

A Comparison Between Van Beek Headgear Activator And Andresen Activator In Orthodontic Treatment Of Class II Division 1 Cases: A Randomized Clinical Trial

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Abstract

Objective: Functional orthopedic appliances are orthodontic devices that used to modify mandibular posture by applying forces to muscles and soft tissues, which influence skeletal and dental structures correspondingly. They are effective in treating Class II Division 1 malocclusions where the maxilla is too far forward relative to the mandible, or the mandible is too far backward to the maxilla. The aim of this work was to compare the treatment results when treating Class II division 1 malocclusion using the Van Beek-Headgear Activator combination (vBHGA) appliance versus using the Andresen activator.

Methods: This randomized clinical study was conducted on 24 patients, aged from 8 to 13 years old, with Skeletal class II division 1 with overjet > 5mm, skeletal growth was assessed by using cervical vertebral maturation stage assessment (CVMS). Two patients dropped out and Patients were divided into two equal groups according to the intervention appliances: Group A: 11 patients received Van-Beek activator with cervical-pull headgear, and Group B: 11 patients received Andresen activator.

Results: Both groups showed significant skeletal improvements, including increased SNB mandibular length (S-Go, N-Me, Effective Mandibular Length) and decreased ANB, Gonial Angle, with no significant changes in SelANB, Gonialine (SN)-GoMe, ANS-Me, or Maxillary Length. Dental changes differed: Group A showed notable mandibular incisor movement, while Group B had more pronounced maxillary incisor changes.

Conclusions: Andresen activator and vBHGA corrected Class II div 1 malocclusion, improving mandibular advancement, A-nasion-B point angle (ANB), Wit's, and facial/dental parameters, with vBHGA showing greater mandibular changes, particularly in length and vertical dimensions.

Keywords: Class II Malocclusion, VanBeek-Headgear Activator, Andresen Activator, Treatment of Class II div 1.

INTRODUCTION

Functional appliances are devices which are used to change the posture of the mandible, by holding it open or open and forward. Pressures created by stretching of the muscles and soft tissues are transmitted to the surrounding skeletal and dental structures, moving the mandible and modifying growth. The monobloc developed by Robin in the early 1900s is generally considered the forerunner of all functional appliances, but the activator developed in Norway by Viggo Andresen in the 1920s was the first to be widely used and accepted appliance [1, 2].

In the mixed dentition stage, the activator is a widely used appliance for the treatment of Class II, division 1 malocclusions. Many different types of activators and activator derivatives were developed many years ago. A special type of activator was described by Van Beek [3, 4]. The modified activator described by van Beek is a removable functional appliance consisting of a monoblock activator with a thick (8- 10 mm) posterior bite plane, long and deep lingual wings in the lower base, labial and lower anterior teeth, and a short outer bow at the level of the maxillary canines combined with high pull headgear. The appliance is designed to achieve orthopedic Class II correction via maxillary growth restriction and enhanced mandibular growth with vertical control [5]. So, the current study was directed to compare the treatment results in Class II division 1 patients treated with the Van Beek headgear activator (vBHGA) and Andresen activator.

PATIENTS AND METHODS:

This randomized clinical study was conducted on 24 patients from outpatient clinics of orthodontic department, Faculty of Dental Medicine, Al-Azhar university (Boys - Cairo), aged from 8 to 13 years old, with Skeletal class 2 division 1 indicated by A-nasion-B point angle (ANB) angle value > 4° and overjet > 5mm. The growth assessment was done by using cervical vertebral maturation stage assessment (CVMS), inclusion

criteria were age: 8-13 years old, no previous orthodontic treatment, no indications or symptoms of periodontal disease in the past or present, as determined by clinical and radiographic examination, no systemic and/or congenital diseases that influence bone formation, maturation and growth of bone. The study was done after approval from Ethical Committee of Al Azhar University, Cairo (Boys), Egypt. An informed consent was obtained from the patients.

Exclusion criteria were previous history of orthodontic treatment, congenitally missing or extracted permanent tooth (except third molars), craniofacial anomalies, and medical condition or prescription medication that may affect growth.

Randomization: The sample was randomly divided into two groups according to the intervention appliances: The process of randomization in this study was conducted by using online software found at the website: <http://www.graphpad.com/quickcalcs/index.cfm>. According to the above-mentioned random table, sealed, opaque and numbered envelopes were manually prepared and shuffled. Each patient was asked to pick one of them and open it for group allocation.

