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A Comparative Analysis Of Treatment Outcomes Of Power scope And Advansync2 In Class II Division 1 Malocclusion: A Retrospective Study

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Abstract:

Aim: The objective of this investigation was to evaluate the dental, skeletal, and soft tissue effects of AdvanSync2 with those of PowerScope.

Methodology: A total of 20 cases were selected, and they were divided into 2 groups, Group 1- cases treated with PowerScope and Group 2- cases treated with AdvanSync2. The treatment procedure for both groups entailed the use of fixed orthodontic treatment. Both the devices were gradually activated to attain desirable results. Once the sagittal discrepancy was excessively rectified, any additional activation was discontinued. Pre-treatment and post-treatment lateral cephalograms were obtained. Lateral cephalograms were traced and measured for skeletal, dental and soft tissue parameters. The comparison between the groups was done using Independent t test and Paired t test.

Results: Both devices showed similar treatment changes. AdvanSync2 provides a greater mandibular advancement when compared to PowerScope, due to its prompt installation during the initial bonding phase. PowerScope exhibited superior restraining effects on the maxilla compared to AdvanSync2. Similar dental effects were also seen in both appliances, PowerScope had a greater amount of proclination when compared to AdvanSync2.

Conclusion: Both devices engendered noteworthy treatment changes, thereby culminating in an enhancement of the facial profiles in the patients. Both appliances give good skeletal and dental

results, clinicians can opt for any of the two appliances in treatment planning taking patient factors and other treatment factors into consideration.

Keywords: Class II malocclusion, Retrognathic mandible, PowerScope, AdvanSync2, Fixed functional appliance, Advancement

Introduction

Class II malocclusion occurs in about one third of the population, thus one of the most common malocclusions encountered in orthodontic clinical practice.[1] Accordingly, the treatment plan for class II malocclusion can either be extraction or non- extraction. Removable functional appliances like twin blocks are generally used in younger patients who are yet to reach the pubertal growth spurt.[2] A study by Baccetti 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.[3]

Whereas during the deceleration stages of growth, fixed functional appliances are commonly being advised to the patient. The fixed functional appliances have been gaining immense popularity as "noncompliant class II correctors" Hence, the orthodontist would have a better control. Fixed Functional Appliance was first initiated into dentistry by Dr. Emil Herbst with the Herbst appliance; which was later rediscovered by Pancherz.[1]

Fixed functional appliances (FFAs) are a viable alternative to removable functional appliances, especially when patients enter their final stages of development, so that the residual growth of the patient can be used in favour of the treatment plan.

Classification of fixed functional appliances: By Ritto A. Korrodi (2001)

A} Rigid Fixed Functional Appliances (RFFA)

1. The Herbst Appliance and its modifications.
2. The Mandibular Protraction Appliance (MPA)
3. The Mandibular Anterior Repositioning Appliance (MARA)
4. The Ritto Appliance
5. The IST-Appliance
6. The Biopedic Appliance

B} Flexible Fixed Functional Appliances (FFFA)

1. The Jasper Jumper
2. The Adjustable Bite Corrector
3. The Churro Jumper.
4. The Amoric Torsion Coils.
5. The Scandee Tubular Jumper
6. The Klapper Super Spring
7. The Bite Fixer

C} Hybrid Fixed Functional Appliances (HFFA)

1. Eureka Spring
2. FORSUS- Fatigue Resistant Device
3. The Twin Force Bite Corrector.
4. Alpern Class II Closers

5. The Calibrated Force Module

PowerScope is the latest innovation in Class II correction which is a direct derivative of the Herbst Type II appliance. Dr. Andy Hayes worked in conjunction with American Orthodontics to develop PowerScope. It is delivered as a one size-fits-all appliance, preassembled with attachment nuts for quick and easy chairside application. The appliance is a wire-to-wire installation with attachments placed mesial to the first molar in the maxillary arch and distal to the canine of the mandibular arch.[4] AdvanSync2 is a new addition into the group of fixed functional appliances. AdvanSync2 appliance is almost half the size of MiniScopeHerbst appliance with a molar-to-molar attachment. The AdvanSync appliance was developed by Dr Terry Dischinger and his son Bill M Dischinger in association with Ormco which was later subjected to some modifications leading to the emergence of the AdvanSync2. 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 other conventional fixed functional appliances.[5]

The principal objective of this investigation was to evaluate the dental, skeletal, and soft tissue effects of AdvanSync2 with those of PowerScope.

