Case Series

Treatment Outcomes in the Sagittal and Vertical Dimensions with the AdvanSync2 Class II Corrector—A Case Series

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ABSTRACT

Class II malocclusions are challenging to treat especially when associated with a skeletal component of either maxillary protrusion, mandibular retrusion or combinations. Use of fixed functional Class II correctors is the treatment of choice in cases of Class II div 1 malocclusions with a retrusive mandible during the growth phase. The AdvanSync2 Class II corrector is the latest in a long series of fixed functional appliances introduced over the years. Literature relating to its efficacy is scarce, especially in the Indian context due to its recent introduction. Four case reports of patients treated with the AdvanSync2 Class II corrector and the findings observed in the sagittal and vertical dimensions are presented. The findings are similar to most fixed functional appliances except treatment duration which is reduced in all cases.

Key words: AdvanSync2, Class II corrector, cephalometrics, modified Herbst.

INTRODUCTION

Management of Class II malocclusions is a challenge for most orthodontists due to the variable nature of the problem and multifactorial etiology.[1] Class II malocclusions may or may not always be associated with a skeletal component.[2] Treatment depends on the age of the patient, type of malocclusion(div1, div2, subdivisions) and presence or absence of a skeletal component. In the Indian scenario, orthodontists are usually confronted with Class II div 1 malocclusions with a component of mandibular retrusion. Class II malocclusions with mandibular retrusions are deemed more common than those exhibiting maxillary prognathism.[3] Use of functional appliances has been advocated for patients with Class II malocclusion associated with mandibular retrusion in the growing years.[4-7] Mandibular retrusion, if left uncorrected, tends to worsen during the pubertal growth spurt and remains the same until adulthood.[8] The prevalence of Class II malocclusion in India is around 14.6% in the age groups between 10 and 13 years when most patients present to the orthodontist for correction.[9] The preferred approach to management of patients with Class II malocclusion with a retrusive mandible is use of fixed Class II correctors in conjunction with fixed orthodontic appliances to reduce treatment time and improve patient compliance. Removable functional appliances like twin blocks are generally used in younger patients who are yet to reach the pubertal growth spurt. A study by Baccetti[10] et al indicated that more skeletal changes with use of functional appliances could be expected when treatment is initiated just before peak as compared to after the onset of the pubertal growth spurt.

The Herbst appliance was introduced in the 19th century for keeping the mandible in a constantly protruded forward position.[5,11] The change in molar relationship from Class II to Class I has both skeletal and dental components.[4,5,11] Minimum skeletal changes have also been noticed after use of the Herbst appliance in patients who had passed their pubertal growth spurt.[6,11,12] However, case selection remains of paramount importance as results could vary when similar appliances are used at different times. The AdvanSync2 Class II corrector is a recently introduced fixed functional appliance. It was modeled on the original Herbst but has a much smaller size, is easier to place, activate and remove and most importantly, can be used in conjunction with full arch fixed appliances throughout. There is no need to level and align both arches and use heavy stainless steel stabilizing wires prior to placement of the Class II corrector like in conventional fixed functionals. As a result, residual growth can be better utilized with overall treatment times being reduced.[13] Most of the orthodontics can be completed along with simultaneous orthopaedic correction which helps reduce overall treatment time by a few months.

The AdvanSync2 corrector works like a modified Herbst appliance. It supposedly gives greater skeletal change as compared to other similar fixed functional appliances due to its similarity with the original Herbst. The Herbst appliance in conjunction with Edgewise brackets produced greater skeletal change with glenoid fossa remodeling. The results were stable long term.[14,15] Ease of use of the AdvanSync2 with ability to place fixed appliances at the beginning of treatment to reduce overall treatment time was the primary factor for us in selection of the appliance. Four Class II division 1patients exhibiting mandibular retrusion both pre and post pubertal were treated with AdvanSync2 with good results.

