

## RESEARCH ARTICLE

# A Modified Three-piece Base Arch for *en masse* Retraction and Intrusion in a Class II Division 1 Subdivision Case

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## ABSTRACT

This case report describes the orthodontic and orthopedic treatment of an 18-year-old male patient who presented with prognathic maxilla, deep bite, low mandibular plane angle, and proclined incisors. Modified three-piece base arch was used for the intrusion and retraction of maxillary incisor. *En masse* retraction was achieved in 6 months. Reduced time for retraction was attributed to a single stage of retraction unlike Burstone three-piece intrusion base arch where canines are individually retracted followed by retraction of incisors. A modified utility arch was used in lower arch followed by a continuous archwire technique. The case was finished using bite settling elastics on a continuous archwire. The step between canine and premolar was corrected in the finishing phase of treatment. The final treatment outcomes were satisfactory and true intrusion was achieved with proper selection of biomechanics.

**Keywords:** Biomechanics, Intrusion, Segmental mechanics, Three-piece base arch.

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## INTRODUCTION

In majority of orthodontic cases, routine treatment protocol has been applied. In few special cases rather than conventional protocol, we need to choose different treatment mechanics. The "segmental mechanics" is very efficient in case of anterior crowding with deep overbite cases and flared incisors.<sup>1</sup> This study describes a modified three-piece base arch for simultaneous deep bite correction and *en masse* retraction. In case of severe anterior crowding, increased overbite, and horizontal growth pattern, the treatment with full arch alignment

stage directly is difficult.<sup>2</sup> Since uprighting of incisors often lengthens the crown vertically and increases the amount of overbite,<sup>3</sup> the use of segmental mechanics can be taken to get satisfactory results.<sup>1,4,5</sup>

## CASE REPORT

The present case report showcases the treatment results and biomechanics involved for *en masse* retraction and intrusion of anterior teeth using a modified three-piece base arch.

## DIAGNOSIS AND TREATMENT PLAN

An 18-year-old male patient in permanent dentition presented with the chief complaint of crowded, overlapping, and forwardly placed anterior teeth. He had a class II Division 1 subdivision malocclusion (Figs 1 to 5). The mandibular midline had shifted 2 mm to the right of the facial midline (Fig. 2). Cephalometric analysis indicated a prognathic maxilla and normal mandible with upper and lower incisor flaring. Patient had a horizontal growth pattern and a reduced lower anterior facial height (Table 1). The overjet was 4.5 mm, and the overbite was 40%. A class I molar relation on the right side and a class II molar relation on left side was diagnosed as a class II division 1 subdivision case. A class II canine relation was present on the right side (Fig. 1).

Following a comprehensive clinical and database analysis, we devised a treatment plan involving extraction



Fig. 1: Pretreatment intraoral right lateral view

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Fig. 2: Pretreatment intraoral frontal view



