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Case Report

Treatment of Deep Overbite in High Angle Patient with Segmented arch Technique: A Case Report

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Abstract:

This case report describes the orthodontic and orthopedic treatment of a 13-year-old female patient who presented with the prognathic maxilla, deep overbite, high mandibular plane angle, and increased incisal display at rest and smile. Burstone three piece intrusion arch was used for the true intrusion of maxillary incisor along with high pull headgear for restriction of maxillary growth. The final treatment outcomes were satisfactory and true intrusion was achieved with proper selection of biomechanics.

Key Words: Burstone, deep overbite, intrusion, segmented technique

Introduction

Strang defined overbite as the overlapping of the upper anterior teeth over the lowers in the vertical plane. The ideal overbite in a normal occlusion may range from 2 to 4 mm or 5% to 25%. The overbite >40% should be considered as deep overbite and affects the periodontal structures and temporomandibular joints.[1]

A deep overbite can be corrected by extrusion of upper/lower posterior teeth, intrusion of upper/lower incisors and combination. Extrusion of posterior teeth is indicated in patients with a short lower facial height, excessive curve of spee in growing patient and moderate to minimal incisor display, whereas intrusion of incisor is indicated in patients with long lower facial heights, excessive incisor display, increased interlabial gap, and gingival smile.[1,2] The orthodontic appliances used to carry out intrusion are J hooks pull headgear, tip back bends, burstone three piece intrusion arch, Ricketts utility arch, Nanda Connecticut intrusion arch, and mini- implants assisted intrusion.[1,3,4]

Intrusive tooth movements are most effectively done with low force magnitudes.[5] The advantage of lower force magnitudes are reduced molar tip back moment and root resorption.[1,6] Burstone three piece intrusion arch is based on statically determinant force system, which implies magnitude of all the forces produced by activation is measurable.[1-6] This paper report a treatment of deep overbite in high angle patient who needs true intrusion of upper anterior teeth which is done by segmented arch technique.

Case Report

A 13-year-old female who came to our hospital with the complaints of proclined upper front teeth and unable to approximate lips. Her medical history was unremarkable, and no history of deleterious habits in childhood was reported by her parents. Extra oral examination showed dolicocephalic head, leptoprosopic facial form, convex facial profile, high clinical mandibular plane angle, increased lower facial height, incompetent lips, everted lower lip, acute nasolabial angle, increased incisal display at rest and smile, increased interlabial gap, upwardly tipped nose (Figure 1). Intraoral examination showed half-cusp Class II molar and canine on both sides, increased overjet of 5 mm, increased overbite of 6 mm, mild crowding in the lower anterior segment, buccal pit dental caries present in 36 and 46 and restoration observed in 16 and 36.

The pre-operative orthopantogram shows presence of all permanent teeth and lateral cephalogram findings reveals prognathic maxilla, orthognathic mandible, Class II skeletal base, high mandibular plane angle, counterclockwise rotation of maxillary jaw bone, short ramus height, upright lower incisor, proclined upper incisor, and vertical growth pattern and protrusive lips (Table 1 and Figure 2). The hand wrist radiographs of Fishman analysis reveals peak pubertal growth spurt would occur during or after this stage.

Treatment objectives

1. Restore buccal pit caries in 36 and 46
2. Restrict the growth of maxilla in anteroposterior and vertical plane
3. Decrease lower facial height
4. Establish ideal overjet and overbite
5. Correct Class II molar and canine relation
6. Level curve of spee
7. Decrease incisal display at rest and smile
8. Improve soft tissue lip relation.