CASE REPORT 1

A 14-year post pubertal female patient reported with the complaint of unappealing facial appearance. She had a convex profile, obtuse nasolabial angle and a deep mentolabial sulcus **(Figure 1A)**. She exhibited a Class II skeletal and dental malocclusion due to a retrognathic mandible with SNB reduced to 77°, ANB of 5°, FMA 21° and lower anterior facial height of 51 mm **(Table 1)**. Intraorally, mild to moderate crowding and slight rotations were present in the upper arch with increased overjet of 9 mm, 6.5 mm of overbite and bilateral Class II molar and canine relationship **(Fig 1B)**. The VTO was positive. The case was planned to be treated non-extraction with a fixed functional appliance in order correct the dental and skeletal sagittal discrepancy. An AdvanSync2 Class II corrector(Ormco Corp, Glendora, Calif) was placed in the first appointment with Damon 3MX (Ormco, Glendora, Calif)self ligating brackets. **(Figure 2)**. Initial arch wires were 0.013″ CuNiTi in both arches for leveling and aligning. The archwires were changed every 10 weeks.The AdvanSync2 appliance was reactivated by 2 mm thrice during therapy .A Class I skeletal and dental relation was achieved in 9 months time **(Figure 3)**. At the end of the functional phase, the arch wires were 18 × 25 CuNiTi in both arches. Post-functional cephalometric analysis revealedan improved ANB angle of 2°, FMA 25°, slight increase in lower anterior facial height at 55mm and reduced skeletal convexity to 2 mm **(Table 1, Figures 4 and 5)**.

Since a majority of tooth movement was completed along with the functional phase, treatment duration also was significantly shortened. The remainder of treatment took an additional 5 months with the patient presently in retention with an upper removable wraparound retainer and a lower canine to canine lingual bonded retainer. Total treatment time was 14 months.

Figure 1 (A) Pretreatment extraoral photographs. (a) Frontal at rest, (b) frontal smiling, (c) profile (d) VTO. (B) Pretreatment intraoral photographs. (a) Right lateral, (b) frontal, (c) left lateral

Table 1

Case1—Pre- and post-treatment cephalometric data

Cephalometric Analysis		
Variable	*Pre-treatment*	*Post-treatment*
SNA	82°	81°
SNB	77°	79°
ANB	5°	2°
FMA	21°	25°
IMPA	109°	112°
LAFH	51mm	55°
Nasolabial angle	119°	111°
Skeletal convexity	4mm	2mm

Figure 2 Initial strap up (Damon 3MX) with simultaneous placement of AdvanSync molar to molar appliance

Figures 3A and B (A) Post-functional extraoral photographs. (a) Frontal at rest, (b) frontal smiling, (c) profile. (B) Post-functional intraoral photographs. (a) Right lateral, (b) frontal, (c) left lateral