Fig. 3: Pretreatment intraoral left lateral view

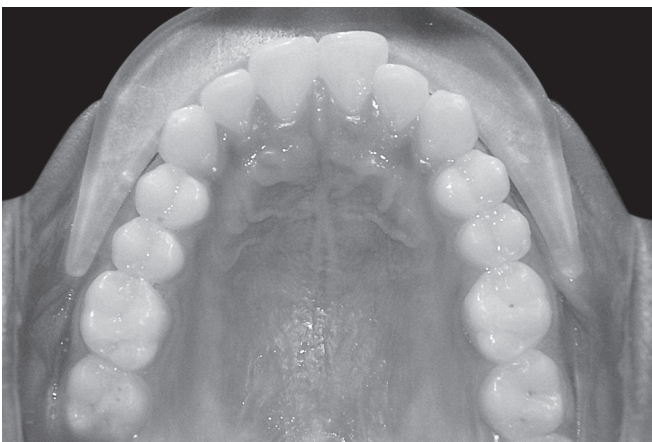


Fig. 4: Pretreatment intraoral maxillary occlusal view

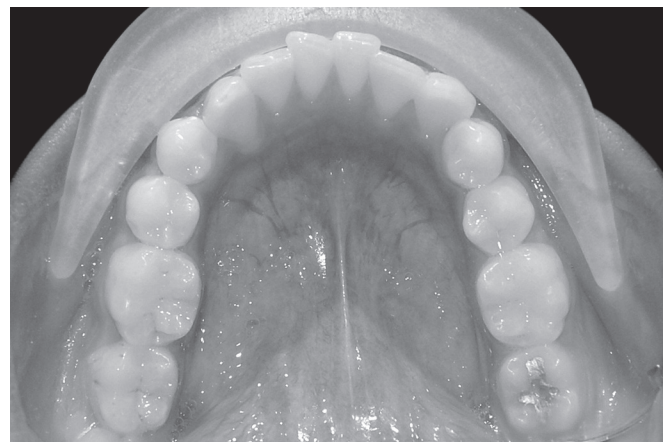


Fig. 5: Pretreatment intraoral mandibular occlusal view

Table 1: Pre-post Treatment Cephalometric Values

	Pretreatment	Posttreatment
SNA	86°	84°
SNB	82°	82°
ANB	4°	2°
Angle of convexity	9°	4°
Wits AO/BO	2 mm	2 mm
FMA	22°	22°
SN-GO-GN	24°	26°
Y-axis	59°	59°
Jarabak's ratio	70.7%	72.32%
LAFH	59 mm	61 mm
Gonial angle	120°	121°
Base plane ang.	15°	16°
U1 to NA angle	40°	25°
U1 to NA linear	9 mm	4 mm
U1 to FH	130°	118°
U1 to SN	126°	113°
L1 to NB angle	40°	26°
L1 to NB linear	8 mm	4 mm
Interincisal angle	96°	124°
Nasolabial angle	99°	105°
"S" line to upper lip	2 mm	-1 mm
"S" line to lower lip	4 mm	0 mm
Lower lip to E-line	3 mm	1 mm

of the upper first premolars, lower left first premolar, and lower right second premolar to achieve a symmetrical buccal occlusion, midline correspondence, appropriate overjet, and adequate retraction of the flared upper and lower incisors. Asymmetric extraction also helped achieve a class I canine and molar relation on the subdivision side.

### TREATMENT PROGRESS

Full-arch 0.022" appliances were bonded, and leveling and alignment were carried out with continuous 0.016" heat-activated nickel titanium archwire (Fig. 6). Laceback and bendback were used. All the second molars were banded to increase the anchorage value of posteriors. This was followed by a 0.019" 0.025" heat-activated nickel titanium wire (Fig. 7). Once the arches were aligned, a segmental approach was used to retract the anterior segment *en masse*. A different approach was used in upper as well as lower arch. A modified three-piece base arch was used in the upper arch.

### Anterior Segment

The rigid anterior segment consisted of a 0.021" 0.025" stainless steel wire placed into the brackets of the incisors





