CASE REPORT

Self Retraction Spring (SRS)

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ABSTRACT

Orthodontic treatment procedure involves closure of extraction spaces to correct proclination, crowding, over jet and overbite. This requires carefully designed treatment strategy with appropriate utilization of the anchorage. Space closure to be done either by anterior retraction or posterior protraction or a combination of both is used. The following case report describes an innovative method of retraction mechanics with an auxiliary attachment which is simple to construct and can be attached for retraction purpose instead of using elastomeric. This reduces frequency of appointments for reactivation procedure as this auxiliary act as a self-retraction spring.

KEYWORDS: Retraction mechanics, Force (F), Moment (M), Center of Resistance (C Res)

INTRODUCTION

Retraction of anterior teeth is dependent upon firstly biological consideration & secondly the mechanical consideration.

The combination of above two factors i.e. biomechanical consideration in a given case to overcome every factor of retraction is dependent on force (F) applied, the moment (M) generated & point of application of force.

Force, as we know, it is a vector quantity, which acts on a body to change the state of rest or motion. Forces are vectors, having both direction and magnitude. Moment of force is When a force is applied at any point other than through the center of resistance, in addition to moving the center of resistance in the direction of the force, a moment is created.

This is very well explained with example of nut and a spanner relationship (Fig.1) For unscrewing of screw, position at 'B' is much easier (as compared to A) because length of arm is increased which gives greater moment with minimal amount of force degradation.

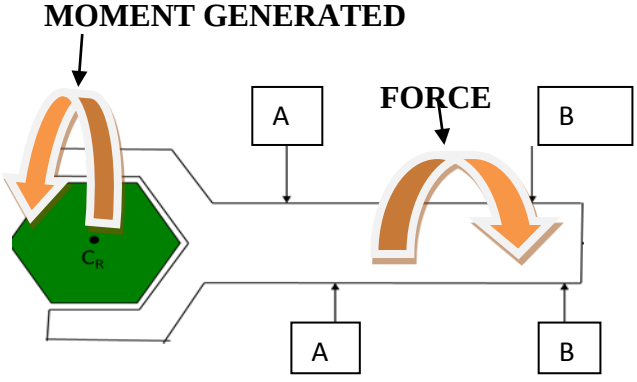

Fig. 1 Nut & Spanner

Types of retraction mechanics include retraction loops, close coil springs, and active tiebacks in which distance of application force is from distal of canine to mesial of molar.[1,2,3]

Self-retraction system SRS" is an auxiliary attachment which assists retraction of anterior teeth with controlled force delivered with minimal descent in magnitude of the forces & allows to retract the anteriors with minimal activations. (Table no.1) It is an inexpensive and innovative retraction system.[4,5]

	Conventional method	Self-retraction system(SRS)
Point of (F)application	From mesial of molar	From distal aspect of molar
Distance from point of force application (from distal of canine to mesial of molar)	Reduces	Constant
Amount of force	Force degradation occurs as the distance gets decreased	Force degradation is minimal

Table no. 1- Differences between conventional method & SRS.

CASE REPORT: Demonstrating the use of SRS

Case history & Diagnosis: Adult female Patient aged 24 years with a chief complaint of forwardly placed upper & lower teeth. Extra-oral examination showed convex profile with potentially incompetent lips. (Fig. 2A)

Intra-oral examination showed a class I molar relationship with bimaxillary protrusion.The Case was diagnosed as angle's class I malocclusion with Dewey's

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modification type 2.