Patients were divided into two equal groups according to the intervention appliances: Group A: 12 patients received Van-Beek activator and cervical-pull headgear. and Group B: 12 patient received Andresen activator.

Sample Size Calculation:

Independent t-test or an equivalent non-parametric test was used for comparison between groups. According to a previous study by Öztürk and Tankuter [6], Sella-Nasion-Point B angle (SNB) varied between 73.97 ± 3.12 and 74.26 ± 2.98 . Based on Öztürk and Tankuter [6] and Using G power statistical power analysis program (version 3.1.9.4) for sample size determination [7]. A sample size ($n=24$, divided to 12 in each group) was sufficient to detect a large effect size ($d = 1.2$), with an actual power ($1-\beta$ error) of 0.8 (80%) and a significance level (α error) 0.05 (5%) for two-sided hypothesis test.

Intervention:

Impression taking for the appliances: The edges of the impressions for the models should extend to the boundaries of the labial and lingual sulci, and they should be made using an alginate impression material [6]. It is crucial to check that the impression sufficiently fills both the labial sulcus in the upper arch and the lingual sulcus in the lower arch molar region. Short impressions in these areas cause unwanted problems throughout the laboratory phases of appliance construction [8].

Bite registration of the appliances: The following details should be kept in mind as a starting point for creating working bites for the treatment of Class 2 division 1 malocclusions: The mandible should be moved forward until the buccal occlusal relationship is normal antero-posteriorly, which should take around 7 mm. Alternatively, edge-to-edge relationships would do. The bite should be open to the point of separating the upper and lower labial segments. It is advised that the construction bite be raised quite high, about 6 to 8 mm in the molar region. midline must line up properly. When biting, the patient is instructed to open, extend the mandible, and then gently close until instructed to stop, at which point should movement cease, and the mandible be held perfectly still. The occlusion can then be examined, and any necessary adjustments can be made without opening through protrusion, retrusion, or sideways movement. [6]

Appliances prescription :

Andresen activator:

Labial bows are active components of the Andresen activator. They regulate the incisors' palatal or lingual movements. Labial bows are springs fixed at both ends. Parts of the labial bow are: Two U-shaped loops, a bow joining the loops, and a retention tag make up the labial bow. It is made of strong SS wire that is 21 gauge or 0.7 mm thick [9]. The most versatile clasp is Adams' clasp, which is a modification on the arrowhead clasp. Baseplate is another crucial component for retention. Additionally, it performs duties such as supporting the appliance's other parts, including the bows, clasps, and modifications like bite planes that correct overbites and offer a propping effect. Figure 2



Figure 2: (A) Short labial bow of the Andresen activator, (B) Andresen activator in patient mouth. 1-Short Labial bow. 2-Adam's Clasp. 3-Acrylic base plate.

Van-Beek activator:

Adams' Clasp and Baseplate by The Van Beek activator differs from other activators by completely covering the maxillary anterior teeth's labial surfaces with acrylic. Consequently, no labial bow is used. The goal is to retain the maxillary anterior teeth as firmly as possible to stop them from retro lining due to the activator's dorsally directed stresses on the maxilla. A well-known and frequently undesired occurrence is the activator treatment-induced ratiocination of the maxillary anterior teeth. Mandibular incisor proclination is an almost inevitable and typically undesired side effect of activator therapy. The mandibular incisors and the alveolar process are freed from acrylic on the lingual side to reduce such proclination with the van Beek activator. However, acrylic has been applied to the labial surfaces of the mandibular incisors to hold the teeth comparable to the maxillary front teeth. Face-bow: The handle that transmits the force of the headgear to the jaws and dentition is called the face-bow. Headgear: The cervical (low pull) facebow [6] is used most frequently in patients with decreased vertical facial dimensions. The facebow is connected to the acrylic and ends just above the premolar region. The strap that connects the outer bow to the cervical area is fastened to the dorsal portion of the neck. Figure 3



Figure 3: (A) Van-Beek activator in patient mouth. 1- Acrylic covering of the upper incisors. 2-Acrylic Baseplate. 3- Adam's Clasp. 4- Face bow embedded in the acrylic base of the appliance and (B) Cervical-pull Neck strap used in the study.

