How to Cite:
Diab, A. M. I., Shendy, M. A. M., & Ali, M. M. M. (2022). Comparative evaluation of treatment effects between two fixed functional appliances for correction of class II malocclusion. *International Journal of Health Sciences*, *6*(S7), 421–436. https://doi.org/10.53730/ijhs.v6n7.11016

Comparative evaluation of treatment effects between two fixed functional appliances for correction of class II malocclusion

Amany Mohammed Ibrahim Diab
Lecturer, Ortodontics Department, Faculty of Dental Medicine for Girls, AL-Azhar University,Cairo, Eygpt,
Email: amanydiab.26@azhar.edu.eg

Mennat Allah M. Shendy
Dentist in ministry of health, Cairo, Egypt.
Email: menna.shendy@gmail.com

Maha Mostafa Mohamed Ali*
Lecturer, Ortodontics Department, Faculty of Dental Medicine for Girls, AL-Azhar University,Cairo, Eygpt,
Email: maha.moustafa@su.edu.eg

Abstract---Background: The purpose of the current study was to analyze and compare the effects of the PowerScope Appliance and the Carriere Distalizer Appliance in the treatment of Class II malocclusion. Twenty patients aged 14 to 18, with Angle Class II Division 1 malocclusion and showed for therapy with fixed functional equipment, were divided into two groups. (n1=10) for the PowerScope Appliance (American Orthodontics, Sheboygan, Wis.) and (n2=10) for the Carriere Distalizer Appliance (Henry Schein company, New York, USA). Cephalometric analysis was performed on pre- and post-treatment lateral cephalogram. PowerScope and Carriere Distalizer appliances' skeletal and dentoalveolar effects were compared. Secondary outcomes included patient comfort and operator convenience. The PowerScope device restricted maxillary development while allowing substantial mandibular expansion, whereas the Carriere Distalizer did not cause any statistically significant correction in the skeletal component. There was no difference in treatment time seen with either appliance. There was no difference in treatment time seen with either appliance. Conclusions:The PowerScope appliance effectively corrects Class II Division 1 malocclusion in adolescent patients by promoting anterior maxillary displacement restriction with considerable forward mandibular repositioning, which minimizes both skeletal and soft tissue profile convexities.

International Journal of Health Sciences ISSN 2550-6978 E-ISSN 2550-696X © 2022.

Manuscript submitted: 9 March 2022, Manuscript revised: 18 May 2022, Accepted for publication: 27 June 2022

Keywords: Power Scope Appliance; Class II Malocclusion; Functional Appliance; Non-Extraction, Fixed Carriere Distalizer

Introduction

Class 2 malocclusion is one of the most prevalent orthodontic disorders observed. This form of disparity results in skeletal profile changes, such as mandibular retrusion, maxillary protrusion, or a combination of the two [1]. Different protocols Called to treat skeletal Class 2, Including a variety of fixed appliances and Procedures of extaction, extraoral Tractions, Orthognathic surgeries, and Functional orthopedic devices. Choice of treatment Depends on the associated properties Deformation, such as the amount of anteroposterior magnitude Inconsistency, age of patient and his compliance, psychological Effects, fiscal conditions and time of treatment. Many treatments modalities have been offered for such cases, including removable functional appliances such as the Harvold activator, bionator, and Twin block, as well as stationary appliances such as Herbst, Jasper Jumper, Advansync, and Power Scope [2-4]. Emil Herbst showed the first fixed bite leaping device for Class II treatment. It was still popular in 1909, although it has the disadvantage of being inflexible, which limits lateral mandibular movements and oral hygiene maintenance [3]. Evolution of fixed functional appliances over years led to introducing newer appliances with better results in noncompliant patients. Class 2 repairs by fixed functional appliances are basically dependent on simulation of mandibular growth, mesial movement of the lower dentition and distal movement of upper molars. From these innovations the Carrier Distalizer [2, 5-7]which is a class II corrector appliance with an articulating ball and socket, The device was named after its inventor Luis Carriere, in 2004. PowerScope, a hybrid appliance for the correction of dental and mild skeletal class II malocclusions in noncompliant patients[3 ,4 ,8-12] . Therefore, the aim of the current study was to determine the the skeletal and dentoalveolar effect of both the Carrier Distalizer and power scope.

Method

Materials and Methods

2.1. Ethicalapproval:

Before beginning the study, patients and/or guardians were fully informed about the procedures, and informed written consents were got and allowed by the Ethical Committee of the Faculty of Dental Medicine for Girls, Al-Azhar University.