Fig. 6: Continuous 0.016" heat-activated nickel titanium archwire

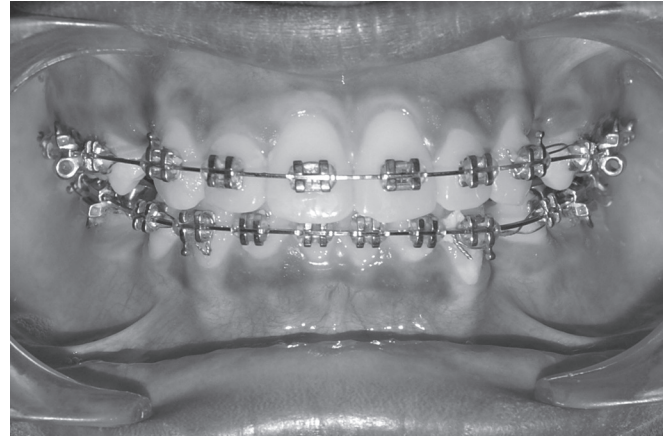


Fig. 7: 0.019" × 0.025" heat-activated nickel titanium wire

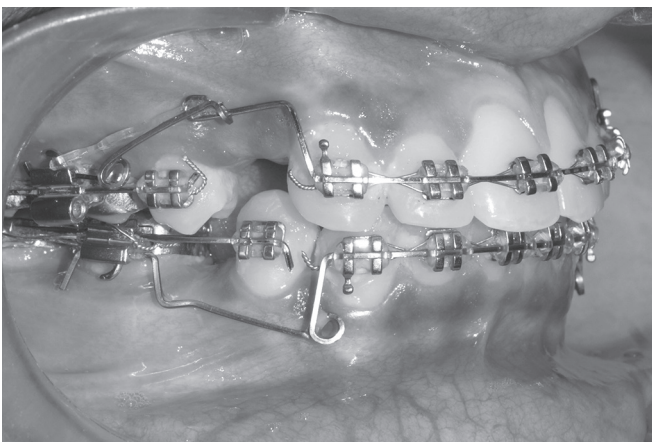


Fig. 8: Modified three-piece base arch – right lateral view



Fig. 9: Modified three-piece base arch – left lateral view

and canines bilaterally and stepped up gingivally distal to the canine brackets. The wire was then again bent to 90° slightly below the center of resistance. The angled posterior segment allows the intrusive and retraction force to pass through the center of resistance such that a complete bodily movement of the incisors could be achieved. The posterior extensions were adapted such that no soft tissue impingement was created (Figs 8 to 10).

### Posterior Segment

The posterior segments were consolidated bilaterally from first premolar to second molar using a passive stabilizing 0.021" × 0.025" stainless steel wire (Figs 8 to 10).

### The Intrusion Spring

The bilateral intrusion spring were made of 0.017" × 0.025" titanium molybdenum alloy (TMA) wire. The tip back bends were incorporated mesial to the auxiliary tube on the maxillary first molars and the springs were inserted into the tube. The hooks which place an intrusion force on the anterior extension were engaged on the posterior extension of the anterior segment at a point distal to canine (Figs 8 to 10).

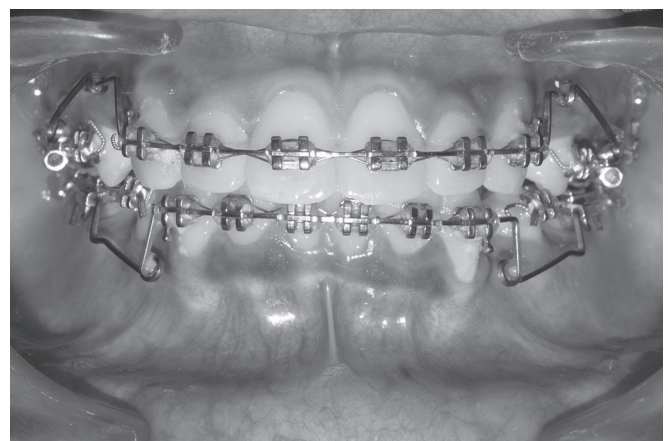
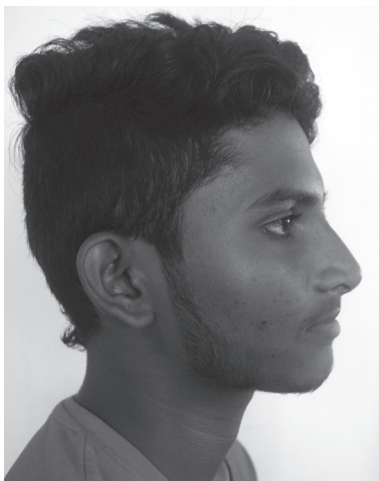


Fig. 10: Modified three-piece base arch – frontal view

### Distal Force Component (Elastic Chain)

An elastic chain is extended bilaterally from the molar hook to the posterior hook of the anterior segment. This small distal force directs the intrusive force so its line of action of force passes through the center of resistance of the anterior segment. A tip back moment is generated on the posterior segment. The anterior segment was retracted as a result of small tip back moment



**Fig. 11:** Continuous arch wire in lower arch after achieving a class I molar relation



**Fig. 12:** Continuous arch wire – left lateral view

created. *En masse* retraction was completed in 6 months (Figs 8 to 10).

