loop-button is bonded on each side of the tooth, forces can be applied in opposite directions—for example, to the lingual cleat of a molar and mesially to the anterior teeth—thus creating a rotational couple.

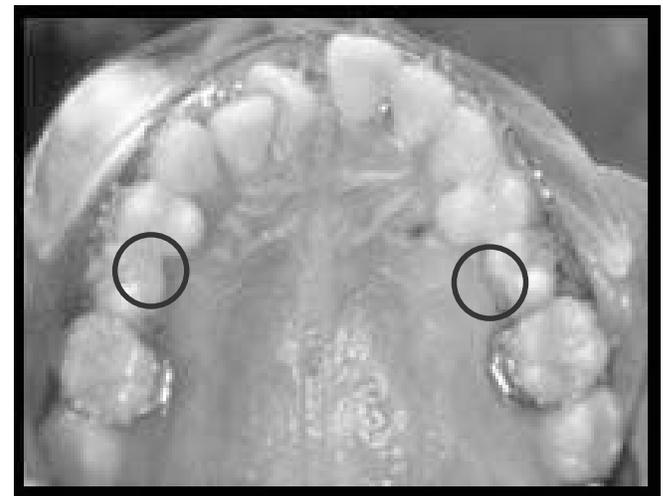
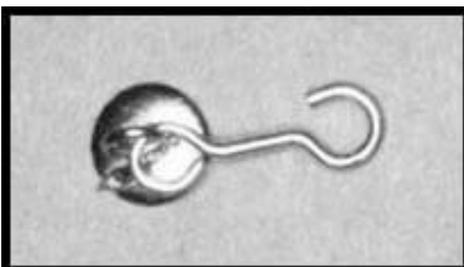


Fig 4: Monkey Hook And Couple Mechanics Used For Derotation Of Upper Premolars

- Advantages are faster rotation correction, simplicity and cost effectiveness.

DEROTATION WEDGES:

It acts as a fulcrum between wire and bracket to correct the rotation. It is ligated to the tie wing of the bracket⁵.



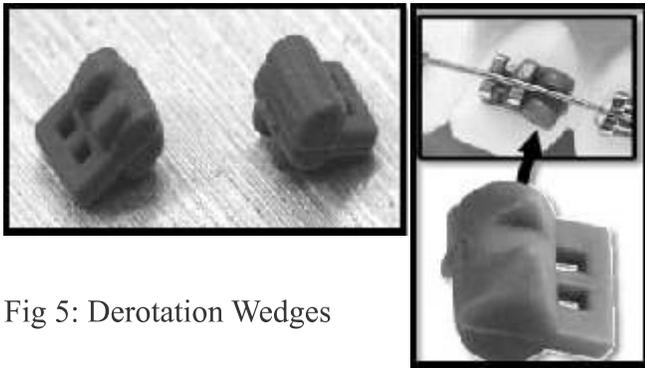


Fig 5: Derotation Wedges

SMITH'S ROTATION TIE:

- Rotation correction is challenging in lingual orthodontics because of the shorter interbracket distance⁶. Smith's rotation tie is one of the means to correct anterior tooth rotation in lingual orthodontic cases.

LINGUAL BUTTON:

- A lingual button bonded on the lingual surface of the tooth along with buccal brackets allows the use of elastomeric chains to aid in derotation by creating a rotational couple.



Fig 6: Lingual Buttons And Couple Mechanics Used For Derotation Of Lower Incisor

ELASTIC LIGATURES AND E-CHAINS:

Elastomeric ligatures can be used to correct individual tooth rotations in conjunction with fixed appliances. To rotate a tooth distolingually, tie an elastomeric ligature in a figure-8 to the distal wing of the bracket. After placing the archwire, tie the mesial wing of the bracket to the archwire with a ligature wire or an elastic tie.

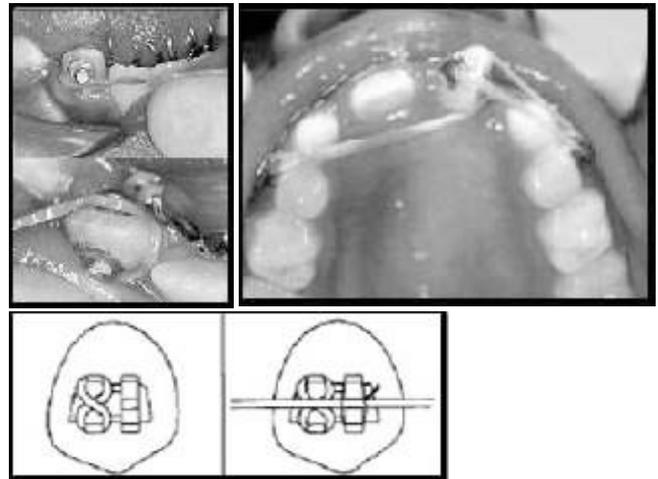


Fig 7: Derotation Of Upper Incisor Using Elastic Chain

RESILIENT ARCH WIRES:

- When the initial rotation are severe, a flexible wire like a super elastic NiTi is used, usually as a sectional along with the 0.014" SS base wire. While using this combination, the base wire often needs to be kept away from the bracket on the malposed teeth, so that they are free to desolate without getting hampered by a contact with base wire.

