

AN EVALUATION OF DENTOFACIAL CHANGES IN ANGLE'S CLASS II DIVISION 1 PATIENTS USING ADVANSYNC 2

Sanshavi Ponnamma A R¹, Sunil Muddaiah², Goutham B³, Sanju Somaiah⁴, B K Shetty⁵

ABSTRACT

Objectives: The purpose of the study is to evaluate the dental and skeletal changes of Advansync 2 appliance, and to evaluate the soft tissue changes of Advansync 2 appliance using photometric analysis.

Methods: The sample size consisted of 15 patients who reported to the Department of Orthodontics, seeking fixed orthodontic treatment. The effects of Advansync 2 appliance were measured at two intervals.

Results: After the nine months, P-values were observed to be less than 0.5, therefore statistically significant for parameters such as SNA, CO-A, WITZ, CO-Gn, ANB, UI-A (degree), LI-B (mm), LL-E plane, Nasolabial angle, Mentolabial angle, Facial angle, and L lip to chin. P-values were however observed to be greater than 0.5, therefore statistically insignificant for parameters such as SNB, CO-Go, UI A(mm), LI B(mm), UL-EPL, H LINE, FMA, Nose tip angle, Nasofrontal angle, Nasomental angle, Upper lip angle, and U lip to chin.

Conclusions: AdvanSync 2 appliance brought about a change in Class II malocclusions through Co-Gn, Co-Go, ANB, FMA, UI-A (degree), UI A (linear) LI B (linear), UL-E plane, LL-E plane, H LINE, Nose tip angle,

Nasolabial angle, Mentolabial angle, Nasofrontal angle, Nasomental angle, Facial angle, Upper lip angle, U lip to chin, and L lip to chin after nine months of appliance delivery.

Main points:

- 1) Advansync 2 normalised class II by an increase in length and body of mandible.
- 2) Advansync 2 has a restraining effect on the growth of maxilla.
- 3) Advansync 2 brings about positive soft tissue changes.
- 4) The major disadvantage is proclination of the lower incisors.

Keywords: 3D Cephalometrics, Functional, Class II, Compliance

INTRODUCTION

For decades, orthodontic researchers have focused on the treatment of class II malocclusions. Several appliances, such as the Calibrated Force Module, Alpern Class II Closers, Saif Spring, and CS 2000 Class II Springs, are used as alternatives for intermaxillary Class II elastics, with coil springs put distal to the mandibular molars and mesial or distal to the maxillary canines. Another intermaxillary therapy option for growing patients with skeletal Class II division 1 malocclusion due to a retruded mandible is functional appliances. They

¹ Postgraduate student, Department of Orthodontics, Coorg Institute of Dental Sciences, Virajpet, Karnataka.

² Professor, Department of Orthodontics, Coorg Institute of Dental Sciences, Virajpet, Karnataka.

³ Professor and head of the Department of Orthodontics, Coorg Institute of Dental Sciences, Virajpet, Karnataka.

⁴ Professor, Department of Orthodontics, Coorg Institute of Dental Sciences, Virajpet, Karnataka.

⁵ Professor, Department of Orthodontics, Coorg Institute of Dental Sciences, Virajpet, Karnataka.

include a range of removable and fixed devices that are designed to alter the position of the mandible resulting in orthopaedic and orthodontic changes.^{1,2,3}

The Herbst appliance is a regularly used rigid fixed functional appliance that has been studied and compared to the effects of other functional appliances in various researches. Herbst appliance has been modified into the Advansync appliance. Because the Advansync appliance only uses the first permanent molars, it may cure dental malocclusion and achieve

class II orthopaedic correction at the same time, thus saving time.¹ (**Figure 1**)

The following were the goals and objectives of this research:

- To evaluate the dental changes of Advansync 2 appliance.
- To evaluate the skeletal changes of Advansync 2 appliance.
- To evaluate the soft tissue changes of Advansync 2 appliance using photometric analysis.
- To assess the efficacy of Advansync 2 appliance in Angle's class II division 1 Patients.

