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Power Arm for Intrusion and Retraction Mechanics (PAIR) – Effective Assistance for Efficient Tooth Movement.

[1]Dr. Manali Prakash Jadhav, Assistant Professor, Department of Orthodontics and Dentofacial Orthopaedics, SMBT Dental College and Research Centre, Sangamner, Maharashtra, India.

[2]Dr. Sunilkumar Laxman Nagmode, Professor and HOD, Department of Orthodontics and Dentofacial Orthopaedics, SMBT Dental College, Sangamner, Maharashtra, India.

[3]Dr. Mithun Krishna, Assistant Professor, Department of Orthodontics and Dentofacial Orthopaedics, A.J institute of dental sciences, Mangalore, Karnataka, India.

[4]Dr.Rithesh Bangera, Assistant Professor, Department of Orthodontics and Dentofacial Orthopaedics, A.J institute of dental sciences, Managlore, Karnataka, India.

Corresponding Author: Dr. Manali Prakash Jadhav, Assistant Professor, Department of Orthodontics and Dentofacial Orthopaedics, SMBT Dental College and Research Centre, Sangamner, Maharashtra, India.

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Abstract

In orthodontics, management of deep overbite includes application of different mechanisms that will result either in true intrusion of anterior teeth, extrusion of posterior teeth or a combination of both. Orthodontic literature encompasses numerous treatment modalities for the orthodontic correction of malocclusions such as increased overjet, bimaxillary dentoalveolar protrusion, deep bite. This case report presents the use of a soldered power arm (SPA) on headgear tube of molar tube in order to combine the use of sliding mechanics with bodily retraction and intrusion of anterior teeth. Thus, Soldered power arm designed for simultaneous intrusion and retraction depicted a drastic change in the patient's profile and smile accompanied by space closure and well finished occlusion.

Keywords: Biomechanics, Intrusion, Retraction, Soldered power arm, Molar tube.

Introduction

Over long decades, malocclusions such as bimaxillary dentoalveolar protrusion with deep bite have been corrected by different treatment techniques and biomechanical approaches that incorporate en masse retraction and intrusion of anterior teeth with minimal or no anchorage loss[1,2]. Optimal force should be applied constantly for the intrusion of anterior teeth using low

load deflection springs. To reduce root resorption and minimize side effects on the reactive unit, it is very important to exert mild forces on the teeth while attempting intrusive tooth movement (10-15 gm/tooth)[3,4,5]. There are numerous treatment modalities like segmented arch approach, retraction and intrusion utility arches, temporary anchorage devices for the orthodontic correction of bimaxillary dentoalveolar protrusion with deep bite. Certainly, they have drawbacks such as good patient compliance requirement and are aesthetically unpleasing[6].

The present article reports a fourteen-year-old male patient who presented with proclined maxillary anterior teeth and incompetent lips. The treatment included a soldered power arm (SPA) fabricated in the headgear tube of molar tube in order to facilitate bodily retraction with intrusion of anterior teeth and hence overcome the necessary patient compliance and strain on aesthetics.

Case Report

A fourteen-year-old male patient presented to the department with the chief complaint of forwardly placed upper front teeth and no relevant medical history. He presented of generalized 'fluorosis', especially in the front teeth. On extra-oral examination (Fig 1), the patient exhibited a symmetric face with convex facial profile, acute nasolabial angle, recessive chin, vertical growth pattern, protrusive and incompetent lips and lower lip trap. The maxillary midline was coincident with the mid-sagittal plane and mandibular midline was shifted to right side by 2mm relative to the upper dental midline. No symptoms of temporomandibular joint disorder were to be observed.

Introral examination (Fig 1) revealed a full cusp Class II molar on right side and half cusp Class II molar on left side and Class II canine relation, bilaterally. He had a Class II div I incisor relationship with proclined maxillary anterior teeth, increased overjet of 13mm, deep bite of 5mm and mild crowding of 3mm in the lower arch. The curve of spee was 1.5 mm on left side and 2.5 mm on right side. Cephalometric assessment depicted a skeletal Class II pattern with an ANB angle of 6 degrees and Wits appraisal of 2 mm. The upper incisors were at an angle of 127 degrees relative to the cranial base (S–N plane), while the lower incisors showed an angle of 95 degrees (IMPA) relative to the mandibular plane (Fig 2 and Table 1).

The case was diagnosed as a Class II skeletal malocclusion with prognathic maxilla and orthognathic mandible. In relation to the occlusal features, the patient had an Angle Class II div 1 malocclusion with proclined maxillary anterior teeth and an increased overjet. The patient had vertical growth pattern and protrusive upper and lower lip.