The patients were instructed to wear the appliances for 16 hours per day including sleep time except for eating and playing certain sports. The overall functional treatment period was determined to be 8 months, Headgear

should be worn for 10-12 hours daily with 12-16 ounces of force per side to effectively control growth and correct Class II malocclusion, avoiding excessive force to prevent dental trauma, [4,5]

Selection of Headgear Type:

The choice of headgear depends on factors like anchorage point, force direction, and facial growth pattern, with cervical headgear being preferred for cases with healthy vertical mandibular growth and minimal maxillary molar movement.[7]

Patients were followed every four weeks to assess cooperation and treatment progress, with antero-posterior dental arch relationships checked with and without appliances in each appointment.

Primary outcomes were evaluation of the dentoskeletal parameters between the two investigated Removable Functional Appliance (RFAs) using the lateral cephalometric radiographs.

Statistical analysis

All data were collected, calculated, tabulated and statistically analyzed using the following statistical tests. A normality test (Shapiro-Wilk) was done to check normal distribution of the samples. Descriptive statistics were calculated in the form of Mean \pm Standard deviation (SD). Independent sample-t-test was used to compare two groups. Paired sample-t-test was used to compare two times (T0 and T1). P value \leq 0.05 is considered be statistically significant. All Statistical analysis were performed using the computer program SPSS software for windows version 26.0 (Statistical Package for Social Science, Armonk, NY: IBM Corp) at P- Value <0.5).

RESULT:

The comparison of Group A (Andresen Activator) between T0 and T1 reveals significant skeletal changes, particularly in SNB, ANB, Wits Appraisal, and Facial Angle, indicating effective mandibular advancement. Other parameters such as Sella-nasion-point an angle (SNA), Y-Axis, Facial Axis, and Frankfort mandibular plane angle (FMA) showed minimal or non-significant changes, suggesting stable vertical and maxillary positions, significant increases were observed in S-Go (P = 0.023), N-Me (P = 0.004), and Effective Mandibular Length (P = 0.001). Gonial Angle showed a slight but significant decrease (P = 0.042). Other changes, including SN-GoMe, ANS-Me, and Maxillary Length, were not statistically significant, Group A exhibited significant dental changes between T0 and T1, notably a reduction in FMA and interincisal angle, along with a significant increase in the L1 to mandibular plane angle. Changes in U1 to SN and U1 to FH also indicate upper incisor proclination. Overall, these findings reflect meaningful alterations in both vertical and incisor positioning over time. Table 1

Table 1: Paired t-test for comparison between pre and post treatment with Andresen Activator (Group A)

		Group A (Andresen Activator)					
		T0		T1		% change	P Value
		Mean	SD	Mean	SD		
Skeletal	SNA	80.0	2.69	80.34	2.72	0.43	0.623
	SNB	73.21	3.68	77.00	1.67	5.18	<0.001*
	ANB	6.79	1.95	3.34	1.91	-50.81	<0.001*
	Facial Angle	84.03	3.54	86.24	4.17	2.63	0.002*
	Wits Appraisal	5.92	3.59	3.12	2.96	-47.30	<0.001*
	Y-Axis	60.68	4.21	59.74	4.32	-1.55	0.064
	Facial Axis	85.72	5.62	86.71	4.87	1.15	0.063
	FMA	27.36	6.33	26.67	6.46	-2.52	0.072
	Gonial Angle	124.67	5.31	123.58	5.99	-0.87	0.042*
	SN-GoMe	36.90	7.11	33.49	7.01	-9.24	0.074
	S-Go (mm)	64.76	4.29	68.92	7.01	+6.42	0.023*
	N-Me (mm)	105.33	6.67	114.23	4.65	+8.45	0.004*
	ANS-Me	61.62	5.33	66.75	8.00	+8.33	0.069
	Effective Mandibular Length	96.87	5.13	107.42	5.80	+10.89	0.001*
Effective Maxillary Length	78.40	3.21	79.27	4.24	+1.11	0.410	
Dental	Interincisal Angle	114.98	8.47	118.38	8	2.96	0.035*
	L1 to mandibular plane angle	99.47	5.61	102.65	5.71	3.20	0.001*
	FMIA	53.86	4.91	49.98	6.17	-7.20	<0.001*

	U1 to SN	110.18	5.29	104.14	6.54	-5.48	0.011*
	U1 to FH	118.88	6.96	114.63	3.4	-3.58	0.002*

Data are presented as mean± SD, *significant p <0.05.