Materials And Methods

This retrospective study was conducted on the records available in the Department of Orthodontics. Written informed consent was obtained from all the patients to use their records for study purposes. The inclusion criteria included the subjects with skeletal class II, a retrognathic mandible, a positive visual treatment objective (VTO), subjects with full cusp or end-on molar relationships. Patients who presented with systemic problems, hormonal problems affecting growth, syndromic or craniofacial anomalies, previous history of trauma or temporomandibular joint disorders, missing teeth, cleft cases, and previous orthodontic treatment were excluded from the study.

A total of 20 cases were selected, and they were divided into 2 groups, Group 1- cases treated with PowerScope and Group 2- cases treated with AdvanSync2. The treatment procedure for both groups entailed the use of fixed orthodontic treatment, with a 0.022 MBT prescription. In the PowerScope group, preliminary leveling of arches was executed and systematically progressed to 19×25 in the stainless steel wire in all patients. This stage necessitated five to six months. Subsequently, the PowerScope apparatus was inserted. Whereas in the AdvanSync2 group the appliance is positioned during the initial bonding process. Both the devices were gradually activated to attain desirable results. Once the sagittal discrepancy was excessively rectified, any additional activation was discontinued, indicating termination of the established functional period. Two sets of lateral cephalograms were obtained, one before starting the treatment, and another one when class II correction was done. Lateral cephalograms were traced and measured for skeletal, dental and soft tissue parameters.

Figure 1.A– Profile image (Group 1)   Figure 1.B– Positive VTO (Group 1)

Figure 2– Pre treatment intra–oral images (Group 1)

Figure 3- PowerScope appliance

Figure 4- Post Class II correction intra-oral images (Group 1)

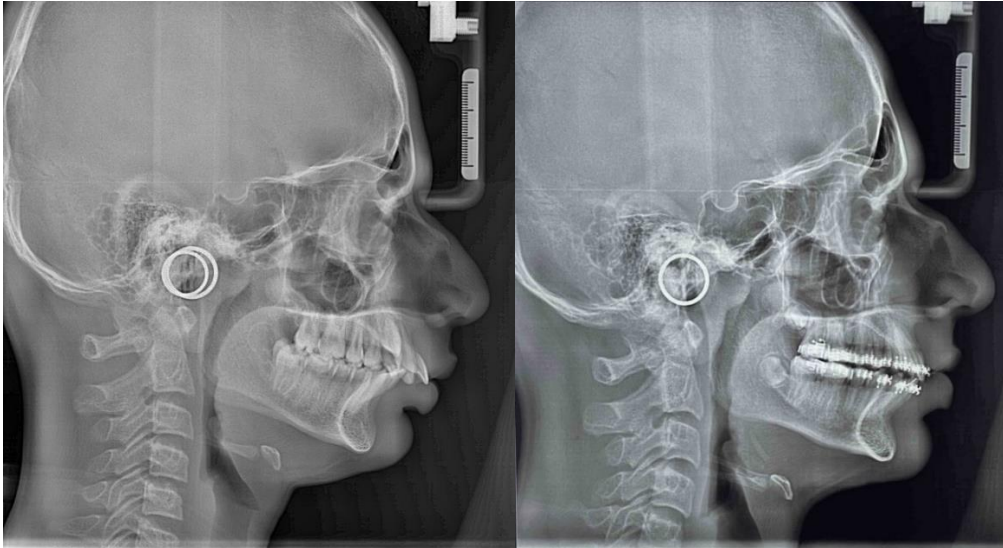Figure 5- Post treatment profile image (Group 1)