Pre-treatment records which included extra oral photographs & intraoral photographs (Fig.no 2 A to E) & lateral cephalograms, OPG were taken.(Fig. no. 2F, 2G)

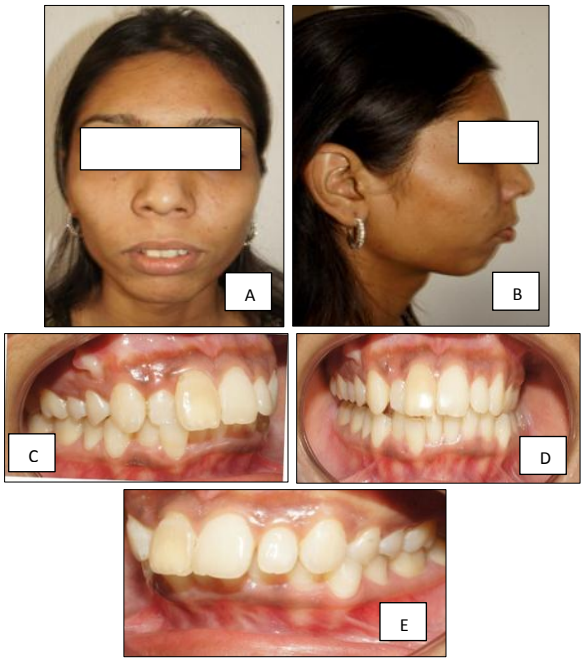

Fig.no. 2 A-E: Pretreatment extra oral photographs: (A) frontal (B) Profile & pretreatment intraoral photographs (C)right lateral, (D)frontal (E) left lateral

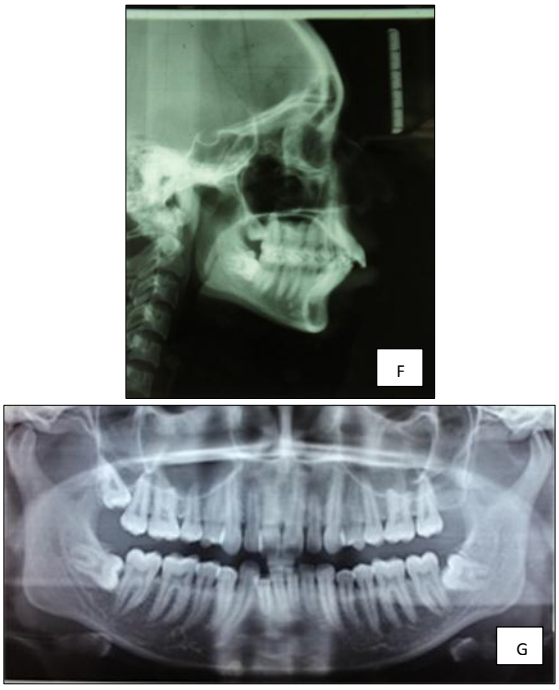

Fig. no. 2 Lateral Cephalograms: (F) Pretreatment
(G) Opg: Pretreatment

Objectives (for all 3 cases)

- Attain a pleasing profile
- Correct the crowding and proclination with upper & lower anteriors
- Achieve an acceptable occlusion

Treatment plan: Treatment plan included upper and lower first bicuspid extraction. In this case PAE appliance was used & retraction was carried out using intra-arch mechanics in antero-posterior plane. Sliding mechanics using 'Self-retraction system' was used for retraction on 0.017*0.025 SS wire. (Fig 3.1-3.3) Transpalatal arch with Nance button was provided for all patients to prevent any kind of anchorage loss during the retraction procedure.