Group B showed significant improvements in mandibular advancement and sagittal correction, as reflected by changes in SNB, ANB, and Wits Appraisal. Vertical growth control was also evident with significant reductions in Y-Axis and FMA. Other parameters like SNA and Facial Axis remained stable, indicating localized skeletal changes post-intervention. Also, it shows significant changes in Gonial Angle decreased notably from 126.81 to 123.29, with a significant P value of 0.003**. Sn-GoMe experienced a significant reduction from 37.69 to 32.28 (P=0.173 is not significant), but S-Go mm increased significantly from 66.10 to 71.02 with a P value of 0.018**. N-Me mm increased markedly from 106.12 to 115.74, with a highly significant P value of 0.007**. The ANS-Me increased from 61.95 to 67.13, with a P value of 0.093, approaching significance. Effective Mandibular Length increased significantly from 97.61 to 112.39 (P=0.020**), indicating a notable growth or change in mandibular development. Effective Maxillary Length showed minimal change, going from 80.30 to 80.42, with a non-significant P value of 0.876. Overall, the data reveal significant decreases in Goniac Angle and increases in S-Go mm, N-Me mm, and Mandibular Length between T0 and T1, highlighting notable skeletal changes in group B over time. The comparison of group B between T0 and T1 reveals significant changes in dental parameters. The Interincisal Angle decreased from 114.56 to 120.04, with a highly significant P value of <0.001**. The L1 to mandibular plane angle increased slightly from 97.85 to 99.65, but this change was not statistically significant (P=0.172). The FMIA decreased from 54.65 to 53.52, with a significant P value of 0.043*. U1 to SN showed a significant decrease from 109.06 to 108.78 (P=0.001**). Similarly, U1 to FH decreased significantly from 119.82 to 118.93, with a P value of <0.001**. These results indicate notable dental and skeletal changes over time in group B, especially in the interincisal angle and U1 to SN, with the decreases in U1 to SN and U1 to FH being highly significant. Table 2

Table 2 : Paired t-test for comparison between pre and post treatment with Van-Beek Headgear Activator (Group B)

Group B (Van Beek Headgear Activator)							
		T0		T1		% change	P Value
		Mean	SD	Mean	SD		
Skeletal	SNA	81.95	2.28	80.71	2.23	-1.51	0.584
	SNB	73.8	1.56	75.91	3.63	2.86	0.001*
	ANB	8.16	2.00	4.8	1.31	-41.18	0.001*
	Facial Angle	84.31	2.04	86.16	3.09	2.19	0.006*
	Wits Appraisal	7.16	3.11	2.84	3.28	-60.34	0.001*
	Y-Axis	61.4	1.94	60.05	1.66	-2.20	0.009*
	Facial Axis	84.6	3.18	85.28	3.77	0.80	0.400
	FMA	29	3.46	26.59	3.19	-8.31	0.001*
	Gonial Angle	126.81	3.89	123.29	5.06	-2.78	0.003**
	SN-GoMe	37.69	3.15	32.28	5.96	-14.35	0.173
	S-Go (mm)	66.10	4.83	71.02	5.41	+7.44	0.018*
	N-Me (mm)	106.12	5.43	115.74	6.47	+9.07	0.007*
	ANS-Me	61.95	4.31	67.13	3.04	+8.36	0.093
	Effective Mandibular Length	97.61	5.24	112.39	7.71	+15.14	0.020*
Effective Maxillary Length	80.30	3.83	80.42	3.05	+0.15	0.876	
Dental	Interincisal Angle	114.56	7.00	120.04	8.08	4.78	<0.001*
	L1 to mandibular plane angle	97.85	5.35	99.65	5.22	1.84	0.172
	FMIA	54.65	4.7	53.52	4.75	-2.07	0.043*
	U1 to SN	109.06	6.98	108.78	2.97	-0.26	0.001*
	U1 to FH	119.82	5.14	118.93	6.77	-2.07	<0.001*

Data are presented as mean ± SD, *significant p <0.05.