Figure 6.A– Pre–treatment Lateral Ceph(Group1) Figure 6.B– Post– treatment Lateral Ceph(Group1)
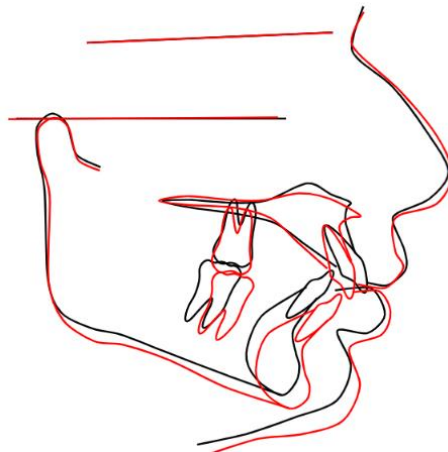

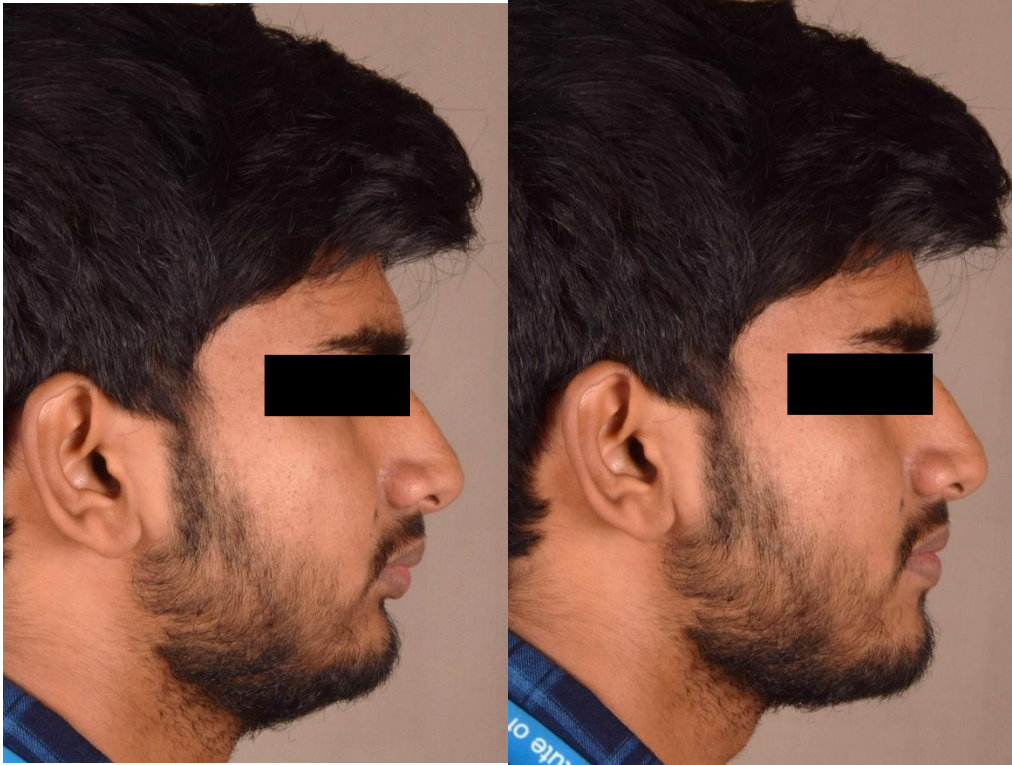Figure 7– Superimposition of Group 1 (Black– Pretreatment, Red–Posttreatment)

Figure 8.A- Profile image (Group 2)   Figure 8.B- Positive VTO (Group 2)

Figure 9- Pre treatment intra-oral images (Group 2)