Table 1: Cephalometric measurements.		
Variables	**Pre-treatment**	**Post-treatment**
SNA	85°	84°
SNB	79°	80°
ANB	6°	4°
N to A (mm)	+2	+1
N to POG (mm)	−8	−3
WITS	AO>BO by 1 mm	BO=AO
SN-GOGN	34°	34°
FMA	30°	28°
SN-OP	20°	16°
OP-PP	14°	12°
OP-MP	16°	16°
Interincisal angle	119°	131°
IMPA	90°	86°
U1-NA (angulation)	28°	18°
L1-NB (angulation)	28°	26°
U1-NA (linear) (mm)	+7	+4.5
L1-NB (linear) (mm)	+8	+6
U1-SN	113°	100°
Y-axis	58°	58°
S-line to upper LIP	+8	+3
S-line to lower LIP	+8	+5
E-line to upper LIP	+5	+1.5
E-line to lower LIP (mm)	+7	+3.5

Figure 1: Pre-treatment extraoral frontal photograph shows increased incisal display at rest.

Figure 2: Pre-treatment lateral cephalogram.

Treatment plan

The presence of crowding and proclination dictate extraction of first premolars in maxillary arch and second premolars in a mandibular arch with fixed appliance. High pull headgear and soldered transpalatal arch are used to control maxillary growth and molar position, respectively.

Treatment alternatives

Extraction of first premolars in maxillary arch and proximal slicing in the lower arch. Here, end on end molar is changed into full cusp Class II molar relation. In this treatment plan, retraction of maxillary anterior teeth is limited by lower anterior segment and leveling of the curve of spee also difficult.

Treatment progress

After extraction of first and second premolar in maxillary and mandibular arch, 0.002 slot MBT brackets were bonded in maxillary and mandibular arch. The soldered transpalatal arch was cemented to maxillary first molar. Initially, alignment and leveling were begun with 0.014 nickel titanium wire. The arch wires were sequentially changed such as 0.016, 0.017 × 0.025, 0.019 × 0.025 nickel titanium, and 0.019 × 0.025 stainless steel. The separate canine retraction was begun in an upper arch with elastomeric chain engaged from 13 to 16 and 23 to 26. En mass retraction was begun in a lower arch with elastomeric chain engaged from 36 to 46. After completion of canine retraction, the upper arch was segmented into two posterior areas and one anterior area. The 0.019 × 0.025 stainless steel archwire was sectioned in between lateral and canine region, sectioned wires were retained from canine to molar region, and anterior wire was removed.

Burstone three piece intrusion arch consist of two cantilever coil spring made of 0.017 × 0.025 β-titanium alloy wire, 0.019 × 0.025 stainless wire extends from lateral to lateral incisor with vertical steps and elastomeric chains. The vertical step anterior wire was ligated with stainless steel wire from lateral incisor into lateral after that cantilever spring was inserted into the auxiliary maxillary first molar buccal tube. The spring was pulled downward and engaged into the anterior segment before that force was calculated with Corex gauge. The elastomeric chain was engaged from maxillary hook to anterior segment for retraction purpose. After 6 months period, the true intrusion was achieved (Figure 3).

Along with three piece patient asked to wear high pull headgear also, this would counteract the molar tip back movement which may result in the opening of the bite. After correction of dental treatment, the patient asked to continue high pull headgear with orthopedic force to restrict the growth of maxilla in the anteroposterior direction. The space closure was completed in a lower arch with en mass method. At the end of active treatment, case was debonded and lower bonded lingual retainer from canine to canine and upper Begg's retainer were given.

Treatment results

The end treatment results showed class I molar and canine relation, ideal overjet and overbite, competent lips, and decreased incisal display at rest and smile (Figure 4). The post-operative orthopantogram reveals parallel roots without any significant root resorption of upper anterior teeth. The post-operative lateral cephalogram reveals mild restriction in the growth of maxilla, maintaining the mandibular plane angle, decreased interincisal angle, decreased protrusion of lips (Table 1). True intrusion of upper incisors was very well appreciated in post-operative lateral cephalogram (Figure 5).