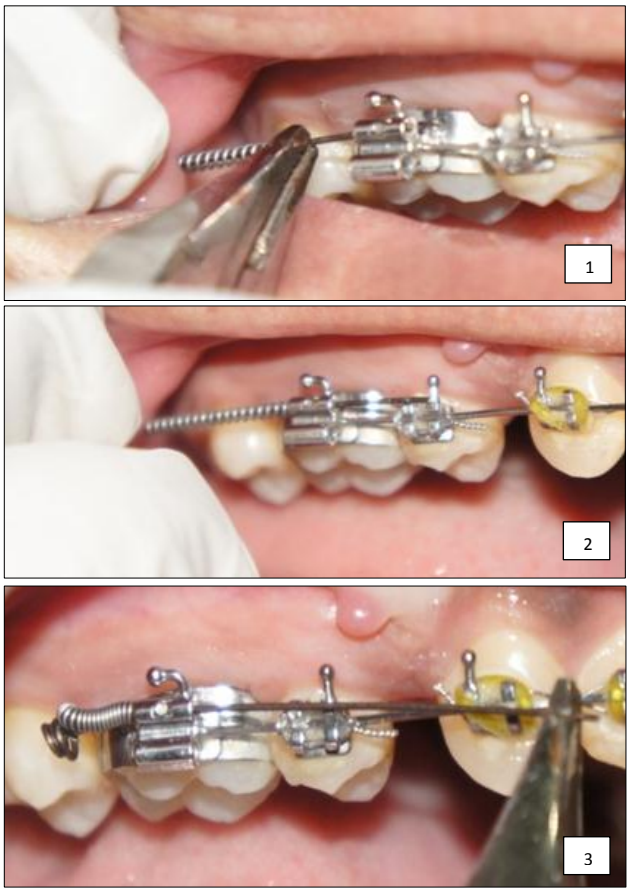

Fig: 3.1-3.3: Retraction of wire

Biomechanics of SRS: Excess force cause tooth tipping and deep bitening i.e. trampoline effect / roller coaster effect (Fig 4). SRS assists free and bilateral smooth retraction and application of force is from distal of the first molar. So vector plane of retraction along the reverse curve stainless steel base arch wire is axially along long axis of tooth & palatally in A-P plane. (Fig 5A-C). Thus resultant vector of force created permits intrusion & retraction simultaneously. Tooth movement achieved is with minimal magnitude of forces. Considering biology of tooth movement, the retraction process lies in between the initial tooth movement and lag phase. This generates lighter forces (224 gms/side) with least harmful effects. (Fig 6A, B, C). The conventional retraction with E-chain & active tie back show force degradation up to 50% in first 24 hrs. As retraction progress, the force value reduces.

Fabrication of SRS: Soldered or crimpable hooks are attached in between lateral incisor & canine for applying

