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SIMULTANEOUS RETRACTION AND INTRUSION OF MAXILLARY ANTERIOR TEETH: A REVIEW

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ABSTRACT Simultaneous retraction and intrusion of anterior segment are required in the patients who have deep overbite along with flared incisors. During the retraction of anterior segment, there is some bite deepening, which also requires intrusion. So there are various conventional methods which are used from many last years to achieve simultaneous retraction and intrusion, but these methods require patient compliance and have some undesirable side effects like anchorage loss. With the advent in technology, Orthodontic mini-implants (OMI) broaden the scope of orthodontic therapy by allowing treatment to proceed with little or no anchoring loss and require less patient participation than traditional procedures. Mini implants can be used to offer good anchorage for anterior tooth retraction and intrusion, and they can be inserted in almost any desirable site. There are various conventional methods as well as mini implant supported methods with which simultaneous retraction and intrusion can be achieved. This review article presents the various methods for achieving simultaneous retraction and intrusion of anterior segment either with conventional techniques or with the help of mini implants.

KEYWORDS : Simultaneous retraction and intrusion, mini implants, conventional methods.

INTRODUCTION

One of the treatment modalities for proclined incisors is by extracting the first premolars and retracting the anterior segment. Correction of a deep overbite in patients with flared incisors, on the other hand, is a serious biomechanical challenge during orthodontic therapy, because uprighting the incisors often lengthens the crowns vertically, increasing the overbite[1]. As a result, in many extraction cases, the axial inclination of flared anterior teeth is initially corrected by retraction of the incisors during initial space closure. When there is no more retraction possible due to the presence of a deep bite and the reduction of the overjet, the intrusion is initiated to open the bite and allow subsequent space closure. This treatment modality increases the treatment time when en masse retraction is followed by intrusion is used. So there is a need for simultaneous retraction and intrusion of the anterior segment[2]. Simultaneous retraction and intrusion of anterior segment can be achieved by conventional techniques or with the help of mini implants.

1) Conventional Methods

These are the methods which are used from last many years. In these methods, proper fabrication of appliance design and its activation is needed for simultaneous retraction and intrusion. So adequate wire bending skills is required in conventional methods. Although, they are very effective in achieving simultaneous intrusion and retraction of anterior segment.

A) RETRUSION UTILITY ARCH BY RICKETS IN 1979

Rickets came up with the idea for utility arches in 1979. The utility arch is a continuous archwire that extends over both buccal segments, but made of different wires for different uses and also based on which arch it is used in. It encloses only six teeth viz., the two first permanent molars and the four incisors. As a result, it is also known as the 2 x 4 appliance. The recommended wire for the mandibular arch with a .018" appliance is .016" × .016" or .016" × .022" Blue Elgiloy. For most maxillary arches, .016" × .022" Blue Elgiloy is recommended. With a .022" appliance, .019" × .019" Blue Elgiloy can be used in either arch[3]. The retrusion arch begins in the auxillary tube of the molar, and 5-8mm of wire is protruded anteriorly before a 3-4mm posterior vertical step is placed. Between the upper lateral incisor and the canine, the vestibular segment continues anteriorly to the interproximal region. A 90-degree bend is made with a no. - 142 arch bending plier at this point. To construct a loop in which the end of the anterior leg crosses behind the end of the posterior leg, a loop bending plier is employed. After a 5-8mm vertical segment is formed, another right angle bend then carries the wire across the anterior teeth. To stimulate arch form, a mild contour is inserted in the wire, with an offset being placed in the canine region[4] (Fig. 1).

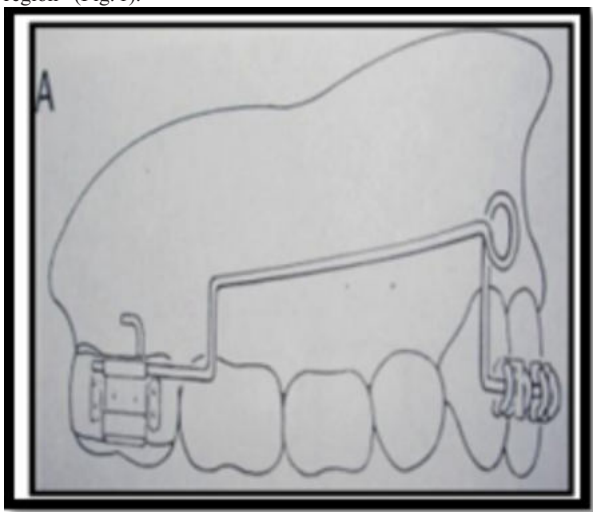

Fig.1 Sagittal View Of Maxillary Retraction Utility Arch

Activation Of The Retrusion Utility ARCH-

There are two possible types of activation with the utility arch. First, a Weingart plier can be used to pull 2-3mm posteriorly and cinch and this will apply retraction force[5] .