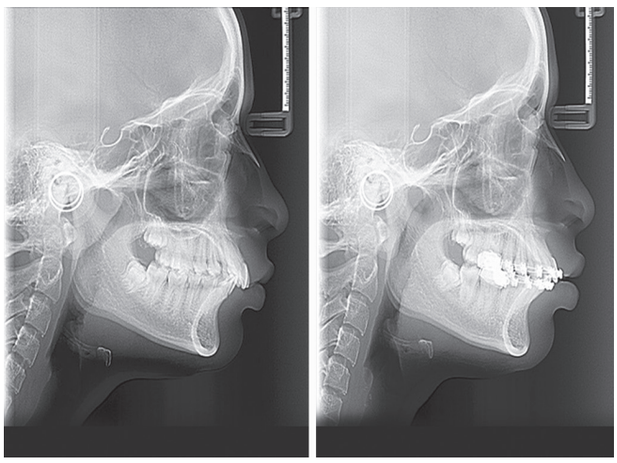


Figure 4 Comparison of pre-treatment and post-functional cephalograms

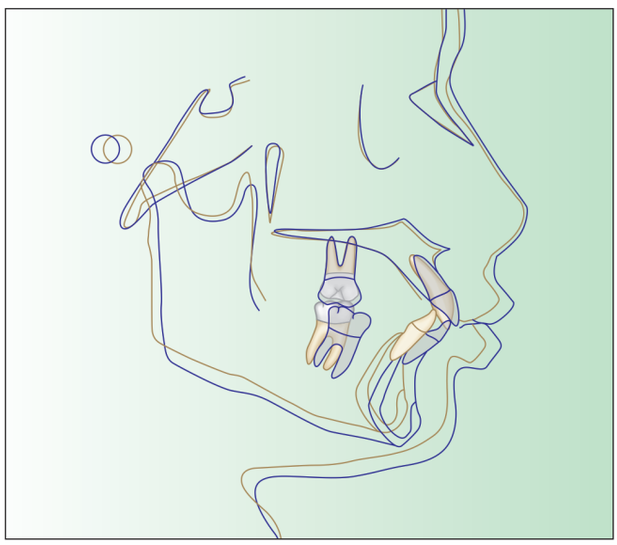


Figure 5 Pre-treatment and post functional superimposition

CASE REPORT 2

A 17 year old post pubertal male patient reported with a chief complaint of irregularly placed upper front teeth. On clinical examination, he had a convex profile an obtuse nasolabial angle and competent lips **(Figure 6A)**. On intra-oral examination, midline diastema was observed in the upper arch with severe crowding and a blocked out 41 in the mandibular arch. He had an end on molar relation bilaterally with an overjet of 12 mm and an overbite of 7 mm **(Figure 6B)**. Cephalometric analysis revealed skeletal convexity of 4mm, a retrognathic mandible with SNB at 75°, ANB increased to 6°, FMA at 24°, lower anterior facial height of 62 mm and an IMPA of 96° **(Table 2)**. The VTO was positive.

Figures 6A and B (A) Pretreatment extraoral photographs. (a) Frontal at rest, (b) frontal smiling, (c) profile (d) VTO. (B) Pretreatment intraoral photographs. (a) Right lateral, (b) frontal, (c) left lateral

Table 2

Case 2—Pre- and post-functional cephalometric data

Cephalometric Analysis		
Variable	*Pre-treatment*	*Post-functional*
SNA	81°	80°
SNB	75°	79°
ANB	6°	1°
FMA	24°	27°
IMPA	96°	101°
LAFH	62mm	66°
Nasolabial angle	149°	140°
Skeletal convexity	4mm	6mm

Figure 7 Initial strap up (Damon 3MX) with simultaneous placement of AdvanSync molar to molar appliance

The case was managed nonextraction using Damon 3MX self ligating appliances with simultaneous placement of an AdvanSync2 Class II corrector for mandibular retrusion **(Figure 7)**. After 9 months, the patient exhibited a stable Class I molar relation bilaterally with ideal overjet and overbite **(Figure 8)**. Post-functional cephalometric analysis showed an improved ANB angle of 1°, FMA 27° and slight increase in lower anterior facial height to 66 mm **(Table 2)**. The blocked out lower incisor was aligned after space creation with an open coil spring. There was significant profile improvement **(Figures 9 and 10)**. Fixed appliance therapy will complete in an additional 6 months.

CASE REPORT 3

A 14-year-old prepubertal male patient reported with the complaint of forwardly placed upper front teeth and desired treatment for the same. On clinical examination, he had a convex profile and an obtuse nasolabial angle with incompetent lips. On intra-oral examination, 33 was impacted with retained 73 **(Figures 11A and C)**. He had Class II skeletal base and Class II molar relation bilaterally with an overjet of 15 mm and an overbite of 6 mm **(Figure 11B)**. Cephalometric analysis revealed skeletal convexity of 3 mm, a retrognathic mandible with SNB at 77°, ANB increased to 7°, FMA at 25°, lower anterior facial height at 50 mm and an IMPA of 97° **(Table 3)**. The VTO was positive.

Anon extraction approach to treatment was initiated using Mini Twin MBT fixed appliances (Ortho Organizers) with simultaneous placement of an AdvanSync2 Class II corrector **(Figure 12)**. Activation of the AdvanSync2 by 2 mm was done by shifting the screwfrom the lower mesial housing to the distal housing after 3 months producing 2 mm activation. C spacers were used for subsequent activations to correct the overjet to 2 mm. After 8 months of Class II corrector use, the patient exhibited a Class I molar relation bilaterally **(Figure 13)**. Post-functional cephalometric changes showed an improved ANB of 2°, FMA at 27° and slight increase in lower anterior facial height to 52 mm **(Table 3, Figures 14 and 15)**. Fixed appliance therapy will complete in an additional 6 months.

Figure 8 (A) Post-functional extraoral photographs. (a) Frontal at rest, (b) frontal smiling, (c) profile. (B) Post-functional intraoral photographs. (a) Right lateral, (b) frontal, (c) left lateral