2.2.Groups

This study included 20 individuals with Class II malocclusion 14 to 18 years old and suggested for treatment with fixed functional appliances. They were evenly divided into two groups. (n1=10) among PowerScope Appliance (American Orthodontics, Sheboygan, Wis;) and (n2=10) among Carriere Distalizer Appliance (Henry Schein company, New York, USA).

2.3. Intervention procedure

All n1 participants underwent bonding of fixed orthodontic appliance (Unitek™ Metal bands, 3M Unitek USA, Unitek™ Miniature Twin Metal Brackets, 3M, Unitek USA, Unitek™ Orthodontic Composite, 3M, Unitek USA).Sequential orthodontic arch wires were used starting from 0.012" Ni-Ti up to 0.019×0.025" St.St. arch wire (G & H wire company, USA). The PowerScope appliance was used until the patient's mandible could not be manipulated more posterior than one mm overjet inter-dental relationship and molar relation and canine relation are corrected to Class I, then appliance was removed and a new lighter stainless steel arch wire placed, the patient was instructed to use 3/16" heavy inter-maxillary elastics for three months from first premolars and the maxillary canines to the mandibular first and second premolars for posterior occlusion settling.

All participants were subjected to extractions of maxillary wisdom teeth to facilitate distalization of teeth. For selecting the correct Carriere Distalizer appliance length, the supplied ruler was used. A measurement was taken from the midpoint of the buccal surface of the maxillary first molar to the midpoint of the labial surface of the maxillary canine.Then labial surface of the maxillary canines and buccal surface of maxillary first molars were first polished using a low-speed polishing brush. They were then deproteinized with 5.25% sodium hypochlorite (NaOCl) for 1minute, followed by rinsing and then drying. This was done toincreasing the bond strength. The enamel surfaces were then etched for 30 seconds with 37 percent phosphoric acid (Meta Etchant, Meta Biomed Co.LTD, Korea), cleaned, and dried. The bonding agent was subsequently applied (Trans bond TMXT Light Cure Adhesive, 3M Unitek, USA).

The carrier distalizer appliance was adjusted and positioned on the buccal surface of the maxillary first molars, followed by the labial surface of the maxillary canine. It was then bonded using light cure composite (Trans bond TMPLUS Color Change Adhesive, 3M Unitek,U.S.)and for the mandibular arch, fabrication of passive lingual arch to avoid labial flaring lower incisors was done.Postoperative Class II elastics were applied bilaterally from the maxillary canine to the mandibular second molar [7].
Every four weeks, the patients were requested to attend a follow-up session to assess their compliance, integrity of the Carriere Distalizer/or PowerScope appliance and transpalatal arch/or passive lingual arch plus the amount of correction achieved.

In order to ensure patients' compliance, a similar technique to that of Veerooet al.[13]was used to encourage their compliance, Patients were told to put on intermaxillary Class II elastics, and warned that otherwise extraction of the first premolars would take place. In order to assess compliance, each patient was given an empty plastic bag and instructed to insert all used elastics in the bag. Each patient was instructed to bring bag with her to the recall visit and the number of the used elastics was counted and compared with the number of days between the appointments. Debonding of PowerScope appliance and Carriere Distalizer appliance occurred in 1 out of 10 bonded Carriere Distalizer appliances (10%) and there is no decementation of passive lingual arch or transpaltal arch occurred.

2.4. Appliance removal:

Both applianceswere removed after either reaching a Class I or a super Class I molar relationship by using bracket removal appliance.

2.5. Records

Each patient had the following regular orthodontic records gathered prior to treatment: Extra-oral images (frontal at rest, frontal during smile, right and left profile views).

Intraoral pictures (frontal, right and left side views, upper and lower occlusal views). dental research models. Standardized lateral cephalometric radiographs.

Panoramic radiograph.

In addition, postoperative extra oral photographs, intraoral photographs and lateral cephalogram were got after an average observation period of 6 to 8 months, then skeletal and dental measurements were evaluated after cephalometric analysis.

3. Results

3.1. Statistical Analysis:

3.1.1. Descriptive analyses:

According to each group, the mean, median, standard deviation (SD), and range of angular and linear measures were given.

3.1.2.Testing for normality:

The Shapiro-Wilk test for normality was used to check the data's normality before selecting the comparative analysis tests.