Second, intrusion can be created by using an occlusally directed gable bend in the vestibular section[5].

Clinical Problems With Utility Arches-

- Soft tissue issues are the most common side effects of using a utility arch.
- The wire can easily become embedded easily, if the posterior step is made too long or if the horizontal section encroaches on the gingival tissue.
- Tissue irritation and fibrous tissue buildup on the inside of the cheek can occur if the horizontal vestibular segment is inserted too far laterally.

- Another key source of concern is the creation of the retraction utility arch's loops. Severe irritation and patient pain can occur if the loops stretch too deep into the vestibular or protrude anteriorly. At the delivery appointment, the patient should be given wax to help with the break-in time after the utility arch has been inserted[6].

B) Three Piece Intrusion Arch By Charles J. Burstone In 1995-

The mechanism used the principles of the segmented arch technique. Rather than using continuous wires, segmented arch mechanics uses various wire cross sections in each arch. The benefit of utilising this method is that it is feasible to build a precise and predictable force system between an anterior segment (incisors) and a posterior segment (premolars and molars), allowing for pure intrusion of the anterior teeth and control of their axial inclinations. The posterior segment's movement is equally well-controlled. Three piece intrusion arch using the friction or sliding mechanics[7].

Fabrication Of Three Piece Intrusion Arch-

A rigid anterior segment of wire which was made up of 0.021"X0.025" stainless steel. It was inserted into the anterior brackets. To avoid any interference with the brackets on these teeth during intrusion and retraction, this anterior wire was stepped up distal to canine. This anterior portion was extended 2-3 mm distal to the anterior teeth's centre of resistance, with 0.019"x0.025" stainless steel posterior stabilising wire. On the posterior segment 17x25 TMA wire, a bilateral tip back bend was given mesial to the first molar to help intrusion of the anteriors. The intrusive force was applied at a site distal to the centre of resistance of the anterior teeth. 30 grams of intrusive forces were applied to both the right and left sides, and a little distal force was supplied by linking an elastomeric chain from the molar to the wire's anterior part[7] (Fig. 2).

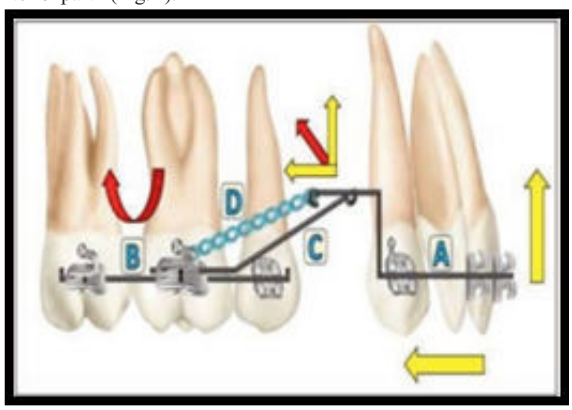

Fig. 2 Three Piece Intrusion Arch

Advantages Of Three Piece Intrusion ARCH-

1. Controlling tooth movement in the vertical and anteroposterior planes is possible with a three-piece intrusive arch.
2. The low load deflection rate of this appliance delivers a constant intrusive force, and the levels of force can be kept low.
3. The design of this appliance enables the physician to deliver a well-controlled, statically defined force system with minimal chairside changes[8].

C) K-SIR (Kalra Simultaneous Intrusion And Retraction) Archwire By Varun Kalra In 1998-

This appliance was developed by Varun Kalra in 1998 for simultaneous intrusion and retraction of six anterior teeth. This appliance works on the frictionless mechanics.

APPLIANCE DESIGN-

1) The K-SIR (Kalra Simultaneous Intrusion and Retraction) archwire is a modification of the segmented loop mechanics of Burstone and Nanda. It is a continuous .019" X .025" TMA archwire with closed 7mm X 2mm U-loops at the extraction sites[9] (Fig. 3).

A 90° V-bend is placed in the archwire at the level of each U-loop to obtain bodily movement and prevent the teeth from tipping into the extraction spaces. When this V -bend is centred between the first molar and canine during space closure, creates two equal and opposite moments to counteract the moments caused by the activation forces of the closing loops. A 60° V-bend located posterior to the centre of the interbracket distance increases the clockwise moment on the first molar, which improves molar anchorage as well as anterior tooth intrusion. A 20° antirotation bend is placed in the archwire just distal to each U-loop to prevent the buccal segments from rolling mesiolingually due to the force produced by loop activation[9].