The comparison of groups A (Andresen Activator) and B (Van Beek Headgear Activator) at each time point shows notable differences. At T0, group B has higher mean values than group A in SNA, SNB, and Facial

Angle, but these differences are not statistically significant ($P > 0.05$). For T1, the differences between the two groups in SNA, SNB, ANB, Facial Angle, Wits Appraisal, Y-Axis, Facial Axis, and FMA are also not statistically significant, as indicated by P values greater than 0.05. Within each group over time, both groups show some changes; for example, in group A, SNA slightly increased, and in group B, SNB increased significantly, but the statistical significance of these differences over time is inconsistent across parameters. Overall, while there are some numerical differences between the groups at T0 and T1, most comparisons do not reach statistical significance, indicating similar effects across the two treatment groups across the parameters analyzed. At T0, Gonial Angle was slightly higher in group B (126.81) than in group A (124.67), but this difference was not significant ($P=0.295$). By T1, the Goniac Angle decreased in both groups, more so in group B, but the difference between groups remained non-significant ($P=0.902$). S-Gome decreased in both groups from initial values, with group A dropping from 36.90 to 33.49 and group B from 37.69 to 32.28; however, these changes were not statistically significant. S-Go mm increased significantly in both groups, with group A changing from 64.76 to 68.92 ($P=0.498$) and group B from 66.10 to 71.02 ($P=0.533$). N-Me mm increased in both groups, significantly in group B (from 105.33 to 115.74, $P=0.763$). ANS-Me showed slight non-significant increases in both groups. Effective Mandibular Length and Maxillary Length did not show significant differences over time or between groups. Overall, the differences between groups over time were generally not statistically significant, though both groups showed trends toward skeletal changes. At T0, the Interincisal Angle is slightly higher in group A (114.98) than in group B (114.56), and this difference is not statistically significant ($P=0.901$). The same applies to T1, with both groups showing similar values and no significant difference ($P=0.635$). The L1 to mandibular plane angle increased slightly in both groups from T0 to T1; however, these changes are not statistically significant. The FMIA decreased modestly in both groups from T0 to T1, with no significant difference ($P=0.702$). The U1 to SN and U1 to FH angles decreased slightly in both groups, with no significant comparisons between T0 and T1 for either group. Overall, most parameters remained stable over time within each group, with no statistically significant differences observed, indicating minimal dental or skeletal change between T0 and T1. Table 3

Table 3: Independent t-test for comparison between groups A (Andresen Activator) and B (Van Beek Headgear Activator) before treatment for skeletal and dental parameters

			Group A (Andresen Activator)	Group B (Van Beek Headgear Activator)	Indep. T-test	P Value
Skeletal	SNA	T0	80.00 ± 2.69	81.95 ± 2.28	-1.83	0.083
	SNB	T0	73.21 ± 3.68	73.80 ± 1.56	-0.49	0.631
	ANB	T0	6.79 ± 1.95	8.16 ± 2.00	-1.63	0.119
	Facial Angle	T0	84.03 ± 3.54	84.31 ± 2.04	-0.23	0.818
	Wits Appraisal	T0	5.92 ± 3.59	7.16 ± 3.11	-0.87	0.395
	Y-Axis	T0	60.68 ± 4.21	61.40 ± 1.94	-0.52	0.611
	Facial Axis	T0	85.72 ± 5.62	84.60 ± 3.18	0.57	0.572
	FMA	T0	27.36 ± 6.33	29.00 ± 3.46	-0.76	0.459
	Gonial Angle	T0	124.67 ± 5.31	126.81 ± 3.89	-1.08	0.295
	SN-GoMe	T0	36.90 ± 7.11	37.69 ± 3.15	-0.34	0.739
	S-Go (mm)	T0	64.76 ± 4.29	66.10 ± 4.83	-0.69	0.498
	N-Me (mm)	T0	105.33 ± 6.67	106.12 ± 5.43	-0.30	0.765
	ANS-Me	T0	61.62 ± 5.33	61.95 ± 4.31	-0.16	0.876
	Effective Mandibular Length	T0	96.87 ± 5.13	97.61 ± 5.24	-0.33	0.743
Effective Maxillary Length	T0	78.40 ± 3.21	80.30 ± 3.83	-1.51	0.146	
Dental	Interincisal Angle	T0	114.98 ± 8.47	114.56 ± 7.00	0.125	0.901
	L1 to mandibular plane angle	T0	99.47 ± 5.61	97.85 ± 5.35	0.693	0.497
	FMIA	T0	53.86 ± 4.91	54.65 ± 4.70	0.389	0.702
	U1 to SN	T0	110.18 ± 5.29	109.06 ± 6.98	0.424	0.676
	U1 to FH	T0	118.88 ± 6.96	119.82 ± 5.14	0.360	0.722

Data is presented as mean ± SD.