3.1.3. Comparative analysis:

The parametric Welsh's t test was used to evaluate between-group differences in normally distributed data, and the Paired t test was used to evaluate pre- and post-treatment changes within groups.
The non-parametric Wilcoxon rank sum test was used for data that were not normally distributed, and the Wilcoxon signed rank test for Paired Data was used to evaluate within-group changes before and after treatment.

3.1.4. The significance level:

It was confirmed at $P \leq 0.05$. If the p-value is less than 0.05, the results are considered statistically significant.

3.1.5 The following statistical software was used in this study:

Version 3.5.2 of the R statistics package (20-12-2018). Copyright (C) 2018. The R Foundation for Statistical Computing. [Reference: *R Core Team (2018). R: A language and environment for statisticalcomputing. R Foundation for Statistical Computing, Vienna, Austria.URL https://www.R-project.org/.]

3.2. The results show that there were statistically significant changes in all skeletal angular measurements except LAFH, LAFH/TAFH, and Corpus Height in the Power Scope group. while in the Carrier Distallizer group; there were no statistically significant changes in all linear measurements.

Except for Corpus Height measures, there was no statistically significant difference between the Power Scope and Carrier Distallizer groups in terms of changes in all skeletal linear measurements.

Table 1. shows a descriptive analysis of Skeletal Linear measures for each group, as well as within-group comparisons

Skeletal Linear measurements			Mean	SD	Median	Min	Max	Within Group Comparison Paired t test		Welsh's t test for group comparison	
								Mean Change (SD)	p-value* [Interpretation]	Mean Difference (95% CI)	P-value* [Interpretation]
UAFH	PS	Pre	51.56	2.40	52	49	56	-1.5 (1.27)	0.0077 (S)	-0.28 (-4.05, 3.49)	0.8715 (NS)
		Post	50.06	2.21	51	46	52				
	CD	Pre	49.33	3.61	48	45	54	-1.78 (4.84)	0.3027 (NS)		
		Post	47.56	6.62	47	40	59				
LAFH	PS	Pre	67.44	8.51	69.5	51	79	-1.17 (1.6)	0.0602 (NS)	0.72 (-2.02, 3.47)	0.575 (NS)
		Post	66.28	9.32	68	50	78				
	CD	Pre	64.33	7.16	64	55	77	-0.44 (3.4)	0.7048 (NS)		
		Post	63.89	7.03	64	53	73				
TAFH	PS	Pre	115.89	7.25	114	105	128	-3.22 (1.39)	0.0001 (S)	-2 (-8.13, 4.12)	0.4765 (NS)
		Post	112.67	7.87	113	100	125				
	CD	Pre	113.56	9.36	112	99	127	-5.23 (7.93)	0.0837 (NS)		
		Post	108.33	10.69	108	92	122				
PFH	PS	Pre	73.39	6.31	72	64	85	-2.17 (2.18)	0.0175 (S)	2.61 (-1.69, 6.91)	0.3503‡ (NS)
		Post	71.22	7.48	72	60	82				
	CD	Pre	68.67	5.85	69	61	79	0.44 (5.41)	0.7256** (NS)		
		Post	69.11	6.03	69	59	76				

‡*Results of the non-parametric Wilcoxon signed rank test for Paired data at p-value ≤0.05. The non-parametric Wilcoxon rank sum test results.*

Table 2. shows a descriptive analysis of Skeletal Linear measures for each group, as well as within-group comparisons

Skeletal Linear measurements			Mean	SD	Median	Min	Max	Within Group Comparison Paired t test		Between Group Comparison Welsh's t test	
								Mean Change (SD)	p-value* [Interpretation]	Mean Difference (95% CI)	p-value* [Interpretation]
LAFH/TAFH	PS	Pre	58.33	4.53	60	47	62	0.99 (1.62)	0.1041 (NS)	NA	NA
		Post	59.32	5.44	60.5	46.8	65				
	CD	Pre	NA	NA	NA	NA	NA	NA	NA		
		Post	NA	NA	NA	NA	NA				
Ramus Height	PS	Pre	59.33	8.57	57	49	78	1.11 (1.05)	0.0133 (S)	-1.67 (-4.51, 1.18)	0.2189 (NS)
		Post	60.44	8.71	59	50	79				
	CD	Pre	67.78	2.59	67	65	72	-0.56 (3.64)	0.6596 (NS)		
		Post	67.22	4.24	67	59	72				
Corpus Height	PS	Pre	65.67	4.36	64	60	72	-1.33 (1.85)	0.063 (NS)	3.78 (0.55, 7)	0.0257 (S)
		Post	64.33	5.41	61	58	72				
	CD	Pre	52.78	5.67	51	45	62	2.44 (4)	0.1044 (NS)		
		Post	55.22	4.41	55	49	62				
Total Mandibular Length	PS	Pre	106.89	8.34	107	96	125	-2.78 (1.99)	0.003 (S)	3 (-2.6, 8.6)	0.2577 (NS)
		Post	104.11	7.98	104	93	120				
	CD	Pre	105.33	5.81	105	97	115	0.23 (7.19)	0.9284 (NS)		
		Post	105.56	6.67	108	92	113				