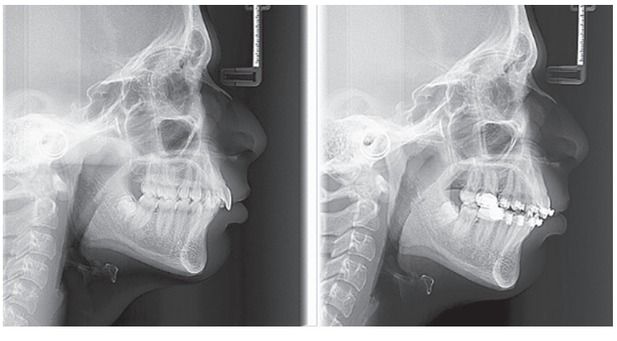


Figure 9 Comparison of pre-treatment and post-functional cephalograms

CASE REPORT 4

An 18 year old post pubertalfemale reported with the complaint of malaligned and small teeth in the lower jaw. On clinical examination, she had a convex facial profile, obtuse nasolabial

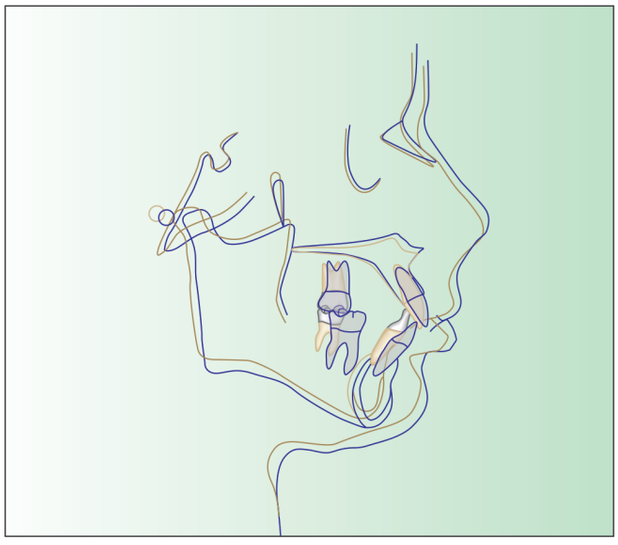
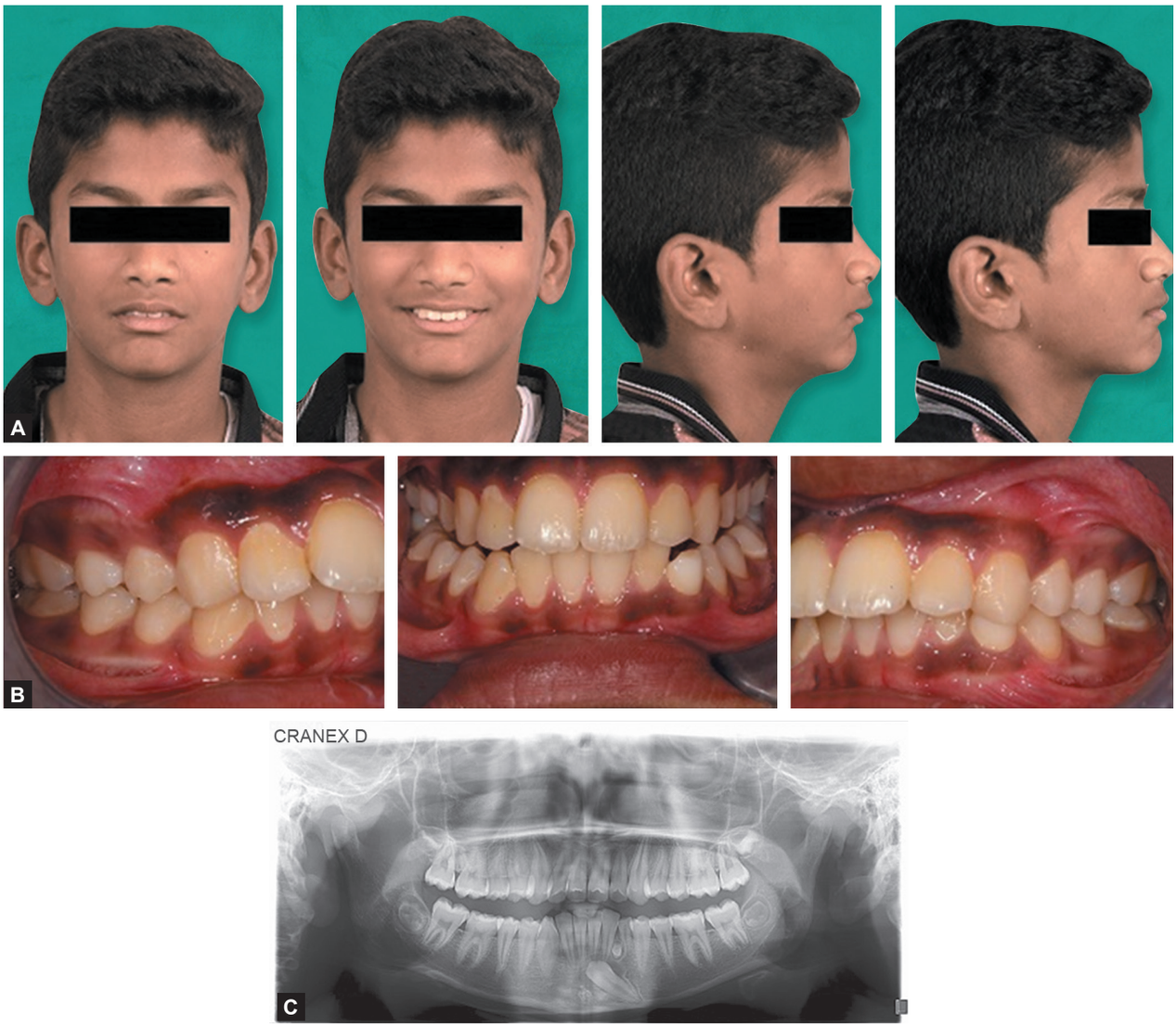