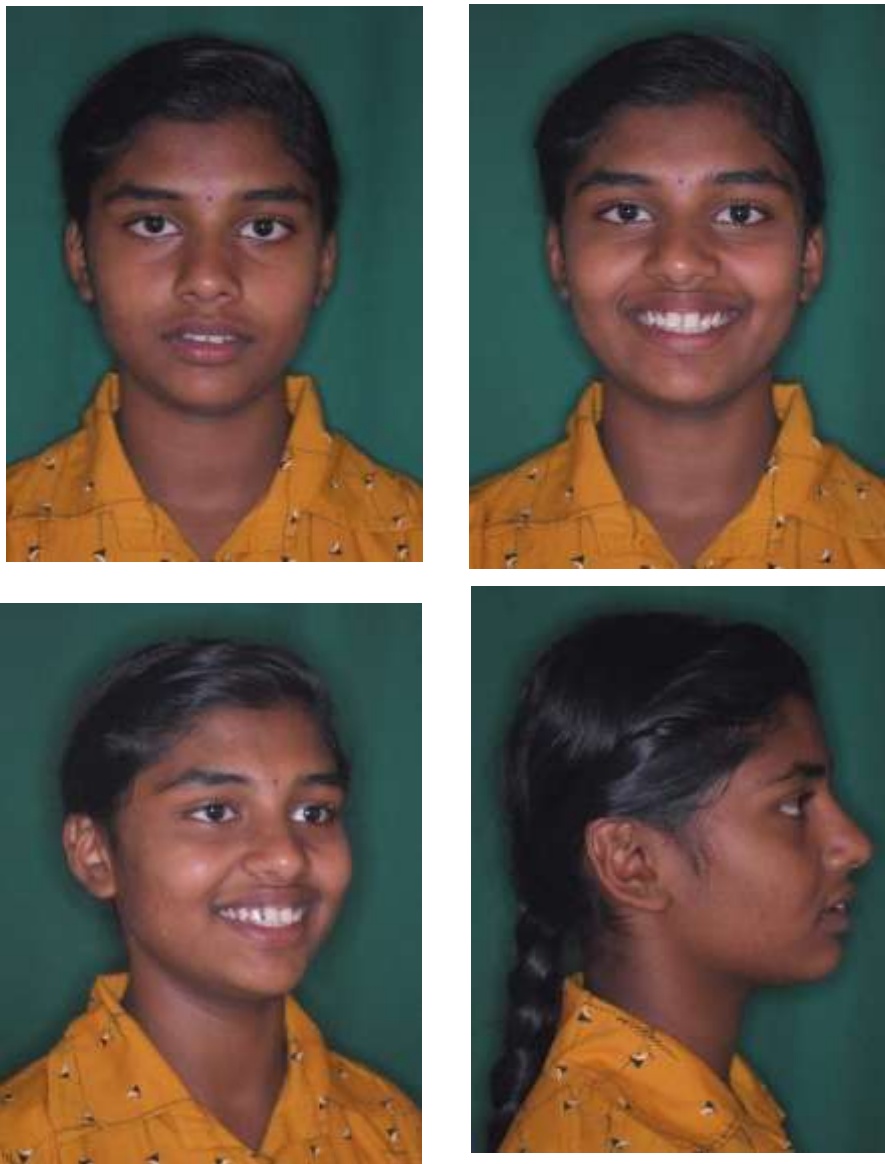


Figure 1: Pre-treatment extraoral photographs (Patient 1).

MATERIALS AND METHODS

The ethical committee has approved the study (IRB/CIDS/294/2019). The proposed study was explained to each of the selected patients, and his/her written consent was obtained prior to the commencement of the study. The demographic characteristics of the patient (age and sex), and the clinical parameters were recorded initially (**Figure 2**).

The sample size consisted of 15 patients who reported to Department of Orthodontics and Dentofacial Orthopaedics, with a chief complaint of backwardly placed lower jaw and seeking orthodontic treatment.

Pre-treatment and post functional lateral cephalograms were taken. All the

digital radiographs were taken using SIRONA (ORTHOPHOS XG 5) with the same operator. To make the radiographs more uniform, all magnifications were set to 0%. One investigator drew all the tracings and measurements. Fixed orthodontic treatment started simultaneously along with fixed functional appliance. Following the active phase of the treatment, the fixed functional appliance was removed only after a minimum of a three-month retention period. (**Figure 3**)

Measurements were taken at two intervals, T0 – Beginning of treatment phase, and at T1 – Completion of fixed functional phase (**Figure 4**).