Table 4: Independent t-test for comparison between groups A (Andresen Activator) and B (Van Beek Headgear Activator) after treatment for skeletal and dental parameters

		Group A (Andresen Activator)	Group B (Van Beek Headgear Activator)	Indep. T-test	P Value	
	SNA	T1	80.34 ± 2.72	80.71 ± 2.23	-0.36	0.723
	SNB	T1	77.00 ± 1.67	75.91 ± 3.63	-0.90	0.378
	ANB	T1	3.34 ± 1.91	4.80 ± 1.31	1.02	0.322
	Facial Angle	T1	86.24 ± 4.17	86.16 ± 3.09	0.05	0.960
	Wits Appraisal	T1	3.12 ± 2.96	2.84 ± 3.28	0.21	0.836
	Y-Axis	T1	59.74 ± 4.32	60.05 ± 1.66	-0.22	0.828
	Facial Axis	T1	86.71 ± 4.87	85.28 ± 3.77	0.77	0.450
	FMA	T1	26.67 ± 6.46	26.59 ± 3.19	0.04	0.970
	Gonial Angle	T1	123.58 ± 5.99	123.29 ± 5.06	0.12	0.902
	SN-GoMe	T1	33.49 ± 7.01	32.28 ± 5.96	1.07	0.296
	S-Go (mm)	T1	68.92 ± 7.01	71.02 ± 5.41	-0.64	0.533
	N-Me (mm)	T1	114.23 ± 4.65	115.74 ± 6.47	-0.23	0.823
	ANS-Me	T1	66.75 ± 8.00	67.13 ± 3.04	-0.10	0.918
	Effective Mandibular Length	T1	107.42 ± 5.80	112.39 ± 7.71	-0.69	0.495
	Effective Maxillary Length	T1	79.27 ± 4.24	80.42 ± 3.05	-0.60	0.555
	Interincisal Angle	T1	118.38 ± 8.00	120.04 ± 8.08	0.483	0.635
	L1 to mandibular plane angle	T1	102.65 ± 5.71	99.65 ± 5.22	1.282	0.214
	FMIA	T1	49.98 ± 6.17	53.52 ± 4.75	1.081	0.293
	U1 to SN	T1	104.14 ± 6.54	108.78 ± 2.97	0.758	0.457
	U1 to FH	T1	114.63 ± 3.40	118.93 ± 6.77	1.184	0.250

DISCUSSION

Class II dental malocclusion considered as the second most prevalent malocclusion after Class I, with a prevalence range of 13%-24%. As described and categorized by Edward Angle more than a century ago, Class II division 1 malocclusion is characterized by distal occlusion of the lower first molars by at least a half cusp width in relation to upper first molars resulting in locking of the mandible in a distal position. Moreover, specific traits of this division were the protrusion of the upper incisors and interruption of the relation of upper and lower incisors by the lower lip. Nevertheless, Class II malocclusion often accompanied by a skeletal discrepancy that could be caused by either a deficient mandible, excessive growth of maxilla, or a combination of both [10]. Functional appliances have been used for many years in the treatment of Class II malocclusions with the aim to obtain a skeletal correction of malocclusions [11].

The Andresen activator functional appliance is a mono-block that during closing induces an anterior position of the mandible. The effects of activator therapy were an increase in condylar growth and a remodeling of the articular fossa [12]. The Van Beek Headgear-Activator (vBHGA) is a less studied removable functional appliance. It has been shown to produce a significant restraining effect on the maxilla during growing years. In addition to dentoalveolar changes, the bulky bite plate is theoretically thought to also control for any increase in the lower anterior facial height, is considered advantageous for sagittal correction [13].

In the present study, we used orthodontic study models, cephalometric analysis, extra and intra-oral photographs, panoramic radiograph and lateral cephalometric radiograph for each patients.

Clinical photographs are essential for maintaining patient records, patient education, diagnosis and treatment planning.

Lateral cephalometric x-ray is a radiographic technique and a crucial diagnostic tool used in orthodontics and craniofacial surgery to evaluate the skeletal, dental, and soft tissue relationships in the craniofacial region.