Figure 10 Pre-treatment and post functional superimposition



Figures 11A to C (A) Pretreatment extraoral photographs. (a) Frontal at rest, (b) frontal smiling, (c) profile (d) VTO. (B) Pretreatment intraoral photographs. (a) Right lateral, (b) frontal, (c) left lateral (C) Pretreatment OPG

Table 3

Case 3—Pre- and post-functional cephalometric data

Cephalometric Analysis		
Variable	*Pre-treatment*	*Post-functional*
SNA	84°	82°
SNB	77°	80°
ANB	7°	2°
FMA	25°	27°
IMPA	97°	103°
LAFH	50mm	52°
Nasolabial angle	117°	111°
Skeletal convexity	3mm	1mm

Figure 12 Placement of AdvanSync appliance

Figures 13A and B (A) Post-functional extraoral photographs. (a) Frontal at rest, (b) frontal smiling, (c) profile. (B) Post-functional intraoral photographs. (a) Right lateral, (b) frontal, (c) left lateral

angle and a retrusive chin **(Figure 16A)**. Intra-oral examination revealed anterior teeth with spacing and rotations with retained 71 and 81. 31 and 41 were congenitally missing **(Figure 16B)**.

She exhibited a Class II skeletal pattern due to a retrognathic mandible with SNB reduced to 77°, ANB angle increased to 7°, FMA at 24° and lower anterior facial height of 65 mm **(Table 4)**. She had an overjet of 7 mm with 6 mm of overbite and a bilateral Class II molar and canine relation **(Figure 16B)**. The VTO was positive.

Use of a fixed Class II corrector was planned in this case even though the patient was several years post pubertal. Self ligating appliances (Damon Q) were used for the dental cor-

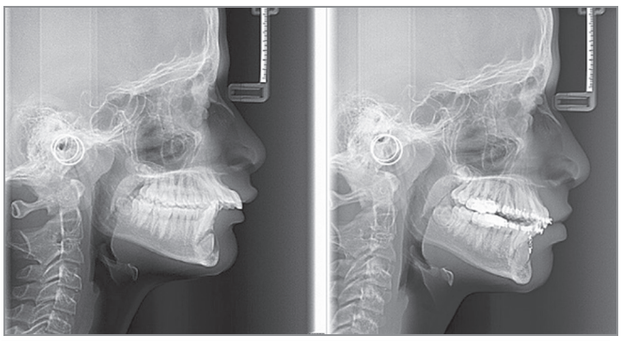


Figure 14 Comparison of pre-treatment and post-functional cephalograms

Figure 15 Pre-treatment and post-functional superimposition

rections in conjunction with an AdvanSync2 Class II corrector **(Figure 17)**. The functional phase was carried out for 7 months and an ideal overjet and overbite with a bilateral Class I relation was obtained in that time **(Figure 18)**. C spacers were used for activation. Post-functional cephalometric analysis showed an improved ANB of 3°, FMA at 27°, and slight increase in the lower anterior facial height to 68 mm with reduced skeletal convexity at 3 mm **(Table 4, Figures 19 and 20)**. The AdvanSync2 was removed and fixed appliance therapy is currently in progress with treatment expected to finish in 15 months.