Figure 10– AdvanSync 2 appliance

Figure 11– Post Class II correction intra-oral images (Group 2)
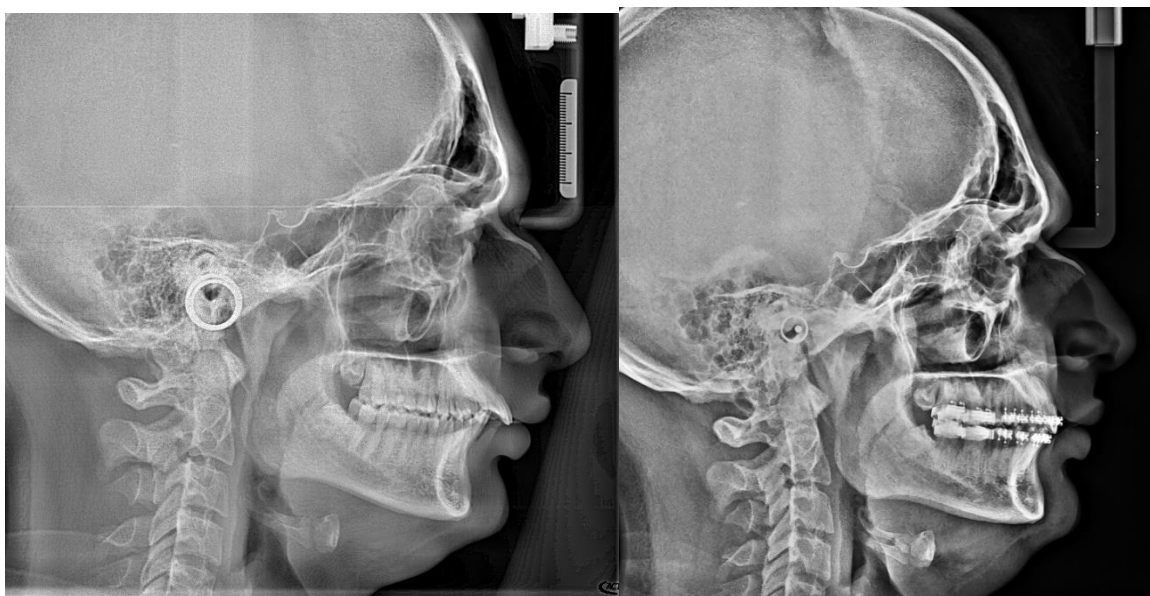
Figure 12- Post treatment profile image (Group 2)

Figure 13.A- Pre-treatment Lateral Ceph (Group2)   Figure 13.B- Post- treatment Lateral Ceph (Group2)
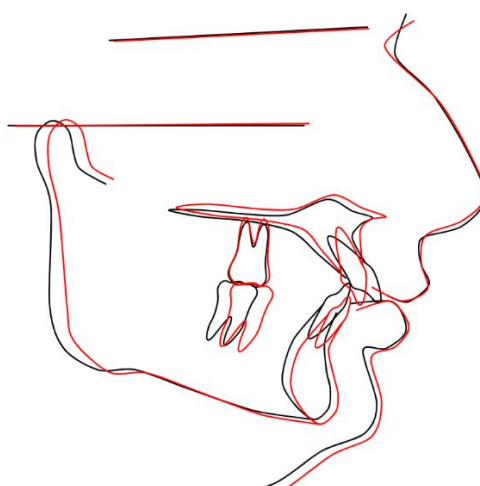

Figure 14- Superimposition of Group 2 (Black- Pretreatment, Red-Posttreatment)

Cephalometric Analysis

Eighteen variables were produced per X-ray and were chosen from different cephalometric analyses to evaluate the skeletal, dentoalveolar, and soft tissue changes. The cephalometric variables measured for evaluation are given in Table 1.

Table 1- Cephalometric Variables Considered in the Study.

S. No.		Variables	
1	Cranial Base	N–S–Ar° (Saddle angle)	The angle formed by points N, S, and Ar. Mean value is 123 ± 5°.
		S–Ar–Go° (Articular angle)	The angle is formed by joining the points S, Ar, and Go. The mean value is 143 ± 6°.
2	Maxillary skeletal	SNA°	The inferior angle formed by the intersection of lines SN and NA is measured. The mean SNA reading is 82°.