Discussion

Absolute intrusion, relative intrusion, and extrusion of posterior teeth are the three methods used for deep overbite correction. Relative intrusion is achieved by preventing the eruption of the lower incisor while ramal growth provides vertical space into which the posterior teeth erupt, whereas in extrusion of the posterior of teeth mandible rotates down and back in the absence of growth. As a general rule, extrusion is undesirable, while relative intrusion is acceptable during growing stage and absolute intrusion in non-growing stage.[5]

In low angle cases with deep bite, bite opening with molar eruption is usually desired, whereas in high angle cases with a deep overbite, bite opening should be carried out with upper and lower anterior teeth intrusion. Clinically intrusion is a difficult movement to achieve, and it requires three dimensional controls. Intrusion mechanics basically depend on the initial inclination of the incisor. Clinically pure bodily intrusion is difficulty owing to the complexity of the movement. A slight change in the relationship of the line of action of the force with the center of resistance can change the type of movement. If the forces passes anterior to the center of resistance the incisor protrude, which can be prevented with a light chain elastic.[2] Leveling by intrusion can be accomplished with continuous archwires that bypass the premolar and segmented archwires with auxiliary depressing arch.[5] Anchor bends in Begg's technique and Rickett's utility arch are example for the continuous method.[7,8] Burrstone three piece intrusion and mini-implant assisted intrusion are an example for the segmented method.

Difficulty in controlling posterior anchorage and application of intrusive force through center of resistance are the two limiting factors in continuous archwire method.[5] This

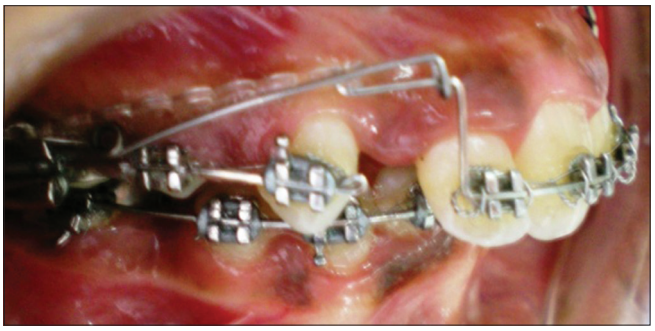

Figure 3: Burstone three piece intrusion appliance in the maxillary arch.

Figure 5: Post-treatment lateral cephalogram.

Figure 4: Post-treatment extraoral frontal photograph shows competent lips.

Figure 6: Superimposition of pre-treatment and post-treatment cephalometric tracings.

limitation can be easily controlled in segmented method and skeletal anchor. In the segmented arch technique, amount of forces and moments are predictable or statically determinate. Meta-analysis in non -growing patients showed that the segmented arch technique can produce 1.5 mm of true incisor intrusion in the maxillary arch and 1.9 mm in the mandibular arch.[9] Micro-implant provides good anchorage support and for absolute incisor intrusion in both the maxilla and mandible.[1,5]

The key to successful intrusion is light continuous force directed toward the tooth apex. The low force also helps in minimizing root resorption. Approximately, 10 g of force per tooth is used for intrusion. The reactionary molar distal tipping and extrusion may occur due to intrusive force in anterior segment.[5,6,10] The molar extrusion rotates the mandible downward and backward which results in an increase of lower anterior facial height and worsening of the incisor lip relationship and soft tissue profile. The occlusal forces normally cannot compensate for this bite opening because high angle individuals have relatively weak chewing muscles. Combination of high pull headgear and transpalatal arch very well control the molar movements in all the planes.[11] So, in our case burstone three piece intrusion arch was selected for absolute intrusion of upper anterior teeth along with high pull headgear and transpalatal arch.

The cephalometric superimpositions revealed mild restraint in the growth of maxilla and a slight increase in the downward and forward advancement of the mandible. The maxillary first molars were slightly extruded and moved mesially. The maxillary incisors were tipped palatally and intruded. The mandibular molars were slightly extruded and mesially moved. The mandibular incisors were moved bodily and intruded. The cephalometric superimpositions and analysis confirmed that deep overbite correction was done by absolute intrusion (Figure 6).

Conclusion

Optimal correction of deep overbite requires proper diagnosis, treatment planning, and efficient execution of treatment mechanics. A careful combination of treatment planning and biomechanics to correct deep overbite can help to achieve a desirable esthetic result and to minimize relapse during the post-retention phase.

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