Figure 2: Pre-treatment intraoral photographs.



Figure 3: Pre-treatment lateral cephalograph.



Figure 4: ADVAN SYNC 2 fixed functional appliance.

A tripod supported a digital camera in the photographic set-up. Adjustment of the tripod height allowed the optical axis of the lens to be maintained in a horizontal position during the recording, which was adapted to each subject's body height. Each patient was asked to relax in a standing stance, with both arms swinging freely beside the trunk. The subject was positioned on a line marked on the floor, and a vertical measurement scale divided into millimeters was placed behind the subject allowing measurements at life size. **(Figure 5)**

A distance of 1.75 meters was always maintained from the marking on the floor where the tripod was placed to another marking where the subject was made to stand. Before each recording, the

operator checked that the subject's neck and ear were all visible, as well as that their lips were relaxed. A mirror was placed 3.5 meters in front of the subject, so that the subjects can look into the mirror with their lips relaxed to record right side profile in Normal Head Position (NHP) **(Figure 6)**. The photographic records were analyzed using the software Photo shoot Adobe cc 2015, Standard Edition. A mill metric paper gauge was attached on the computer monitor, thereby producing a universal background. Using the above-mentioned method, all photographic records were scaled to life size, and 12 landmarks located on the digitized image were used to obtain all angular measurements. The same operator undertook all procedures. **(Figure 7)**



Figure 5: ADVAN SYNC 2 appliance; delivery intraoral photographs.



Figure 6: Post functional intraoral photographs.

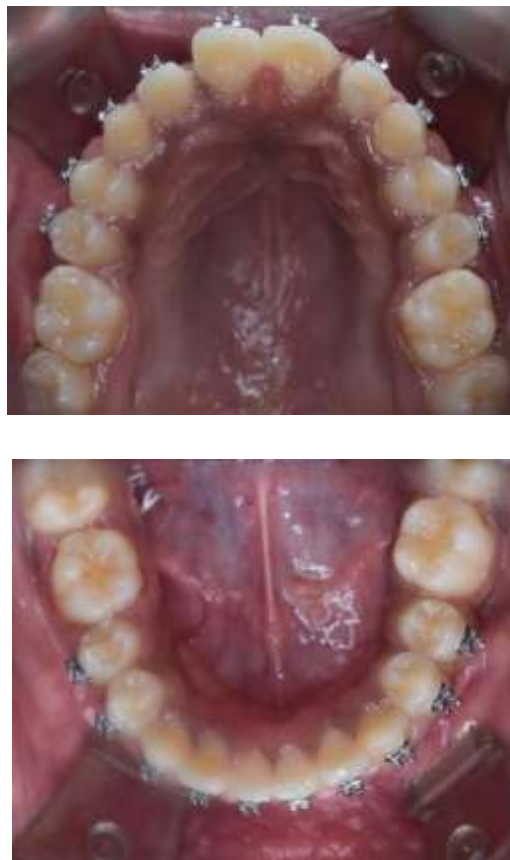


Figure 7: Post functional occlusal photographs.



Figure 8: Post functional extraoral photographs.



Figure 9: Post functional cephalograph.



Figure 10: Pre and post functional photometric analysis.

Inclusion criteria:

1. Patients who were willing for orthodontic treatment (cooperative and who gave consent).
2. Angle's Class II Division 1 malocclusion patients.
3. Patients with Skeletal Class II malocclusion indicated by an ANB angle greater than 4° .

Exclusion criteria:

1. Patients with missing teeth (excluding third molars).
2. Patients with syndromic or craniofacial anomalies that affect craniofacial growth.
3. Patients with skeletal Class I malocclusion.
4. Patients with Angle's Class II Division 2, and Angle's Class III malocclusion.
5. Patients who are not willing to participate (who does not give consent).

Sample size estimation

All the data were analyzed with MINITAB VERSION 13.1 & SPSS SOFTWARE. The result data is provided as a Mean \pm SD. For intra-group comparisons (i.e. pre- and post-changes), a paired t-test was utilized, and a value of 0.05 or less was considered for the result to be statically significant.