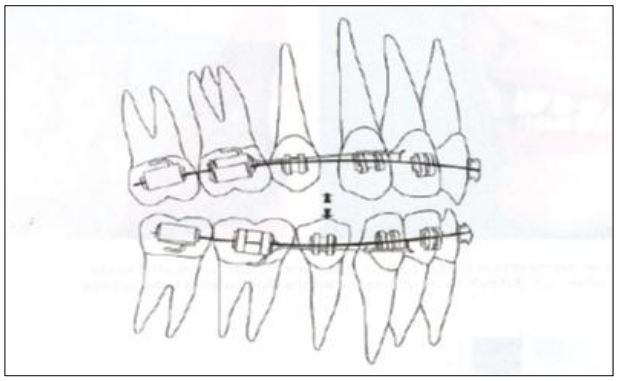

Fig 4: Roller coaster effect

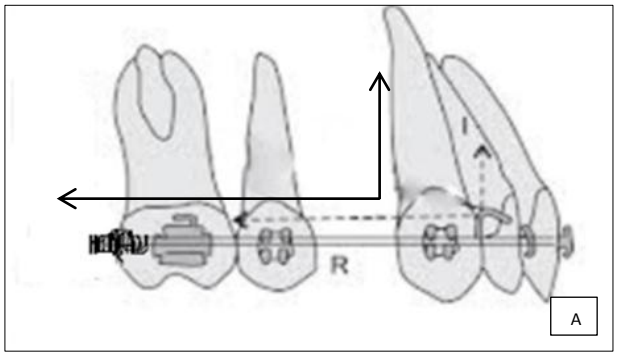

Fig 5A: Vector Plane of Retraction

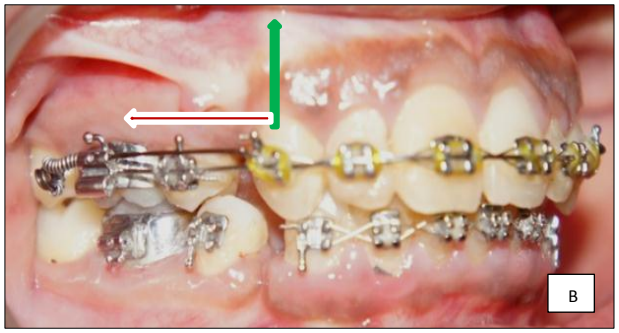

Fig 5B: Vector Plane of Retraction

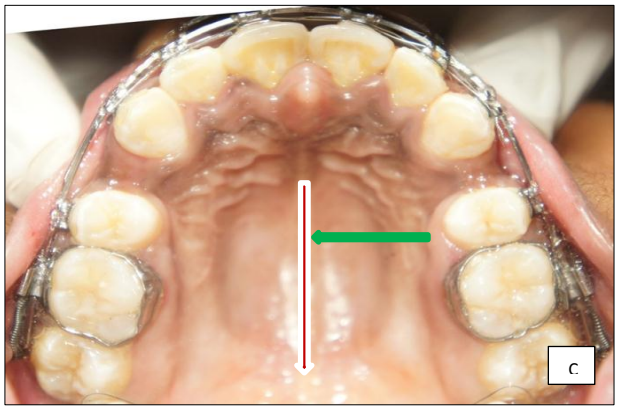

Fig 5C: Vector Plane of Retraction

Fig 6A: Elastic chain: 420 Gms force

Fig 6B: Active tieback: 326 gms

Fig 6C: SRS: 224 gms

Fig 7.1: Curving of Arch wire

retraction force to base arch wire 0.017 *0.025 SS which is given in shape of reverse curve of spee. [6] (Fig7.1)

- Prepared hooks are soldered to base arch wire perpendicularly as application of retraction force will be close to center of resistance of the anterior teeth (Fig7.1)
- Stainless steel open coil spring (1.5mm diameter) is utilized for fabrication of spring.(fig 7.2 & 7.3)

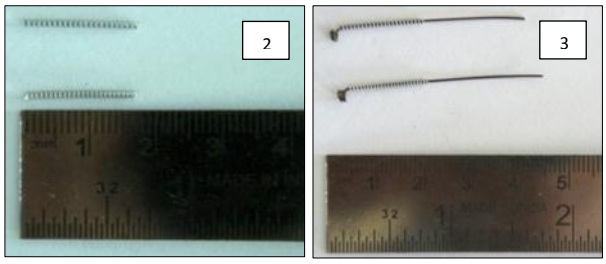

Fig 7.2,7.3: Open Coil Spring

- Length of coil spring is around 15mm i.e double the length of extraction space. (fig 7.2 & 7.3)
- 0.014 inches Stainless Steel Australian AJ willcock heat treated (premium) wire with coils placed at one end and a straight stump with length larger than distance between distal of cuspid to mesial of the second molar is fabricated. The open coil spring is then inserted in the fabricated stump. (Fig7.3)

Clinical Procedure: This appliance is placed in the accessory tube of upper molars from distal aspect of the first molar and attached to the passive arm of the canine. (fig 3.1, 3.2, 3.3) or the soldered power arm of the base arch wire or the crimpable hook.

Treatment Progress: Patient was recalled after every 15 days just to observe the treatment progress. Treatment changes were recorded in successive appointments. It was found that 50% space closure was observed within 45 days & complete space closure was observed in 90 days (3 months), Out of which anchorage loss due to mesial movement of molar was approximately around 1.4-1.5mm unilaterally & rest of space closure was purely due to SRS.