[1]Results of the non-parametric Wilcoxon signed rank test for Paired data at p-value ≤0.05. The non-parametric Wilcoxon rank sum test results.

3.2.2 Skeletal Angular Measurements. (Table 3,4)

The results show that there were statistically significant changes in all skeletal angular measurements in the Power Scope group, but only in the ANB measurement in the Carrier Distallizer group.

The between-group analyzes revealed a statistically significant difference between the Power Scope and Carrier Distallizer groups in terms of changes in all skeletal angular metrics except SNA and SNB.

Table3. Descriptive study of Skeletal Angular measures for each group and comparisons within groups:

Skeletal Angular measurements			Mean	SD	Median	Min	Max	Within Group Comparison Paired t test		Between Group Comparison Welsh's t test	
								Mean Change (SD)	p-value* [Interpretation]	Mean Difference (95% CI)	P-value* [Interpretation]
SNA	PS	Pre	81.67	4.21	83	73	85	-0.56 (0.53)	0.0369** (S)	0.11 (-1.01 1.24)	0.6556† (NS)
		Post	81.11	3.92	83	73	84				
	CD	Pre	79	2.35	79	75	83	-0.44 (1.42)	0.2542** (NS)		
		Post	78.56	2.74	80	74	82				
SNB	PS	Pre	74.22	3.70	76	67	78	3.11 (0.49)	<0.0001 (S)	-1.78 (-3.79 0.23)	0.076 (NS)
		Post	77.33	3.50	78.5	70	81				
	CD	Pre	75.22	3.53	73	72	83	1.33 (2.6)	0.1622 (NS)		
		Post	76.56	3.13	77	72	82				
ANB	PS	Pre	7.44	1.01	8	6	9	-3.67 (0.61)	<0.0001 (S)	2.78 (1.9 3.66)	<0.0001 (S)
		Post	3.78	0.75	4	2.5	4.5				
	CD	Pre	4.56	1.88	5	2	8	-0.89 (1.05)	0.0352 (S)		
		Post	3.67	1.87	3	2	7				
N-A-Pg	PS	Pre	12.22	4.17	11	8.5	20	-4.61 (1.95)	0.0001 (S)	3.06 (0.8 5.31)	0.0112 (S)
		Post	7.61	2.76	8	4	12				
	CD	Pre	7.44	4.28	7	1	15	-1.56 (2.51)	0.0995 (NS)		
		Post	5.89	4.83	3	1	15				

†Results of the non-parametric Wilcoxon signed rank test for Paired data at p-value ≤ 0.05.
The non-parametric Wilcoxon rank sum test results.

Table (4) Descriptive study of Skeletal Angular measures for each group and comparisons within groups

Skeletal Angular measurements			Mean	SD	Median	Min	Max	Within Group Comparison Paired t test		Between Group Comparison Welsh's t test	
								Mean Change (SD)	p-value* [Interpretation]	Mean Difference (95% CI)	P-value* [Interpretation]
S-Ar-Go	PS	Pre	148	11.16	145	128	164	2.72 (1.06)	<0.0001 (S)	-4.28 (-6.68 , 1.88)	0.0027 (S)
		Post	150.72	11.05	148.5	130	166				
	CD	Pre	145.89	6.43	145	137	156	-1.56 (3.05)	0.164 (NS)		
		Post	144.33	5.89	145	137	156				
Facial Angle	PS	Pre	86.11	3.66	88	81	90	4.50 (1.06)	0.0079** (S)	-4.94 (-8.04 , -1.85)	0.0194ǂ (S)
		Post	90.61	2.98	91.5	86	94				
	CD	Pre	84.44	2.46	85	79	87	-0.44 (3.97)	0.7458 (NS)		
		Post	84	2.87	84	78	88				

ǂResults of the non-parametric Wilcoxon signed rank test for Paired data at p-value ≤ 0.05.
The non-parametric Wilcoxon rank sum test results.