For the lower arch, a modified intrusion and retraction utility arch was used, which consisted of incisors and canine made of 0.017" 0.025" TMA wire. The utility arch was inserted in the auxiliary tube of the first molars bilaterally. Posterior segment consisted of segments from second premolar to second molar on the left side (Fig. 10) and from first premolar to second molar on the right side (Fig. 8). The curve of Spee was corrected by the tip back moment from the utility arch. An e-chain was used from lower right first molar to first premolar to convert the subdivision side to class I molar relation before retraction. After achieving a class I molar on the subdivision side, a continuous arch wire with friction mechanics was used to complete the case (Figs 11 and 12).

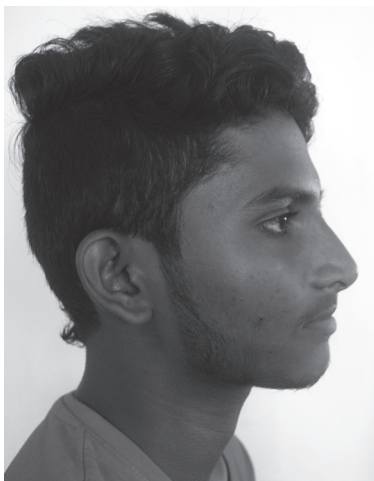
## DISCUSSION

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 teeth mandible rotates down and back in the absence of growth.<sup>6</sup> As a general rule, extrusion is undesirable, while relative intrusion is acceptable during growing stage and absolute intrusion in nongrowing stage.<sup>6</sup> Bite opening with molar eruption is usually desired in low angle cases with deep overbite, whereas in high angle cases with a deep overbite, bite opening should be carried out with upper and lower anterior teeth intrusion.<sup>7</sup> 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 difficult 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.<sup>8</sup> If the forces pass anterior to the center of resistance of the incisor protrude, it can be prevented with a light chain elastic.<sup>7</sup> Leveling by intrusion can be accomplished with continuous archwire that bypasses the premolar and segmented archwire with auxiliary depressing arch.<sup>6</sup>

The key to successful retraction and intrusion is light continuous force directed through the center of resistance of the anterior segment.<sup>3</sup> The low force also helps in minimizing root resorption. Approximately, 10 gm of force per tooth is used for intrusion. The reactionary molar distal tipping and extrusion may occur due to intrusive force in anterior segment.<sup>6,7,9</sup> 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 can compensate for this bite opening because low angle individuals have relatively strong chewing muscles. So, in our case, modified three-piece base arch was selected for intrusion and retraction of upper anterior teeth. The cephalometric superimpositions revealed mild restraint in the growth of maxilla and a slight increase in the downward and forward advancement of the mandible (Fig. 13). The maxillary first molars were slightly extruded and moved mesially. The maxillary incisors were translated palatally and intruded. The mandibular molars were slightly extruded and mesially moved. The mandibular incisors were moved bodily and intruded. The end treatment results showed class I molar and canine relation, ideal overjet and overbite (Figs 14 to 18), competent lips, and decreased incisal display at rest and smile. The postoperative orthopantomogram reveals parallel roots without any significant root resorption of upper





**Fig. 13:** Pretreatment and posttreatment superimposition



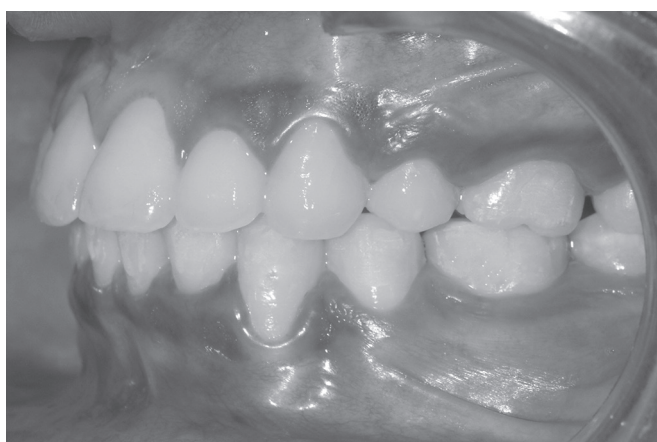
**Fig. 14:** Posttreatment intraoral right lateral view