We used cephalometric analysis to measure the effect of the Andresen activator and the Van-Beek Headgear activator on the correction of skeletal class II malocclusion by measuring the difference between T0 - T1 in skeletal measurements such as SNA , SNB , ANB , Facial Angle , Wits Appraisal , Y-Axis , Facial Axis , FMA , Gonial Angle, SN-GoMe , Effective mandibular length, Effective maxillary length, dental measurements in this study included Interincisal Angle, L1 to mandibular plane angle, FMIA, U1 to SN, U1 to FH .

In the present study, the comparison of group A (Andresen Activator) between T0 and T1 shows varying changes across parameters and the P value indicates no significant difference in some parameters and significant difference in other parameters.

SNA showed non-significant change in Group A between T0 - T1 this was in agreement with the results of Baccaglione (11), Cura (8), and Türkkahraman (2).

SNB increased significantly in Group A between T0-T1 indicating forward mandibular positioning , this comes with agreement with studies such as Baccaglione (11), Bilgiç (14) , Cattaneo (16), Premkumar (7), Perillo (21), Faccioni (22) and Türkkahraman (2), All endorsing studies highlight mandibular positional or structural enhancement through functional advancement, condylar growth stimulation, and neuromuscular adaptation.

ANB decreased significantly in the present study which was endorsed by Cattaneo (16), Baccaglione (11), Faccioni (22), Kishnani (11), Dolce (12), Türkkahraman (2) and Cura (8).

FMA, Y-Axis and Facial angle decreased with a non-significant difference in Group A between T0 - T1 which was in agreement with Türkkahraman (2). Reasons for the insignificant changes in vertical dimensions in group A maybe due to that it lacked the extraoral traction needed for true vertical control.

Mandibular length parameters such as S-Go, N-Me, Effective mandibular length showed significant increase in the present study in Group A between T0 - T1 which agreed with Cattaneo (16) who documented significant 3D condylar and ramus growth.

Faccioni (22), also agreed that early treatment boosts mandibular morphological response, Perillo (21) also concluded that mandibular length consistently increases with functional appliances .

McNamara (10) and Bilgiç (14) supported the increase in the length of the mandible.

In the present study significant dental changes were observed, the Interincisal angle increased significantly between T0 and T1 which agrees with the study by Cura (8), which emphasized the dental compensation by incisor tipping for correction of class II malocclusion in the activator group, this was in harmony with Baccaglione (11), who demonstrated significant increase in interincisal angle.

U1 to SN and U1 To FH significantly decreased in Group A from T0 to T1 which emphasized on the retroclination of upper incisors, this may be caused by the labial bow in the Andresen activator which can cause retroclination of the upper incisors.

This was in harmony with Kotyk (5), Premkumar (7), and Türkkahraman (2). who concluded that activator type appliances produce upper and lower incisors retroclination as well as significantly increase in the interincisal angle.

Additionally, L1 to MP decreased significantly and FMIA increased significantly in Group A, This was in harmony with studies such as Baccaglione (11), Kotyk (5), Premkumar (7), Türkkahraman (2) and Cura (8), lower incisor proclination maybe due to incomplete coverage of the lower incisors by the Andresen activator. On the other hand , studies such as Cattaneo (16) and Perillo (21) disagreed with the dental parameters changes in the present study, they concluded that Activator appliances show more skeletal changes than dental changes , reasons for disagreement may be Construction bite may have enhanced pressure on incisors or Acrylic design did not cover the lower incisors completely leading dental changes with the skeletal changes. In the present study, the comparison of group B (Van-Beek Headgear activator) between T0 and T1 shows varying changes across parameters, and the P value indicates no significant difference in some parameters and significant difference in other parameters.

SNA showed mild decrease with non-significant change in Group B between T0 - T1 this was supported by Cura (8), who stated that Activator-Headgear restricts maxillary forward growth.

This was in harmony with Phan et al (13), who agreed with restriction of the maxilla by the Van-Beek headgear activator, Altenburger et al (2), also agreed that the headgear - activator combination shows mild maxillary restraint.

On the other hand, Kirtane (20) conducted a study that resulted in significant decrease in SNA , this

disagreement may be due to the larger sample size in the conflicting study and maxillary clockwise rotation rather than maxillary decrease in size, Van Beek (4), Al-Kurwi et al (24) and Farret et al (26) also disagreed with the results of the present study as it showed more pronounced maxillary restriction.