3.3. Dental measurements (Table 5 , 6) (Fig 1,2,3)

The results show that there were statistically significant changes in all dental metrics in the Power Scope group, but not in the Carrier Distallizer group, except for 6L-NB mm and Overjet.

The between-group analyzes revealed a statistically significant difference in all dental metrics except 6U-NA mm, 1L-SN, 1L-NB, and 6L-NB mm between the Power Scope and Carrier Distallizer groups.

Table (5): Dental measures descriptive analysis for each group and within-group comparisons

Dental measurements			Mean	SD	Median	Min	Max	Within Group Comparison Paired t test		Between Group Comparison Welsh's t test	
								Mean Change (SD)	p-value* [Interpretation]	Mean Difference (95% CI)	P-value* [Interpretation]
1U-SN	PS	Pre	109.89	6.31	108	103	124	-15.7 (4.58)	<0.0001 (S)	15.44 (9.64 , 21.24)	<0.0001 (S)
		Post	94.22	6.20	95	80	104				
	CD	Pre	104.44	7.60	104	92	116	-0.22 (6.7)	0.9232 (NS)		
		Post	104.22	8.33	105	92	114				
1U-NA mm	PS	Pre	29.22	6.50	30	21	40	-16.4 (4.31)	<0.0001 (S)	18.83 (10.19, 27.48)	0.0006 (S)
		Post	12.83	6.18	10	7.5	26				
	CD	Pre	26.89	9.88	25	13	40	2.44 (10.9)	0.5196 (NS)		
		Post	29.33	10.89	28	14	49				
1U-NA mm	PS	Pre	7.27	2.73	7.4	3	11	-2.77 (0.75)	<0.0001 (S)	2.54 (-0.22 , -2.77)	0.0102 (S)
		Post	4.50	2.76	4.5	1	9				
	CD	Pre	7.22	2.33	6	5	11	-0.22 (2.28)	0.7773 (NS)		
		Post	7.00	2.87	6	2	10				
6U-NA mm	PS	Pre	24.00	2.45	25	21	27	-2.17 (1.2)	0.0006 (S)	4.38 (-1.39 , 10.14)	0.1189 (NS)
		Post	21.83	1.85	22	19.5	24				
	CD	Pre	8.11	3.52	8	2	15	2.21 (7.47)	0.4004 (NS)		
		Post	10.32	8.04	7	2.3	24				

**Significance level at p-value ≤0.05.*

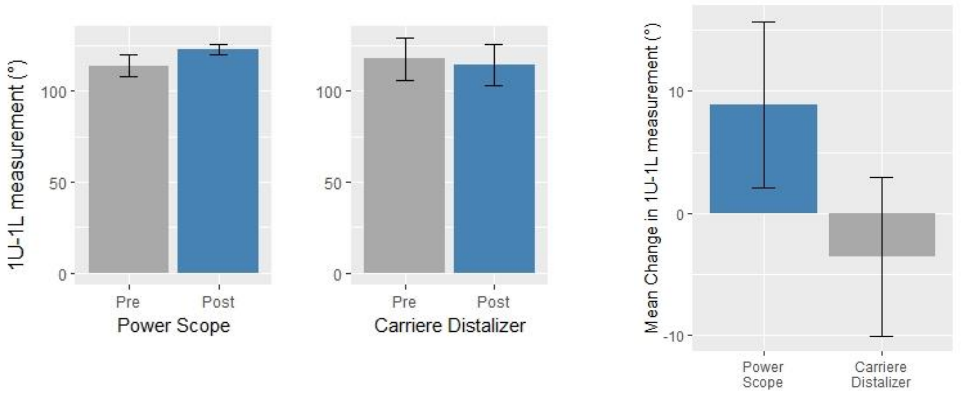


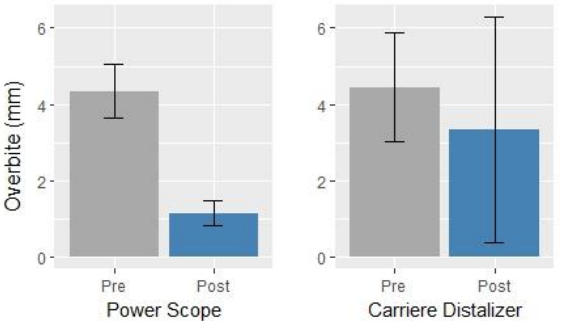
Fig 1.*A.Chart showing 1U-1L measurements regarding each group (Power Scope , Carrier Distalizer) and B. within-group comparisons:*