		Point A–N Perpendicular, mm	The linear measured between nasion-perpendicular and point A. Normal range is 0–1 mm.
3	Mandibular skeletal	SNB°	The angle between the SN plane and a line joining nasion to point B. The average value is 80°.
		Pog–N Perpendicular, mm	The distance from pogonion (Pog) to N-perpendicular. The normal range is −4.0 ± 3.0 mm.
		Go–Gn, mm	Linear measurement of the mandibular corpus length from constructed point Gonion to constructed Gnathion. The normal range is 5.9 ± 5.9 mm.
4	Intermaxillary	ANB°	The angle formed by the intersection of lines joining nasion to point A and nasion to point B. The mean value is 2°.
		Wits appraisal, mm	Perpendiculars are drawn to the occlusal plane are termed as AO and BO. Normal range is −1 ± 1.0.
5	Vertical skeletal	ANS–Me, mm	Measured from anterior nasal spine to menton.
		FH–mandibular plane°	The mandibular plane angle formed by the intersection of the mandibular plane with the FH plane. The mean value is 21.9° (range 170–28°).
6	Maxillary dentoalveolar	U1–NA °	The angle between the long axis of the upper incisor and the NA plane
		U1–SN°	The long axis of the upper incisors is extended to intersect the SN line and the posterior angle is measured. Mean value is 102.5 ± 5.5°.
7	Mandibular dentoalveolar	IMPA°	The angle formed by the intersection of the long axis of the lower incisors with the mandibular plane. The mean value is 90°.
		L1–NB °	The angle between the long axis of the lower incisor and the NB plane
8	Interdental	U1–L1°	Measured as the angulation between the long axes of maxillary incisor to that of the mandibular incisor. The normal range is 130°–131°
9	Soft tissue	Upper lip to E-plane, mm	Distance between the upper lip and the esthetic line (tip of nose to soft tissue pogonion). The normal range is 0 ± 2 mm
		Lower lip to E-plane, mm	Distance between the lower lip and the esthetic line (tip of nose to soft tissue pogonion). The normal range is −2 ± 2 mm

Statistical Analysis

Descriptive statistics such as mean and standard deviation for continuous variables was calculated. Bivariate analyses were performed using Independent t test and Paired t test. Level of statistical significance was set at P value less than .05.

Results

Table 2– Pre-Post Treatment Comparison of the Study Parameters in Group 1 (PowerScope).

Parameters	Pre-treatment (Mean ± SD)	Post-treatment (Mean ± SD)	P Value
N-S-Ar°	115.87 ± 2.66	114.40 ± 2.04	0.017*
S-Ar-Go°	151.59 ± 3.69	154.96 ± 4.53	0.035*
SNA°	85.28 ± 3.58	83.96 ± 2.37	0.251
SNB°	75.87 ± 2.51	77.02 ± 2.95	0.050*
ANB°	9.41 ± 1.53	6.94 ± 1.76	0.011*
Wits appraisal, mm	11.02 ± 1.56	3.47 ± 1.84	0.021*
Pt A-N Perp, mm	3.61 ± 1.34	1.88 ± 1.09	0.068
Pog-N Perp, mm	−10.07 ± 5.23	−7.25 ± 4.99	0.137
Go-Gn, mm	72.43 ± 6.46	73.60 ± 6.25	0.003*
ANS-Me, mm	60.72 ± 7.41	60.96 ± 7.03	0.026*
FH-MP °	19.36 ± 5.23	20.39 ± 4.17	0.050*
IMPA°	115.39 ± 5.21	116.06 ± 4.99	0.026*
U1-SN°	118.43 ± 5.76	106.27 ± 6.01	0.037*
U1-NA °	27.14 ± 5.83	17.28 ± 6.31	0.375
L1-NB °	37.09 ± 4.78	38.91 ± 3.78	0.293
U1-L1°	104.46 ± 7.36	116.42 ± 6.91	0.036*
U lip to E-plane, mm	1.71 ± 1.74	−2.12 ± 2.02	0.378
L lip to E-plane, mm	2.17 ± 2.13	−0.43 ± 2.56	0.426

Notes: Statistical Analysis: Paired *t* test.
*Denotes statistically significant at the 0.05 level.

The result shows that there was a significant difference from pretreatment to posttreatment outcomes with respect to NSAr°, SArGo°, SNB°, ANB°, Wits appraisal, CoGn, ANS-Me, U1-NA, FH-mandibular plane°, IMPA, U1SN°, U1-L1 where $P < .05$, when compared using Paired *t* test in group 1 (PowerScope) (Table 2).