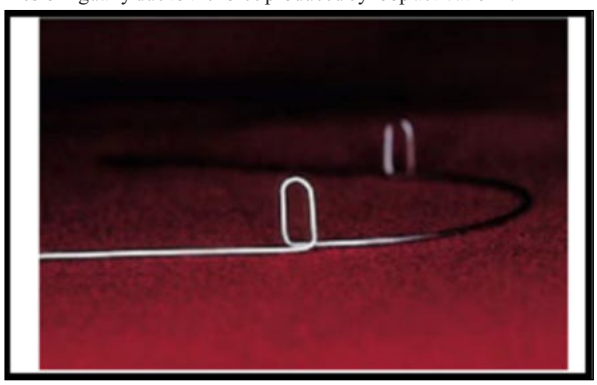

Fig. 3 K-SIR archwire- .019" × .025" TMA archwire with closed U-loops 7mm long and 2mm wide

ACTIVATION OF THE APPLIANCE-

1) A trial activation of the archwire is performed outside the mouth. This trial activation minimises the intensity of the V-bends by releasing the stress built up from bending the wire. The archwire's shape, on the other hand, should be maintained in consecutive loop activations[9].
2) The neutral position of each loop is determined after the trial activation, with the legs stretched horizontally[9].
3) The U-loop will be about 3.5mm wide rather than 2mm in neutral position. The archwire is inserted into the auxiliary tubes of the first molars and engaged in the six anterior brackets (Fig. 4A). It is activated about 3mm, so that the mesial and distal legs of the loops are barely apart[9] (Fig. 4B).

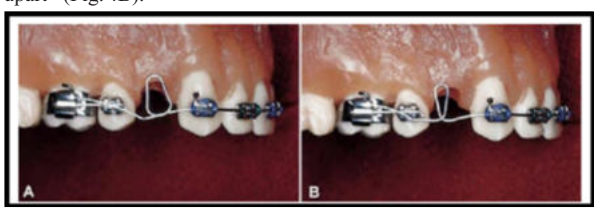

Fig. 4A K-SIR archwire in place prior to cinching back. First molar and second premolar are connected by segment of .019" X .025" TMA wire.

Fig. 4B Archwire cinched back to activate loop about 3mm, so that mesial and distal legs are barely separated.

ADVANTAGES OF K-SIR-

1) Its simplicity of design, with a minimal amount of wire in the loop configuration.
2) It's simple to make, comfortable for the patient, and is less prone to induce tissue impingement.
3) Even without headgear, molar anchorage control is excellent. As a result, in a maximal anchorage condition, there is less reliance on patient participation for a successful outcome.
4) The K-SIR archwire reduces treatment time as compared to conventional edgewise mechanics since the intrusion of the six anterior teeth happens at the same time as their retraction, and the canines and incisors are retracted as a unit[10].

D) SOLDERED POWER ARM-

A soldered power arm is an easy and effective method for simultaneous intrusion and retraction of the anterior teeth which allows the use of sliding mechanics[11].

In this, the length of the power arm is dictated by the resultant force vector required for simultaneous retraction and intrusion of teeth, as well as the sulcus depth in the molar region's buccal vestibule. Bend the desired length of 20 gauge stainless steel wire using the rounded hook for attaching Nickel-titanium closed coil springs or a flexible chain. Caution should be exercised in case of irritation of the mucous membrane with the cut end of the wire. Place the distal end of the power arm on the molar tube, stabilise it and soldering the power arm to the molar tube. Adjust the SPA's hooked vertical end so that it clears the alveolar mucosa. Nickel titanium closed-coil springs, each with a retraction force of 250 to 300 gm, are engaged between the SPA and soldered anterior hooks on the archwires, with the forces exerted by the

springs directed more apically, toward the anchor units' centre of resistance. The SPAs also applied distal forces to the molars[11].

2)Mini Implant Supported Simultaneous Intrusion And Retraction-

Simultaneous retraction and intrusion of anterior segment by conventional methods is efficient in closing the extraction space as well as correcting the deep bite. But still in conventional methods there is some amount of anchorage loss, in the anterior (mesial movement of molar) and vertical plane (extrusion of posterior teeth) which leads to unwanted tooth movements and also due to cumbersome wire bending, there is gingival irritation and impingement of wire in the buccal vestibule. So conventional methods required more patient compliance. The growing demand for orthodontic treatment methods that require minimal compliance and maximum anchorage control, especially among adults, has resulted in the advancement of implant technology. Miniscrews have been developed as temporary anchorage devices for a variety of applications, including canine retraction, anterior retraction, en-masse anterior retraction, molar uprighting, distalization, and protraction. They have the advantages of being smaller in size, having more implant sites and indications, being easier to place surgically and connect orthodontically, having a shorter or even no waiting period, not requiring laboratory work, being easier to remove after treatment, and being less expensive than implants, onplants, and miniplates[12].

We may now move teeth farther, position the maxillary or mandibular incisors in ideal angulation and inclinations, and intrude the incisors farther with miniscrews because anchorage is no longer a limitation[12].