Sample size calculation was based on a study conducted by Esen Ali Gunay et al titled: Evaluation of the Immediate Dentofacial Changes in Late Adolescent Patients Treated with the Forsus FRD. Based on the comparison of the required

parameters, the sample size was calculated using:

$$Z_\alpha = 1.96$$

$$\sigma^2 = 0.0081$$

$$e = \text{margin of error} = 0.0025$$

$$N = 12.446 = 13$$

RESULTS

In the patients with Advansync 2 fixed functional appliances, the mean of the cephalometric readings, such as SNA, SNB, WITZ, Co- A, Co-GN, Co-Go, ANB, FMA, UI-A (degree), UI A (linear), LI-B (degree), LI B (linear), UL-E plane, LL-E plane and H LINE at the beginning of the treatment were 81.5333 ± 4.37308 , 84.8667 ± 4.17247 , 77.0000 ± 5.18239 , 105.1333 ± 5.62985 , 59.7333 ± 7.56370 , 5.5333 ± 2.99682 , 4.6000 ± 2.16465 , 26.8667 ± 6.40164 , 31.4000 ± 8.58404 , 31.8667 ± 7.81817 , 7.3333 ± 3.84831 , 6.1333 ± 2.87518 , -4.667 ± 2.23180 , $-1.7333 \pm .79881$ and $-.7333 \pm 2.15362$, respectively. (Table 1)

After nine months of treatment with the Advansync 2 fixed functional appliance, the means of the cephalometric readings in the patients for parameters, such as SNA, SNB, WITZ, Co- A, Co-GN, Co-Go, ANB, FMA, UI-A (degree), UI A (linear), LI-B (degree), LI B (linear), UL-E plane, LL-E plane and H LINE were found to be 78.2667 ± 5.71298 , 81.9333 ± 4.09646 , 76.1333 ± 5.84156 , 110.3333 ± 3.15474 , 60.0667 ± 7.24536 , 3.4000 ± 2.72029 , $.7333 \pm 1.62422$, 25.4667 ± 2.13363 , 26.2000 ± 6.87854 , 36.2667 ± 5.68792 , 6.7333 ± 3.34806 , 5.8000 ± 2.30527 , -1.1333 ± 2.55976 , $-.2667 \pm .70373$ and -1.0000 ± 1.36277 , respectively.

C0-Gn, C0-Go, ANB, WITZ, UI-A (degree and mm), LI-B (mm) UL-E plane, LL-E plane, H LINE and FMA were found to be improved after nine months of the Advansync 2 fixed functional appliance delivery. On the contrary, SNA, SNB, CO-A, and LI-B (degree) were reduced after nine months of the Advansync 2 fixed functional appliance delivery.

P-values were observed to be less than 0.05 for parameters such as SNA, WITZ, CO-A, C0-Gn, ANB, UI-A (degree), LI-B (degree) and LL-E plane. Therefore, the above-mentioned parameters SNA and LI-B (degree) were observed to be statistically significant, and the remainder parameters were highly significant.

P-values for SNB, C0-Go, UI-A (mm), UI A, LI B (mm), UL-EPL, H LINE and FMA were however observed to be greater than 0.05. Therefore, the above-mentioned parameters were observed to be statistically non-significant.

In the patients with Advansync 2 fixed functional appliances, the means of the photometric analysis readings, such as Nose tip angle, Nasolabial angle, Mentolabial angle, Nasofrontal angle, Nasomental angle, Facial angle, Upper lip angle, U lip to chin, and L lip to chin during the beginning of the treatment were 81.6000 ± 1.35225 , 96.9333 ± 3.97252 , 84.7333 ± 5.39135 , 132.8000 ± 9.84305 , 129.4000 ± 2.32379 , 88.2667 ± 5.9362 , 11.6000 ± 8.2808 , 7.0000 ± 3.7796 and 4.0667 ± 2.5820 , respectively.

Table 1: Comparison of effects of Advansync 2 fixed functional appliance between the beginning of the treatment and nine months after appliance delivery using lateral cephalogram.