DISCUSSION

Functional appliances in general, correct Class II malocclusion by a combination of skeletal and dental changes. The degree of skeletal or dental change is usually difficult to quantify.

Figures 16A and B (A) Pretreatment extraoral photographs. (a) Frontal at rest, (b) frontal smiling, (c) profile (d) VTO. (B) Pretreatment intraoral photographs. (a) Right lateral, (b) frontal, (c) left lateral

Table 4

Case 4—Pre- and post-functional cephalometric data

Cephalometric Analysis		
Variables	*Pre-treatment*	*Post-functional*
SNA	84°	82°
SNB	77°	79°
ANB	7°	3°
FMA	24°	27°
IMPA	102°	115°
LAFH	65mm	68mm
Nasolabial angle	119°	107°
Skeletal convexity	7mm	3mm

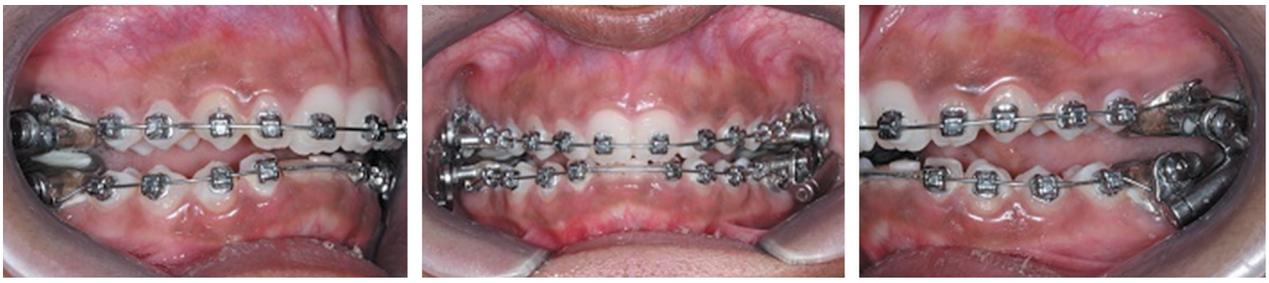


Figure 17 Initial strap up (Mini Twin MBT fixed appliances) with simultaneous placement of AdvanSync appliance

Figures 18A and B (A) Post-functional extraoral photographs. (a) Frontal at rest, (b) frontal smiling, (c) profile. (B) Post-functional intraoral photographs. (a) Right lateral, (b) frontal, (c) left lateral