A)Placing 2 Mini Implants In The Posterior Region Between Roots Of Second Premolar And First Molar-

En masse retraction and intrusion of anterior segment can be achieved by placing a mini implant in between the roots of second premolar and first molar (Fig. 5).

To maximize the potential of Mini implants, it is crucial to understand the underlying mechanics behind the force application from an MI to the active unit or teeth. Mini implant are usually inserted apical to the occlusal plane into the bone between the roots of teeth, with a force applied at an angle. This angulated force lends itself to be broken into two components- horizontal and vertical. Horizontal component resulted in retraction while vertical component moved the anterior teeth upward. However, the force vector passed below the centre of resistance of anterior teeth; therefore moment was created which also tipped the incisors lingually. Therefore, the retraction of incisors involved both the translation and tipping movement, as the inclination of the incisors was improved along with the lingual movement of roots. So thus, the force (F) exerted by the nickel-titanium coil springs (bilaterally) had two distinct components to it: a larger and predominantly retractive force (r) and a smaller intrusive force (i), causing en masse retraction and some intrusion of the anterior teeth[13].

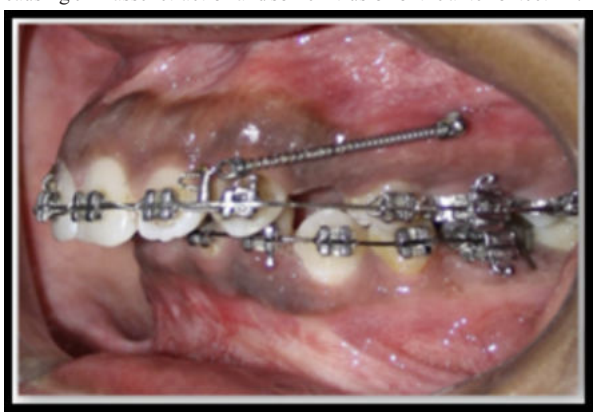

Fig. 5 Enmasse Retraction And Intrusion Of Anterior Segment By Placing 2 Mini Implants

ANCHORAGE PRESERVATION AND VERTICAL CONTROL BY MINI IMPLANTS-

According to Victor et al, on effectiveness of mini implants in three dimensional control during retraction found that there was distal tipping of molars in mini implant group while mesial tipping is observed in non mini implant group. In vertical plane, mini implant group indicate that there was intrusion of incisors and molars while non mini implant group indicated extrusion of incisors and molars[14]. Three-dimensional control is better in the implant group compared to the non-implant group. Also according to another study done by Upadhyay et al, it was found that, in the implant group, both the maxillary and mandibular molars were distalised and intruded. In addition, the maxillary and mandibular incisors were retracted and intruded. In the non-implant group, the maxillary and mandibular molars mesialised and were extruded[15]. Hence, there is anchorage loss by conventional methods as compared to mini implant supported simultaneous retraction and intrusion.

B) PLACING 2 MINI IMPLANTS IN THE POSTERIOR REGION AND ONE MINI IMPLANT IN BETWEEN THE CENTRAL INCISORS FOR INTRUSION-

Simultaneous retraction and intrusion can be achieved by placing two mini implants in posterior region in between the roots of second premolar and first molar and applied a retraction force from anterior retraction hook soldered to main arch wire in between lateral incisor and canine and one mini implant for intrusion placed between the roots of central incisors[16]. A study done by parayaruthottam and antony, found a significant amount of retraction and intrusion when using one mini implant in between central incisor for intrusion and anterior retraction hook for retraction[17].

C) PLACING 2 MINI IMPLANTS IN THE POSTERIOR REGION AND 2 MINI IMPLANTS IN BETWEEN THE LATERAL INCISORS AND CANINE ON BOTH SIDE FOR INTRUSION –

More control of simultaneous intrusion and retraction of anterior segment can be achieved by placing 2 mini implants in the posterior region for retraction and 2 mini implants in between the lateral incisors and canine on both side for intrusion[18].

CONCLUSION-

Simultaneous retraction and intrusion of anterior segment can be achieved by both conventional and mini implant supported methods, but both has its own advantages and disadvantages. However, to achieve simultaneous retraction and intrusion by any of the method it is important to consider the force system delivered on the anterior segment which depends on the point of application of the force and its direction. Majority of the studies stated that to achieve the bodily displacement of the anterior teeth, the force should pass through the centre of resistance. The key influencing factor in determining the degree and course of movement of anterior teeth by mini implant supported method, might be the length of the power arm and the position of the micro implants and in the conventional techniques, the wire bending skills and the position of the bends. So before starting the treatment, its mandatory to assess the problems, establish clear objectives of treatment, and develop adequate techniques to achieve the established results. Thus, clinicians should evaluate each patient to develop the proper biomechanics for each particular case that leads to effective treatment results.

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