		Mean	Standard deviation	t	Sig.
SNA (degree)	Pre	81.5333	4.37308	2.977	0.010 (S)
	Post	78.2667	5.71298		
Co-Pt A (mm)	Pre	84.8667	4.17247	5.196	0.000 (HS)
	Post	81.9333	4.09646		
SNB (degree)	Pre	77.0000	5.18239	0.840	0.415 (NS)
	Post	76.1333	5.84156		
Co-Gn (mm)	Pre	105.1333	5.62985	-	0.000 (HS)
	Post	110.3333	3.15474	6.925	
Co-Go (mm)	Pre	59.7333	7.56370	-	0.096 (NS)
	Post	60.0667	7.24536	1.784	
ANB (degree)	Pre	5.5333	2.99682	4.289	0.001 (HS)
	Post	3.4000	2.72029		
WITZ (mm)	Pre	4.6000	2.16465	5.449	0.000 (HS)
	Post	.7333	1.62422		
FMA (degree)	Pre	26.8667	6.40164	0.862	0.403 (NS)
	Post	25.4667	2.13363		
U1-Pt-A (degree)	Pre	31.4000	8.58404	3.658	0.003 (HS)
	Post	26.2000	6.87854		
L1-Pt-B (degree)	Pre	31.8667	7.81817	-	0.032 (S)
	Post	36.2667	5.68792	2.384	
U1-Pt-A (mm)	Pre	7.3333	3.84831	1.871	0.082 (NS)
	Post	6.7333	3.34806		
L1-Pt-B (mm)	Pre	6.1333	2.87518	0.960	0.353 (NS)
	Post	5.8000	2.30527		
U lip to E plane (mm)	Pre	-.4667	2.23180	1.848	0.086 (NS)
	Post	-1.1333	2.55976		
L lip to E plane (mm)	Pre	-1.7333	.79881	-	0.002 (HS)
	Post	-.2667	.70373	3.898	
H line (mm)	Pre	-.7333	2.15362	0.673	0.512 (NS)
	Post	-1.0000	1.36277		

*P VALUE= 0.05; P VALUE < 0.05 =SIGNIFICANT; P VALUE > 0.05 =
NON SIGNIFICANT.

After nine months of the Advansync fixed functional appliance treatment, the means of the cephalometric readings in the patients for parameters, such as Nose tip angle, Nasolabial angle, Mentolabial angle, Nasofrontal angle, Nasomental angle, Facial angle, Upper lip angle, U lip to chin and L lip to chin were found to be 81.7333 ± 1.22280 , 103.3333 ± 3.53890 , 114.0000 ± 4.14039 , 133.4000 ± 7.06905 , 129.3333 ± 1.91485 , 89.8000 ± 8.6189 , 12.4667 ± 1.72654 , 7.3333 ± 8.1650 and 4.4000 ± 5.0709 , respectively. **(Table 2)**

All the parameters were found to be improved after nine months of the

Advansync fixed functional appliance delivery. P-values were observed to be less than 0.5 for parameters such as Nasolabial angle, Mentolabial angle, Facial angle and L lip to chin. Therefore, the above-mentioned parameters L lip to chin were observed to be statistically significant and the remainder parameters were highly significant.

P-values for Nose tip angle, Nasofrontal angle, Nasomental angle, Upper lip angle and U lip to chin were however observed to be greater than 0.5. Therefore, the above-mentioned parameters were observed to be statistically insignificant.

Table 2: Comparison of effects of Advansync II fixed functional appliance between the beginning of the treatment and nine months after appliance delivery using photometric analysis.

		Mean	Standard deviation	t	Sig.
Nose tip angle (degree)	Pre	81.6000	1.35225	-	0.758
	Post	81.7333	1.22280	0.315	(NS)
Nasolabial angle (degree)	Pre	96.9333	3.97252	-	0.000
	Post	103.3333	3.53890	4.932	(HS)
Mentolabial angle (degree)	Pre	84.7333	5.39135	-	0.000
	Post	114.0000	4.14039	19.299	(HS)
Nasofrontal angle (degree)	Pre	132.8000	9.84305	-	0.664
	Post	133.4000	7.06905	0.444	(NS)
Nasomental angle (degree)	Pre	129.4000	2.32379	-	0.925
	Post	129.3333	1.91485	0.095	(NS)
Facial angle (degree)	Pre	88.2667	.59362	-	0.000
	Post	89.8000	.86189	5.996	(HS)
Upper lip angle (degree)	Pre	11.6000	.82808	-	0.084
	Post	12.4667	1.72654	1.857	(NS)
U lip to chin (mm)	Pre	7.0000	.37796	-	0.136
	Post	7.3333	.81650	1.581	(NS)
L lip to chin (mm)	Pre	4.0667	.25820	-	0.019
	Post	4.4000	.50709	2.646	(S)

*P VALUE= 0.05; P VALUE < 0.05 =SIGNIFICANT; P VALUE > 0.05 = NON SIGNIFICANT.