Activation of SRS is done by cutting anterior end which is engaged on canine bracket power arm or crimpable hook. Use of auxiliary tube is utilized by SRS. The force generated when measured by dontrix gauge was about 224 grams unilaterally, which is considerably less than generated by elastic chains (420 Gms) & active tie backs (326 Gms). (Fig 6A, B, C) Biologically SRS works in between the initial tooth movement and lag phase.

Since continuous, active, sustained lighter force was applied, tooth movement continued till complete space was closed. This appliance doesn't require patient co-operation. Time interval between two successive visits is also increased & frequent activation is not required. Frequent visit is required in conventional retraction methods. The extended component of SRS didn't interfere with the buccal musculature. During every appointment, the extended base arch wire was cut distal to molar tube only if it caused any discomfort to the surrounding mucosa.

Lower retraction was continued with active tie backs with scheduled activation after every 3-4 weeks. Retraction time required in upper & lower arch was same. In lower arch due to the presence of thick buccal muscular fold at retro molar area, it was interfering in SRS device, hence active tie backs were used in all cases for enmass retraction of anterior with sliding mechanics.

Treatment Results: After a total 3-4 months of retraction, arches were well aligned, overbite and overjet were normal, and Class I molar and canine relationships had been established in all case. Facial profile was showing good esthetics with competent lips. (Fig. No. 8A-E, 8F, 8G, 8H)

Fig.no. 8 A to E Post-treatment extra oral photographs:
(A) frontal (B) Profile & post treatment intraoral photographs (C) right lateral, (D) frontal, (E) left lateral

Fig 8F: LATERAL CEPHALOGRAMS- Stage III before debonding

Fig 8G: OPG- Stage III before debonding

Fig 8H: OCCLUSAL- Stage III before debonding

Advantages: This innovative technique is simple to construct, 50% of space closure within 6 -7 weeks & complete retraction done in 90 days where (6-7mm). It is economical & reduced frequency of appointments for activation. There is utilization of auxiliary tube which is mostly unused.

Limitations

- Asymmetric extraction of space closure.
- Food accumulation
- Unable to use for closure of Spaces of (1-1.5mm) sizes.

DISCUSSION

Retraction is usual step in orthodontics irrespective of the appliances. In 1990, a method of controlled space closure was described using sliding mechanics. This has proved effective and reliable for many years, and has seen widespread acceptance by clinicians.

Sliding mechanics has become a popular method for space closure, with the development of various prescriptions in bracket system.[7]

Furthermore, various space closing auxiliaries have been developed such as e-chain, active tiebacks which has been extensively evaluated for their clinical efficiency. Their effectiveness is enhanced with optimum force magnitude and low load deflection rate/force decay. Nickel-titanium springs can be used, instead of elastomeric modules, if large spaces need to be closed, or it there are infrequent adjustment opportunities. Recent work by Samuels et al has recommended that the optimal force for space closure is 150 gm when using nickel-titanium coil springs as the force for space closure. So newer approach came in orthodontics as the the open coil traction system, or open coil retraction spring, utilizing Ni-Ti open coil springs for orthodontic space closure.[1]

Objective of anterior retraction as a biomechanical test effectively managed by obeying the simple laws of physics.

- Point of application of force
- Point where the force is delivered
- Vector created due to the applied force
- Resultant force

Conventional sliding of loops mechanics work on principle of moment generated.[8,9]

In SRS the moment generated from retro molar region to canine area or canine-lateral incisor junction is stable.

This distance between the points from where the force is applied to the point where force is delivered is maintained as retraction progresses.[1]

This facilitates ease in reactivation as arm tucked on the anteriors has to cut & readapt over the anterior section for the frequent reactivation.

The point of application of force is constant as the retraction progress.[10]

CONCLUSION

Self-retraction spring is boon for sliding mechanics as an auxiliary attachment. Further modification will continue in the SRS spring in lower arch. It can be safely used in upper arch for retraction of anteriors where there is moderate anchorage requirement

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