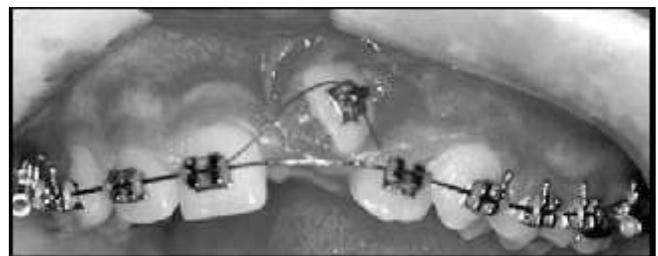


Fig 8: Flexible Piggy Back Niti Wire In Place

TRANSPALATAL ARCH:

- Distal molar relationships can arise due to themesiopalatal rotation of maxillary molars⁷. In some cases, an ideal Class I intercuspation can be achieved with the opposing molar and a Class II relationship can be corrected by molar derotation.

Transpalatal arches have been used routinely to derotate and stabilize the molars. The TPA can be removable or fixed but mainly a removable one is used for molar derotation⁸.



Fig 9: Transpalatal Arch For Derotation of Upper Molar

MULTI PURPOSE ATTACHMENTS:

- In case of rotations, it may be difficult to place a bracket because of interference with a neighbouring bracket. An MPA can be bonded in such a case⁹. A rotated tooth can be corrected by tying the main arch wire with a double tie. Usually a Ni-ti wire is in place in rotation cases, so the archwire can get deflected to some extent and the tooth gets derotated due to two point contact of the ligature tie on the main arch wire.

Rotations can also be corrected by passing one end of a piece of Ni-ti wire through the lumen of the attachment and the other end of the wire can be tied to other brackets or the arch wire.



Fig 10: Single And Double Ties On MPAs

MINI MOLDS:

- Mini molds technique is a simple technique used to make direct resin attachments to the tooth with the help of mini molds tips.

The button bonder tips can be used to make a precise resin button that can be placed anywhere on the tooth surface for attachment of elastics and rotation correction. The wire bonder tips can also be used to correct minor rotations by bonding nickel-titanium.

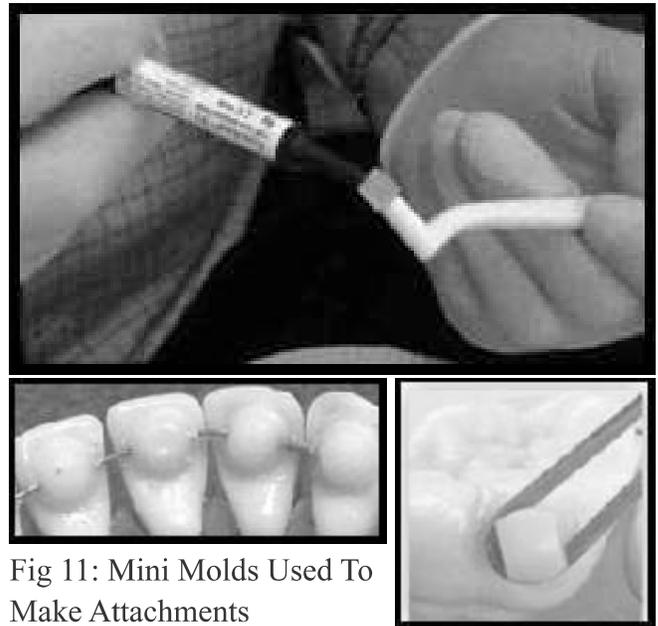


Fig 11: Mini Molds Used To Make Attachments For Elastic Attachment

- Advantages – easy to make invisible esthetic attachments, saves chair time, precise

INVISALIGN/CLEARALIGNERS:

- The Invisalignsystem is based on clear, removable teeth aligners used as an alternative to traditional metal dental braces made from a translucent thermoplastic material.

Advantages include better esthetics, excellent fit due to custom preparation, and good oral hygiene as they are removable. Rotation is an orthodontic movement reported to be difficult to achieve and control with the Invisalign system. The use of resin attachments¹⁰, interproximal reduction, thermopliers, overcorrection or auxiliaries to aid rotational movement are recommended.



Fig 12: Rotation Correction With Invisalign

CONCLUSION:

- In the orthodontics practice, to achieve quality treatment along with comfort as well as esthetics is most challenging.
- We have employed several derotation

techniques in our department. Out of these monkey hooks using couple mechanics are proved to be efficient owing to their biomechanical advantages, simplicity in design and cost effectiveness. However, other techniques like MPAs, mini moulds and invisalign are gaining popularity in the new era.

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