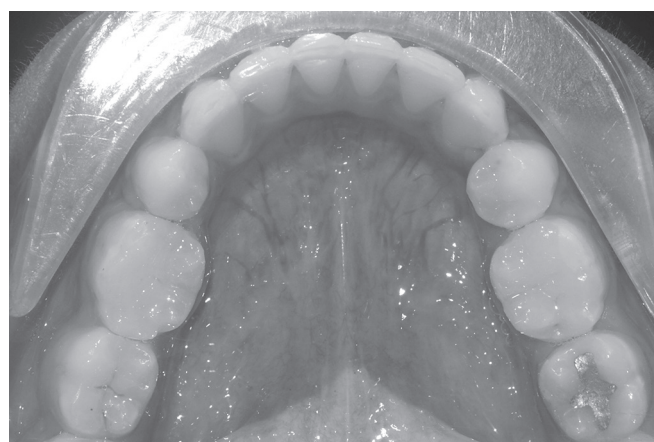
**Fig. 15:** Posttreatment intraoral left lateral view



**Fig. 16:** Posttreatment intraoral frontal view



**Fig. 17:** Posttreatment intraoral maxillary occlusal view



**Fig. 18:** Posttreatment intraoral mandibular occlusal view

anterior teeth (Fig. 19). The postoperative cephalometric values reveal mild restriction in the growth of maxilla, maintaining the mandibular plane angle, decreased interincisal angle, and decreased protrusion of lips (Table 1). Comparing the pretreatment extraoral photographs (Figs 20 to 24) with posttreatment extraoral

photographs (Figs 25 to 29), a significant improvement was seen in smile line, smile arc, lip competency, and profile.

### CLINICAL SIGNIFICANCE

Simultaneous retraction and intrusion with three-piece base arch proves to be an efficient treatment mechanics



**Fig. 19:** Posttreatment orthopantomogram



**Fig. 20:** Pretreatment extraoral frontal view



**Fig. 21:** Pretreatment extraoral frontal smile view



**Fig. 22:** Pretreatment extraoral oblique view



**Fig. 23:** Pretreatment extraoral oblique smile view



**Fig. 24:** Pretreatment extraoral right lateral profile view

in terms of time. Unlike the traditional three-piece base arch where a staged retraction in two stages was done, the modified base arch for *en masse* retraction does not require the canines to be retracted first. Also, since canines receive an intrusion force along with incisor, the roots are placed more in the cancellous bone and the interference from

lower canine in the class II side is avoided. This accelerates the *en masse* retraction.

## CONCLUSION

A careful combination of treatment planning and biomechanics to correct deep overbite and proclined inci-



**Fig. 25:** Posttreatment extraoral frontal view



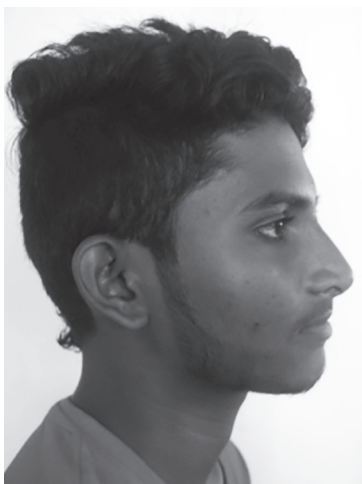
**Fig. 26:** Posttreatment extraoral frontal smile view



**Fig. 27:** Posttreatment extraoral oblique view



**Fig. 28:** Posttreatment extraoral oblique smile view



**Fig. 29:** Posttreatment extraoral right lateral profile view

sors can help to achieve a desirable esthetic result. The modified three-piece base arch is effective in controlled translation and intrusion of anteriors and would be a preferable mechanotherapy in low angle case with deep bite, proclined anteriors, and class II canine relationship.

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