The etiology of the malocclusion was regarded as developmental as the patient had no significant medical history. Careful extra-oral examination and cephalometric assessment of the patient revealed that the skeletal antero-posterior class II discrepancy was characterized by maxillary prognathism with vertical descent of the maxilla making a normal mandible appear retrognathic. On further investigation of the patient's history, it was found that the reason for the generalised fluorosis was related to the increased fluorine content in the water supply which was an endemic condition in his area of residence.

In this case, the ideal treatment plan could have been to defer the treatment until the completion of patient's growth and then opt for comprehensive orthodontic treatment combined with orthognathic surgery. However, such an option seemed to be perilous and expensive. Moreover, the existing risk of psychological trauma to the patient had to be addressed in the first instance.

Hence, two phase therapy was suggested to the patient; the first phase involved a high pull headgear to redirect the

skeletal maxillary growth followed by second phase of fixed appliance treatment. The patient refrained from wearing headgear owing to the aesthetic and social concerns and opted for the second alternative of fixed appliance therapy. Thus, the treatment plan involved extraction line of treatment with removal of upper first premolars, orthodontic alignment of teeth followed by intrusion and retraction of anterior teeth using soldered power arm.

Owing to his history of generalised fluorosis, the patient was advised to follow and maintain prescribed oral hygiene regime throughout the course of the fixed appliance treatment. Banding of first molars was done and the rest of the teeth were bonded with 0.022" preadjusted edgewise appliance (MBT prescription, American Orthodontics mini master series). Due to the fact that the patient exhibited a vertical growth pattern, banding of second molars was excluded right from the start of the treatment to prevent their extrusion and further exaggeration of the existing vertical growth pattern. A transpalatal arch 3-4 mm away from the palate was placed on the upper first molars to facilitate intrusion of molars by tongue pressure. Treatment was commenced using 0.016" NiTi in both arches, which was further followed by 0.016 × 0.022" NiTi and 0.019 × 0.025" NiTi. Leveling and alignment was achieved in 4 months (Fig 3). Once the upper and lower arches had completed alignment and leveling, maxillary and mandibular anterior teeth from canine to canine were consolidated and single unit was formed with continuous steel ligation. Finally, to facilitate full slot engagement, a 0.019" × 0.025" stainless steel wire was placed as a working arch wire.

The curved vertical end of the power arm and its assembly were kept free from the alveolar mucosa followed by its soldering to the molar tubes. Cementation of molar bands was done. Brass wire bent into hooks were soldered on the anterior segment of the wire. Further between these soldered brass wire hooks and soldered power arm, nickel titanium closed-coil springs (12 mm), each exerting a retraction force of 250 to 300 gm were engaged on either side (Fig 4).

Alignment and leveling in the lower arch were mainly achieved by proclination of incisors and some interproximal reduction. Settling of the occlusion was accomplished with 0.016" stainless steel in the upper and lower arches with settling elastics over a period of 3 months. After debonding, the retention protocol consisted of a begg's wrap around retainer placed on the upper arch and bonded lingual retainer placed in both upper and lower arches. The total active treatment time was 18 months. Majority of the treatment objectives outlined for this patient were achieved.

Following 18 months of treatment, the patient's profile and smile greatly improved owing to the retraction of lips. Space closure was accomplished with the intrusion and retraction of upper anterior teeth and correction of deep bite. The midlines were coincident with each other and with the face. On intra-oral assessment, a normal overjet and overbite supplemented with a good buccal occlusion and Class I canine relation was achieved. Centric occlusion and centric relation were coincident (Fig 5).

In this case report, noticeable dento-alveolar changes were seen in post-treatment measurements such as: Maxillary incisors were retracted significantly by 7mm linear and 12° angular. Superimposition and cephalometric analysis showed 3 mm of maxillary anterior teeth intrusion. Soft tissue profile improved considerably with the change in nasolabial angle from 80° to 95°. Significant retraction of upper lip and lower lip was demonstrated by reduction in 'S' line to upper lip from 6mm to 3mm and 'S' line to lower lip from 7mm to 4mm respectively (Fig 6 and Table 1). Superimposition also showed significant improvement

in dentoalveolar component and soft tissue profile after treatment (Fig 7).