Table 3– Pre-Post Treatment Comparison of the Study Parameters in Group 2 (AdvanSync2).

Parameters	Pre-treatment (Mean ± SD)	Post-treatment (Mean ± SD)	P Value
N-S-Ar°	123.38 ± 4.21	117.74 ± 5.01	0.642
S-Ar-Go°	144.42 ± 5.22	145.95 ± 5.39	0.036*
SNA°	81.64 ± 3.21	80.73 ± 3.09	0.873
SNB°	76.17 ± 2.47	79.91 ± 2.12	0.038*
ANB°	4.47 ± 2.45	2.02 ± 1.78	0.001*
Wits appraisal, mm	5.99 ± 2.13	3.24 ± 1.90	0.003*
Pt A-N Perp, mm	−4.73 ± 1.62	−3.16 ± 2.01	0.047*
Pog-N Perp, mm	−10.99 ± 2.69	−7.98 ± 2.82	0.193
Go-Gn, mm	75.95 ± 3.46	76.36 ± 2.79	0.014*
ANS-Me, mm	60.08 ± 6.31	62.61 ± 5.82	0.025*
FH-MP °	13.01 ± 4.71	14.52 ± 4.26	0.006*
IMPA°	113.61 ± 3.51	109.43 ± 3.28	0.037*
U1-SN°	125.02 ± 5.31	105.42 ± 4.92	0.654
U1-NA °	42.38 ± 3.73	18.98 ± 3.03	0.483

L1–NB °	4.64 ± 2.41	25.29 ± 2.57	0.172
U1–L1°	105.50 ± 1.58	130.31 ± 2.92	0.164
U lip to E–plane, mm	−2.72 ± 1.35	−2.74 ± 2.03	0.156
L lip to E–plane, mm	−2.27 ± 2.76	−2.64 ± 2.48	0.147

Notes: Statistical Analysis: Paired *t* test.

*Denotes statistically significant at the 0.05 level.

The result shows that there was a significant difference from pretreatment to posttreatment outcomes with respect to S–Ar–Go°, SNB°, ANB°, Wits appraisal, Pt A–N Perp, Go–Gn, ANS–Me, FH–mandibular plane°, IMPA° where $P < .05$, when compared using Paired *t* test in group 2 (AdvanSync2) (Table 3).

Table 4– Intergroup Comparison of the Mean Difference for the Study Variables.

Variables	Group 1 (PowerScope)	Group 2 (AdvanSync2)	*P* Value
N–S–Ar°	114.40 ± 2.04	117.74 ± 5.01	0.093
S–Ar–Go°	154.96 ± 4.53	145.95 ± 5.39	0.487
SNA°	83.96 ± 2.37	80.73 ± 3.09	0.572
SNB°	77.02 ± 2.95	79.91 ± 2.12	0.031*
ANB°	6.94 ± 1.76	2.02 ± 1.78	0.271
Wits appraisal, mm	3.47 ± 1.84	3.24 ± 1.90	0.276
Pt A–N Perp, mm	1.88 ± 1.09	−3.16 ± 2.01	0.374
Pog–N Perp, mm	−7.25 ± 4.99	−7.98 ± 2.82	0.471
Go–Gn, mm	73.60 ± 6.25	76.36 ± 2.79	0.066
ANS–Me, mm	60.96 ± 7.03	62.61 ± 5.82	0.162
FH–MP °	20.39 ± 4.17	14.52 ± 4.26	0.659
IMPA°	116.06 ± 4.99	109.43 ± 3.28	0.718
U1–SN°	106.27 ± 6.01	105.42 ± 4.92	0.372
U1–NA °	17.28 ± 6.31	18.98 ± 3.03	0.287
L1–NB °	38.91 ± 3.78	25.29 ± 2.57	0.032*
U1–L1°	116.42 ± 6.91	130.31 ± 2.92	0.021*
U lip to E–plane, mm	−2.12 ± 2.02	−2.74 ± 2.03	0.512
L lip to E–plane, mm	−0.43 ± 2.56	−2.64 ± 2.48	0.534

Notes: Statistical Analysis: Independent sample *t* test.