Table (6} Dental measures descriptive analysis for each group and within-group comparisons

Dental measurements			Mean	SD	Median	Min	Max	Within Group Comparison Paired t test		Between Group Comparison Welsh's t test	
								Mean Change (SD)	p-value* [Interpretation]	Mean Difference (95% CI)	P-value* [Interpretation]
1L-SN	PS	Pre	42.56	4.95	43	35	49	-3.89 (3.92)	0.0176 (S)	1.11 (-4.82, 7.04)	0.6909 (NS)
		Post	38.67	6.65	37	30	47				
	CD	Pre	41.33	7.81	40	35	59	-2.78 (7.19)	0.28 (NS)		
		Post	38.56	11.24	36	21	57				
1L-NB	PS	Pre	31.83	5.66	32	25	42	4.83 (2.21)	0.0002 (S)	-1.39 (-5.12, 2.34)	0.4318 (NS)
		Post	36.67	5.87	39	28	44				
	CD	Pre	33.22	6.82	34	19	40	3.44 (4.61)	0.0554 (NS)		
		Post	36.67	8.93	37	21	51				
1L-NB mm	PS	Pre	7.24	2.22	6	5	11	1.41 (0.38)	<0.0001 (S)	-6.63 (-11.28, -1.99)	0.0013‡ (S)
		Post	8.66	2.00	7.9	6.5	12				
	CD	Pre	18.78	4.52	20	8	24	-5.22 (6.04)	0.0568** (NS)		
		Post	13.56	5.64	12	6	20				
6L-NB mm	PS	Pre	17.44	2.60	17	12	21	-3.33 (1.52)	0.0002 (S)	-0.56 (-3, 1.87)	0.6271 (NS)
		Post	14.11	2.36	14	10	18.5				
	CD	Pre	17.22	1.86	16	15	20	-3.89 (2.98)	0.0044 (S)		
		Post	13.33	3.5	14	5	17				

**Significance level at p-value ≤0.05.*
***The non-parametric Wilcoxon signed rank test results for Paired data.*
‡ The non-parametric Wilcoxon rank sum test results.

A



B

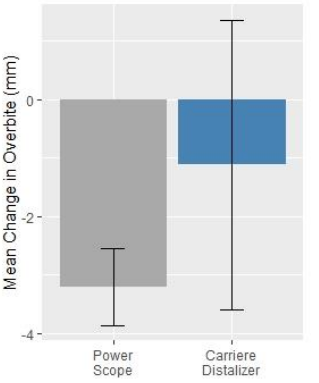
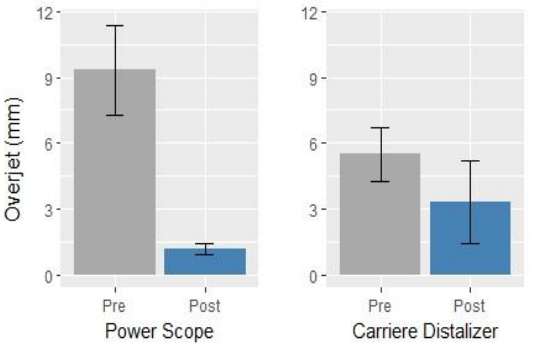


Fig 2. A. Chart showing Overbite measurementsregarding each group (Power Scope , Carrier Distalizer) and B. within-group comparisons:

A



B

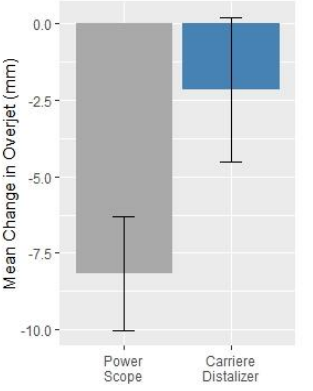


Fig 3. A. Chart showing Overbite measurements regarding each group (Power Scope, Carrier Distalizer) and B. within-group comparisons:

3.2. Normality test (Table 7,8)

Table (7): The Shapiro-Wilk test was used to determine the normality of skeletal measurement changes in both treatment groups:

Skeletal measurements		Shapiro-Wilk test	
		p-value*	**Interpretation**
SNA	**PS**	0.0004	*Data do not follow a normal distribution*
	CD	0.0042	
SNB	**PS**	0.2729	Normally distributed data
	CD	0.066	

ANB	**PS**	0.0826	
	CD	0.0391	
N-A-Pg	**PS**	0.023	
	CD	0.0588	
S-Ar-Go	**PS**	0.2028	
	CD	0.5105	
Facial Angle	**PS**	0.0043	*Data do not follow a normal distribution*
	CD	0.3041	normally distributed data
UAFH	**PS**	**0.1237**	
	CD	0.4557	
LAFH	**PS**	**0.3882**	
	CD	0.2125	
TAFH	**PS**	0.5565	
	CD	0.8257	
PFH	**PS**	0.2732	
	CD	0.0073	*Data do not follow a normal distribution*
LAFH/TAFH	**PS**	0.3071	Normally distributed data
	CD	NA	
Ramus Height	**PS**	0.0391	
	CD	0.1151	
Corpus Height	**PS**	0.2209	
	CD	0.0378	
Total Mandibular Length	**PS**	0.0127	
	CD	0.6112	

**Significance level at p-value ≤0.01.*

Table (8): Shapiro-Wilk Test for Normality of Changes in Dental Measurements for Both Treatment Groups:

Dental measurements		Shapiro-Wilk test	
		p-value*	**Interpretation**
1U-SN	**PS**	0.1461	Normally distributed data
	CD	0.4846	
1U-NA	**PS**	0.1049	
	CD	0.0651	
1U-NA mm	**PS**	0.9646	

	CD	0.2937	
6U-NA mm	**PS**	0.0222	
	CD	0.8278	
1L-SN	**PS**	0.0111	
	CD	0.7557	
1L-NB	**PS**	0.3419	
	CD	0.8743	
1L-NB mm	**PS**	0.2327	
	CD	0.0096	*Data do not follow a normal distribution*
6L-NB mm	**PS**	0.011	Normally distributed data
	CD	0.0151	
1U-1L	**PS**	0.4003	
	CD	0.2871	
Overjet	**PS**	0.2554	
	CD	0.0741	
Overbite	**PS**	0.6012	
	CD	0.4357	

**Significance level at p-value ≤0.01.*

Discussion

The purpose of this research was to evaluate and compare the skeletal and dental changes caused by the Carrier Distallizer and Power Scope appliances. The adoption of an untreated control group is motivated by ethical considerations. The blind methods envisaged in the data analysis reduced the study's bias.
Class II malocclusion is among the most prevalent developmental abnormality, with a propagation ranging from 15 to 30% in most populations. Patients with dental and skeletal Class II malocclusion have a greater risk of dental trauma, a more negative observance of facial and dental esthetics, a negative influence on life quality and self- esteem, a greater proclivity to periodontitis and tooth wear, anecrease of oropharyngeal space and greaterhappening of sleep disorders [1 3].

Class II patients with mandibular deficit are most typically treated with functional orthodontic equipment. A functional appliance applies orthopedic force to the mandibular condyle. These appliances promote skeletal correction by beginning remodeling changes at the mandibular condyle and glenoid fossa, as well as repositioning the mandibular condyle in the glenoid fossa and allowing the mandibular bone to auto-rotate [5 6]

The resultsthat in Power Scope group, except for LAFH, LAFH/TAFH, and Corpus Height; PFH (Posterior facial height), and ramus height, there were statistically significant changes in all skeletal linear measurements, which might be attributed

to distal migration of maxillary molars generating a wedging effect. This conclusion was consistent with a prior study that found a modest rise in AFH (Anterior facial height), PFH, and ramus height, but none of these changes were significant [3].

There were no statistically significant differences in all linear metrics in the Carrier

Distallizer group.

The results show that there were statistically significant changes in all skeletal angular measurements in the Power Scope group, but only in the ANB measurement in the Carrier

Distallizer group.

There was a statistically significant difference (P≤0.05) decrease in SNA angle, which showed the effect of Powerscope appliance on the restriction of the maxillary base that agreed with the results reported by other Powerscope studies [8-12]

There was a statistically significant difference (P≤0.05) increase in SNB angle. This change resulted from the forward position of the mandibular base using the Powerscope appliance that brought the position of point B forward. That agreed with the results of Powerscope studies [4 8] .