Discussion

In maximum anchorage cases, while attempting retraction of maxillary anterior teeth, it is of utmost importance to maintain upright position of upper molars[7]. Routine clinical practice frequently involves retraction carried out by applying force from the hook attached between maxillary lateral incisor and canine to the gingival hook of maxillary molar tube[8]. Inevitably to

some extent, the maxillary molars tend to tip mesially during the space closure as the point of force application is below the center of resistance (CR) of maxillary molars. This in turn requires uprighting of molars during the finishing stage. Anchorage loss may also be an unwanted effect. Hence the force on molars should be applied at their CR, which is at the trifurcation areas in order to avoid the unwanted cascade of events[9].

For the precise simultaneous retraction and intrusion of anterior teeth, the soldered power arm is an easy, rigid, accurate and fruitful alternative. During the progress of treatment, it does not lead to distortion or loosening from the headgear tube of molar tube as it is constructed from a sturdy 19-gauge stainless steel wire and soldered within the tube. For retraction and intrusion to occur side by side, force levels need to be maintained throughout the treatment. Forces, being vectors units can be combined or divided mathematically. A single force at a particular point can be represented by adding two or more forces using simple trigonometry or vector addition acting at that point (Fig 8).

Thus, with a soldered power arm, retraction and intrusion of the anterior teeth along with the management of the increased overjet and deep bite is accomplished in an efficient way as the resultant force vector runs apically toward the center of resistance of the anchor unit.

Conclusion

Soldered power arm removes the necessity of tedious and not so aesthetic segmented wire bending and use of miniscrew anchorage for the successful treatment of malocclusions such as accentuated overjet, bimaxillary dentoalveolar protrusion with deep bite. In the era of modern orthodontics, the construction, patient compliance and clinical application of this magical power arm on to the maxillary first molars for the retraction and intrusion of anterior teeth stands out vividly.

Patient consent form

Consent of the patient and his parents to participate in the present study is obtained.

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References

1. Bennett JC, McLaughlin RP. Controlled space closure with a preadjusted appliance system. J Clin Orthod. 1990;24(4):251-260.
2. Klontz HA. Tweed-Merrifield sequential directional force treatment. Semin Orthod. 1996;2(4):254-267.
3. Shroff B, Lindauer SJ, Burstone CJ, Leiss JB. Segmented approach to simultaneous intrusion and space closure: biomechanics of the three-piece base arch appliance. Am J Orthod Dentofacial Orthop. 1995;107(2):136-143.
4. Dellinger EL. A histologic and cephalometric investigation of premolar intrusion in the Macaca speciosa monkey. Am J Orthod. 1967;53(5):325-355.
5. Reitan K. Initial tissue behavior during apical root resorption. Angle Orthod. 1974;44(1):68-82.

6. Vibhute PJ. Molar-stabilizing power arm and miniscrew anchorage for anterior retraction. J Clin Orthod. 2010;44(11):679-688.
7. Ammar HH, Ngan P, Crout RJ, Mucino VH, Mukdadi OM. Three-dimensional modeling and finite element analysis in treatment planning for orthodontic tooth movement. Am J Orthod Dentofacial Orthop. 2011;139: e59-71.

Legends Tables and Figures

Table 1: Lateral cephalometric analysis of the treatment.

Parameter	Mean	Pre-treatment	Post treatment
SNA	82^0 ±2	87^0	86^0
SNB	80^0±2	81^0	80^0
ANB	2^0	6^o	6^o
WITS appraisal	-1mm	2mm	1mm
Go-Gn to SN	32^0	31^o	32^o
Basal plane angle	25^0	31^o	32^o
Jarabak Ratio	62-65%	64.88%	65.02%
FMA	25°	29°	30°
U1 to NA(mm)	4mm	12mm	5mm
U1 to NA (^{0})	22^0	40^0	28^0
U1 to SN	102^0	127^0	102^0
U1 to NF(⊥ NF)	30.5± 2.1mm	31mm	28mm
U6 to NF(⊥ NF)	26.2±2 mm	23mm	24mm
L1 to NB (mm)	4mm	9mm	10mm
L1 to NB (^{0})	25^0	32^0	34^0
IMPA	90^0	95^0	105^o
Interincisal angle	130^0	95^o	105^o
Nasolabial angle	$90\text{-}110^0$	80^o	95^o
'S' line to upper lip		6mm	3mm
'S' line to lower lip		7mm	4mm