*Denotes statistically significant at the 0.05 level.

On the intergroup comparison (Table 4) using Independent *t* test, few variables showed significant difference between the outcomes for PowerScope and AdvanSync2 appliance– SNB°, L1–NB ° and U1–L1°.

Discussion

This retrospective study was designed to compare the skeletal, dentoalveolar, and soft tissue changes with the PowerScope appliance and AdvanSync2 appliance in the treatment of class II malocclusion. The mean pretreatment age in group 1 was 15.10 ± 0.99 years and for group II was 15.8 ± 1.07 years. In group I, 50% of the patients were of CVMI stage 2 and 40% were of CVMI stage 3, and 10% were of CVMI stage 4 whereas in group 2, 40% of the patients were of CVMI stage 2, 50% were from CVMI stage 3, and 10% were from CVMI stage 4.

Cranial Base Variables

AdvanSync2 brought about a considerable decrease in the saddle angle suggesting the forward positioning of the mandible with respect to cranial base, and decrease in articular angle suggesting clockwise rotation of the mandible with respect to cranial base. In the PowerScope group too, the articular angle was decreased and saddle angle was increased considerably. Thus, the changes in the cranial base cephalometric variables were found to be similar in both the groups.

Maxillary Skeletal Variables

The PowerScope group showed a notable decrease in SNA and Pt A-N perpendicular. The decrease in SNA could be explained by the distal reciprocal force exerted on the maxilla (headgear effect) by the appliance. The findings are similar in the AdvanSync2 group also but lesser as compared to PowerScope. Ankit Kumar Shahi et al also found in a study that AdvanSync2 appliance have lesser restrictive effect on maxilla.[6]

Mandibular Skeletal Variables

In both the groups, a considerable increase was observed in SNB, and decrease in Pog-N perp whereas a minor increase in Go-Gn length and mandibular plane angle was seen, indicating clockwise rotation of the mandible. Other studies also demonstrated similar results. [7-9]

Dentoalveolar Variables

In both the groups the upper incisor inclination has been decreased markedly, that can also be due the levelling and aligning of the maxillary arch and not only the effect of the appliance.

In the PowerScope group the mandibular incisor inclination has been increased slightly where as in the AdvanSync2 group the mandibular incisor inclination appeared to decrease than before. The PowerScope appliance in attached to the mandibular arch wire in the anterior segment, which might cause light proclination of the lower incisor, whereas AdvanSync2 appliance in only attached to the lower molar thus not contributing in lower anterior proclination. Another study done by Vinni Arora et al, states that PowerScope had less skeletal effects on the mandible and more dentoalveolar effects, contributing to Class II correction.[10]

Soft Tissue Variables

In both group upper lip to E-plane value does not show any major changes, but lower lip to E-plane shows greater advancement in AdvanSync2 group when compared to C group. As AdvanSync2 appliance is placed at the starting of the treatment, the advancement of the mandible, thus soft tissue changes take place at an early stage. Early placement of the AdvanSync2 appliance utilises the remaining growth of the patient, which is not seen in PowerScope. Avisha Middha et al, concluded in their study that enhanced improvements in facial profile were observed following the administration of both appliances.

Conclusions

Both devices engendered noteworthy treatment changes, thereby culminating in an enhancement of the facial profiles in the patients. In the context of the treatment of skeletal class II patients, AdvanSync2 provides a greater mandibular advancement due to its prompt installation during the initial bonding phase. This appliance optimally harnesses the patients growth potential and yields superior skeletal outcomes. PowerScope exhibited superior restraining effects on the maxilla compared to AdvanSync2. Proclination of lower anteriors is a common disadvantage of FFAs, which is also seen in both the groups, but PowerScope had a greater amount of proclination when

compared to AdvanSync2. Both appliances give good skeletal and dental results, clinicians can opt for any of the two appliances in treatment planning taking patient factors and other treatment factors into consideration.

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