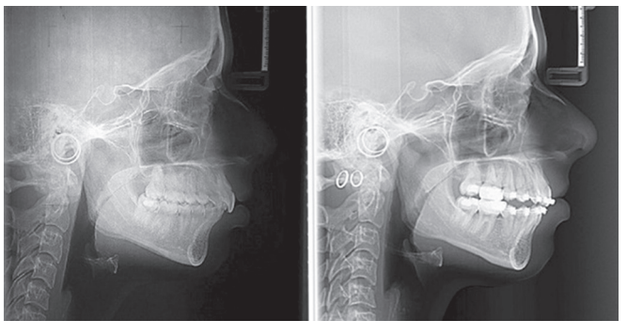


Figure 19 Comparison of pre-treatment and post-functional cephalograms

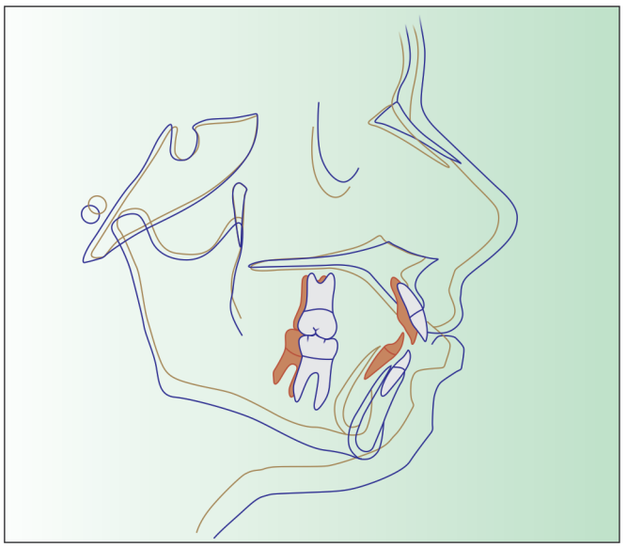


Figure 20 Pre-treatment and post-functional superimposition

However, if used correctly and for the proper duration, results achieved with fixed functional appliances have been found to be stable. Varied responses to treatment have been observed in patients exhibiting similar malocclusions.[16] The four patients treated with AdvanSync2 Class II correctors had ages ranging from 14-18 years. Results obtained were satisfactory in all cases. Functional appliances induce skeletal growth when used during the active growth periods before or during puberty or Peak Height Velocity.[17,18] With increasing age, changes are predominantly dentoalveolar rather than skeletal. The AdvanSync2 appliance produced satisfactory changes in all patients even though some had completed the pubertal spurt. As the appliance design has been modeled on the original Herbst, the findings in our patients are in accordance with Ruf and Pancherz who reported significant mandibular growth changes in patients past their Peak Height Velocities.[19] Maximum skeletal change can be expected when functional appliances are used during the circumpubertal stage of development.[20,21] Timing of the growth spurt in many individuals shows wide variation and may be difficult to accurately determine. A probable reason for the AdvanSync appliance working well in all cases could be that bite jumping was not delayed and the appliance was effective immediately on commencement of treatment unlike in other fixed functionals where heavy stainless steel arch wires would be required prior to appliance placement.Reduced treatment time with early sagittal discrepancy correction was associated with better patient motivation and oral hygiene maintenance.[22,23]

In all 4 cases treated with the AdvanSync2, the IMPA angulation increased post treatment. Proclination of the lower incisors is noticed on use of most functional appliances.[24] The AdvanSync2 appliance by its unique design of molar to molar attachments was expected to reduce lower incisor proclination since force vectors would not be directed anteriorly. However, this was not substantiated in our findings. All 4 patients exhibited some degree of post functional lower incisor proclination. A possible reason could be that heavy wires with labial root torque were not in place during the period of mandibular advancement to counteract the anterior vectors of force. In cases having residual growth, it would be beneficial to align the arches and place heavy dimension stainless steel or TMA arch wires with labial root torque incorporated prior to appliance activation to minimize lower incisor proclination to the greatest extent. Placement of miniscrews bilaterally in the lower arch distal to canines with the lower anterior segment connected could also be considered to prevent proclination.

The molar to molar attachment exerted a headgear like effect on the maxillary molars and prevented mesial movement to a great extent as evident from post treatment superimpositions. This is beneficial for obtaining a Class I molar relationship. The restriction on maxillary growth is similar to other studies on the Herbst appliance.[24-26] At the same time, mesial mandibular molar and lower incisor movement enabled correction of the Class II dentition to a Class I. SNB also increased post treatment as expected with relocation of the mandible in a sagittal direction.SNA also showed a reduction in all cases post treatment. These findings of maxillary growth restriction were similar to a study by Al-Jewairet al.[23]

Mandibular molar extrusion was not noticed in any of the cases treated. This could be attributed to the vertical force vector from the AdvanSync2 arms. Lower anterior facial height showed a mild increase in all 4 patients. This was probably due to extrusion of the maxillary molars. Increase in the lower facial height is beneficial in average to horizontal growth patterns. A systematic review and Meta analysis on stabil-

ity of cases treated with Class II correctors found that cases treated with the Herbst appliance were the most stable long term.[27] Most fixed functional appliances demonstrated good dentoskeletal stability. Since the AdvanSync2 appliance is an offshoot of the original Herbst, results can be expected to be stable.

The patients treated were of varying ages with pre and post pubertal subjects. No guidelines are available to help determine treatment protocols for individuals requiring functional appliance therapy. No differences exist between two phase or single phase therapy with results being almost the same.[28]

CONCLUSION

The AdvanSync2 Class II corrector was effective in normalizing Class II malocclusions with a mandibular deficiency component.

Maxillary growth restriction with a combination of mandibular molar mesialization and lower incisorproclinationoccured in all cases.

There was an increase in the FMA angle and lower anterior facial heights in all cases. This could beproblematic in vertical growth pattern patients.

Pre and post pubertal patients showed similar results which most likely are a combination of skeletal and dentoalveolar changes.

Use of fixed appliances with labial root torque in the lower anterior segments, cinch backs and heavy stabilizing wires with miniscrew anchorage[29,30] can reduce lower incisor proclination.

The AdvanSync2 Class II corrector enabled rapid correction of the Class II malocclusion with shortened treatment times.

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Conflicts of Interest

There are no conflicts of interest.

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