Figure 1. Pre Treatment- Extra oral and Intra oral photographs

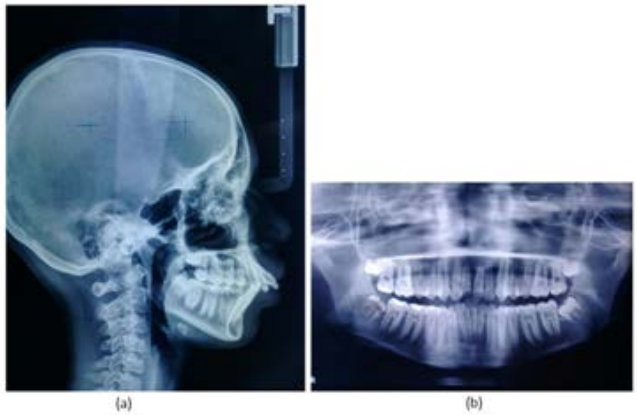

Figure 2. (a,b) Pre Treatment- Lateral Cephalogram and Panoramic Tomogram

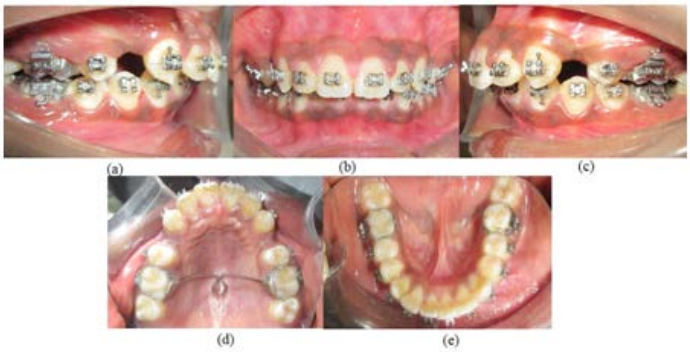

Figure 3. (a-e) Mid Treatment-Intra oral photographs

Figure 4. (a-c) Soldered Power arm for intrusion and en-mass retraction of maxillary anteriors.

Figure 5. Post Treatment- Extra oral and Intra oral photographs

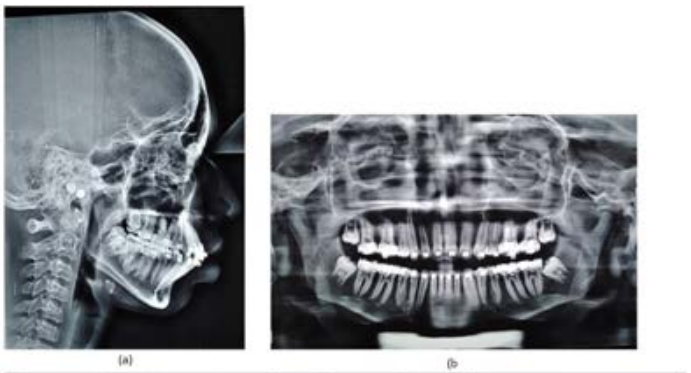

Figure 6. (a,b) Post Treatment- Lateral Cephalogram and Panoramic Tomogram

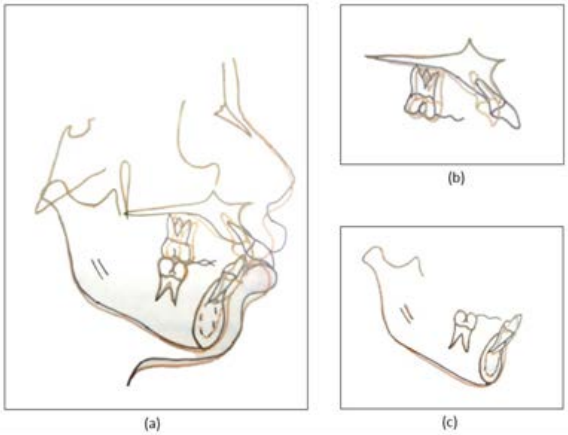

Figure 7. Pre-treatment (black) and Post-treatment (red) cephalometric tracings, superimposed on (a) Sella–Nasion plane at sella,(b) Palatal plane at ANS (c) Inner cortical structure of the inferior border of symphysis and mandibular canal.

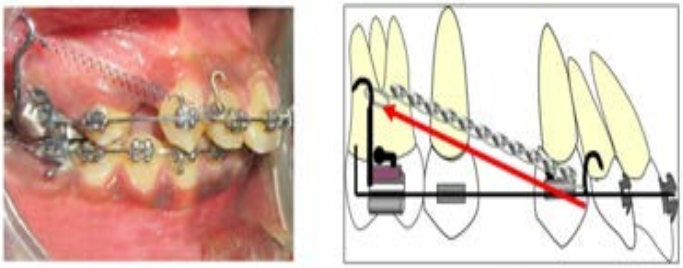

Figure 8. (a,b) Schematic representation of forces produced by soldered power arm