DISCUSSION

This was a cephalometric and photometric study looking at the dental, skeletal, and soft tissue treatment impacts of the AdvanSync 2 fixed functional appliance in treating Class II malocclusions.

As a result of these dentoalveolar alterations, the occlusal plane was rotated clockwise. All of the patients' overbite and overjet were minimized. Soft tissue profile slightly improved.^{4,5,6}

The Advansync 2 appliance produced its effect through maxillary growth restriction and dentoalveolar changes. This concurs with another research by **May H. EL Mofty et al**, testing the equivalent appliance. The purpose of this study was to compare the skeletal, dentoalveolar, and soft tissue impacts of the Advansync functional appliance to intermaxillary NiTi coil springs in the treatment of growing people with Class II division 1 malocclusion.^{1,7,8,9}

The maxillary restriction was the major skeletal impact of the AdvanSync 2 appliance. This concurs with another research by Al-Jewair et al, testing the equivalent appliance. **Al-Jewair et al** showed a 3.3° decrease in SNA, a 3.3 mm decrease in A-Na perp, and a 1.8 mm rise in maxillary length (Co-A) (from natural growth). Maxillary dentoalveolar changes with the AdvanSync 2 in our investigation were like the past examination, with no

critical changes contrasted with the untreated controls (except for a slight incisor extrusion, undoubtedly because of fixed appliance mechanics) (4)^{10,11,12}. Mandibular dentoalveolar changes were additionally reliable with the past investigation, with the AdvanSync patients displaying incisor protrusion and proclination and molar mesialization contrasted with their separate control groups. However, **Al-Jewair et al**, revealed huge mandibular molar extrusion with AdvanSync contrasted with the controls; this was not found in our examination. This might be due to the advances in biomechanics of AdvanSync 2 over AdvanSync. The noticed dentoalveolar changes with the AdvanSync 2 were predictable generally with those detailed in investigations including the Herbst and the MARA.^{13,14}

Prasad Chitra et al derived similar conclusions from another research. They also stated that pre and post pubertal patients showed similar results, which most likely are a combination of skeletal and dentoalveolar changes.^{15,16}

According to **Mevlut Celikoglu et al** skeletal Class II malocclusions due to mandibular retrusion can be treated with removable or fixed functional orthodontic appliances. However, all those appliances cause protrusion of the mandibular incisors, thus limiting the skeletal contribution to

overjet correction compared to the Advansync 2.^{17,18,19}

The results of the present study showed that patients treated with the Advansync 2 fixed functional appliances had better C0-Gn, C0-GO, ANB, FMA, UI-A (degree), UI A (linear) LI B (linear), UL-E plane, LL-E plane, H LINE, Nose tip angle, Nasolabial angle, Mentolabial angle, Nasofrontal angle, Nasomental angle, Facial angle, Upper lip angle, U lip to chin, and L lip to chin after the nine months of appliance delivery.

A limitation of this study is that only two time points before the treatment phase and nine months after functional appliance removal were included. A time point at fixed orthodontic treatment should have been recorded. The lower incisor proclination has increased drastically and has not been recorded in database as of date and was one major finding in this study.

We restricted our study to AdvanSync 2 fixed functional appliance while numerous different modalities are accessible. Usually, appliances should be chosen for their probability of satisfying the individual patient necessities dependent on sound evidence.

CONCLUSIONS

The following footprints were laid out within the bounds of this study:

1. AdvanSync 2 appliance was effective in normalizing Class II malocclusions.

2. AdvanSync 2 corrected Class II malocclusions through changes in C0-Gn, C0-GO, ANB, FMA, UI-A (degree), UI A (linear) LI B (linear), UL-E plane, LL-E plane, H LINE, Nose tip angle, Nasolabial angle, Mentolabial angle, Nasofrontal angle, Nasomental angle, Facial angle, Upper lip angle, U lip to chin, L lip to chin.

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