The possible reasons for disagreement between those studies and the present study may be due to variability in headgear compliance by the patients or the individual differences in maxillary growth velocity during treatment or the sample used in the present study may have experienced less natural maxillary forward growth. SNB increased significantly in Group B between T0-T1 indicating forward mandibular positioning, this comes with agreement with studies such as Kirtane (20), and Kotyk (5), which showed that SNB increased significantly by the Van-Beek Headgear combination.

This was in harmony with Bendeus (14), and Altenburger et al (2) who emphasized that the SNB increased significantly, Cura (8), and Van Beek (4), Al-Kurwi et al (24), Scaglia & Zimdahl (25) also agree with the present study in SNB increase.

ANB decreased significantly in the present study which is in agreement with the results by Kirtane (20), Phan et al (13), Altenburger et al (2), Van Beek (4), Al-Kurwi et al (24), Scaglia & Zimdahl (25) and Farret et al (26) which resulted in similar ANB decrease.

Wits appraisal decreased significantly from T0 to T1 in the present study, this was supported by Phan et al (13), which showed that Wits appraisal significantly decreased showing clear sagittal improvement, Kirtane (20) also agreed with the marked decrease in Wits appraisal.

FMA decreased significantly from T0 to T1 along with Y-Axis and Gonial angle, Facial angle increased significantly from T0 to T1 and the Facial axis showed insignificant change these results showed vertical skeletal improvement in Group B (Van Beek Headgear activator).

This was in harmony with the studies carried by Kotyk (5), who showed that Van Beek activator reduced vertical dimensions, Marşan (23), and Phan et al (13), agreed that the headgear along with the Van Beek activator limited vertical growth and improved mandibular rotation.

On the other hand, Kotyk (5) and Phan et al (13) disagreed with the Facial Axis change as they showed more significant change in facial axis, possible reasons for the disagreement may be due to the relative stability of the facial axis parameter and less sensitivity to treatment.

Mandibular length parameters such as S-Go, N-Me, Effective mandibular length showed significant increase in the present study in Group B between T0 - T1 which agreed with Cattaneo (16) who documented significant 3D condylar and ramus growth, This was in harmony with Kotyk (5), who reported significant increase in mandibular length with Van Beek activator, Bendeus (14) also concluded that mandibular length consistently increases with Van Beek Headgear activator.

In the present study significant dental changes were observed, the Interincisal angle increased significantly between T0 and T1 which agrees with the study by Kotyk (5), which reported that dental compensation by incisor tipping for correction of class II malocclusion, this was in harmony with Premkumar (7), who demonstrated significant increase in interincisal angle.

U1 to SN and U1 To FH significantly decreased in Group B from T0 to T1 which emphasized on the retroclination of upper incisors in the Van Beek Group. this was in harmony with Kotyk (5), Cura (8), and Van Beek (4) who reported that activator headgear type appliances produce upper incisors retroclination as well as significantly increase in the interincisal angle.

On the other hand, L1 to MP increased and FMIA decreased in Group B from T0 to T1 but the change was not significant, This was in contradiction with studies such as Van Beek (4), along with the early functional appliance literature which reported that Lower incisor changes often accompany mandibular advancement, possible reasons for the disagreement may be due to improvement of the appliance design over time or the strong skeletal response which reduced the need for dental compensation.

The comparison of groups A (Andresen Activator) and B (Van Beek Headgear Activator) at each time point shows notable differences At T0, Group B presented with slightly higher mean values of SNA, SNB, and Facial Angle, reflecting a marginally more prognathic maxillofacial pattern than Group A. However, these differences were not statistically significant, confirming that both groups were comparable at baseline.

This similarity is essential because it validates the methodological soundness of comparing the two appliances. Neither group began with significantly more severe sagittal or vertical discrepancies, which ensures that the observed changes are treatment-related rather than growth-related or sample-dependent.

At T0, group B has higher mean values than group A in SNA, SNB, and Facial Angle, but these differences are not statistically significant. For T1, the differences between the two groups in SNA, SNB, ANB, Facial Angle, Wits Appraisal, Y-Axis, Facial Axis, and FMA are also not statistically significant.

Poor postural behavior of the orofacial musculature is a primary etiologic factor in Class II malocclusions. Correction is achieved by permanently advancing the mandible through muscular exercise. Overall, the differences between groups over time were generally not statistically significant, though both groups showed trends toward skeletal changes.

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