The mandible is moved forward during Carrier Distallizer treatment by hefty elastics that patients wear practically full time. As a result, mandibular length (Co-Gn) increases during treatment may be expected compared to normal growth. There was no statistically or clinically significant increase in mandibular length in this trial, which is consistent with prior Carrier Distallizer investigations [5-7].

Class II malocclusion was corrected mostly by dentoalveolar alterations. The results show that there were statistically significant changes in all dental metrics in the Power Scope group, which is consistent with the findings of previous Powerscope research.

Except for 6L-NB mm and Overjet, there were no statistically significant changes in the Carrier Distallizer group. The mandibular molar mesial movement and lower incisor proclination both contribute to overjet reduction.

Conclusion

The PowerScope appliance effectively corrects Class II Division 1 malocclusions in teenage patients by promoting anterior maxillary displacement restriction with considerable forward mandibular repositioning, which minimizes both skeletal and soft tissue profile convexities. The PowerScope appliance generated dentoalveolar modifications such as modest maxillary molar distalization, mesialization of the lower molars, and proclination of the lower incisors, resulting in Class II malocclusion treatment.

Carrière Distalizer appliance could repair Class II canine-molar connection into Class I canine-molar relationship with no significant skeletal modifications.

Carrière Distalizer appliance generated dentoalveolar modifications such as modest maxillary molar distalization, mesialization of lower molars, and proclination of lower incisors, resulting in correction of Class II malocclusion.
Author Contributions: All authors read and agreed to the published version of the manuscript.Funding: This work has no extra funding
Institutional Review Board Statement: Not applicable.
Informed Consent Statement: Not applicable.
Data availability: Available upon request from the corresponding author.

Acknowledgments

Taif University Researchers Supporting Project Number (TURSP-2020/130), Taif University, Taif, Saudi Arabia.
Conflicts of Interest**:** The authors declare no conflicts of interest.

References

1. Antony, T.; Amin, V.;Hegde ,S.; Hegde, S.; Shetty, D.; Khan, MB. The evaluation and clinical efficiency of powerscope: Anoriginal research. J Int.Soc .Prevent.Communit.Dent. 2018,8,264-270.
2. Aroraa,V.; Sharmab,R.; Chowdhary,S.Comparative evaluation of treatment effects between two fixed functional appliances for correction of Class II malocclusion: A single-center, randomized controlled trialAngle Orthod. 2018, 88, 259-266
3. El-Hossainy,H.; Al-khalefa,HN.;Abouelnour,AM.Three-dimensional Evaluation of the Efficacy OfPowerscope Appliance In Treatment Of SkeletalClass Ii Malocclusion: A Prospective Clinical Study.Al-Azhar J. Dent. Sci. V 2022,25, 223:231.
4. Espinosa, D.; Santos, M.; Mendes, S.;Normando, D. Mandibularpropulsion appliance for adults with Class II malocclusion:a systematic review and meta-analysis. Eur. J.Orthod.2020, 42, 163-73.
5. Hamilton, CF.;Saltaji, H.; Preston, CB,.;Flores-Mir, C.;Tabbaa,S.Adolescent patients' experience with the Carriere distalizerappliance. Eur.Paediatr. Dent. 2013,14, 219–224.
6. Kaur, GJ.; Gandhi, G.; Khanna, M.; Loomba, A.; Sharma, A.A Cephalometric Evaluation and Comparison of Skeletal,Dentoalveolar, and Soft Tissue Changes Brought aboutby the Forsus Fatigue Resistant Device and PowerScopeFixed Functional Appliance. J Indian Orthod. Soc. 2021, 1,1-10.
7. Kim-Bermana, H.; McNamara, JA.; Lints, J.;McMullen,C.;Franchie, L.Treatment effects of the Carrieret Motion 3De appliance for the correction of Class II malocclusion in adolescentsAngle Orthod. 2019, 89, 839-846.
8. Mcnamara, JA. Components of Class II malocclusion inchildren 8–10 years of age. Angle Orthod. 1981, 51, 177–202
9. Rodrigues, H. Unilateral application of the Carriere distalizer.J Clin. Orthod. 2011, 45, 177–180.
10. Sandifer, CL.; English, JD.; Colville, CD.;Gallerano, RL.;Akyalcin,S. Treatment effects of the Carri `ere distalizer using lingual arch and full fixed appliances. J World Fed. Orthod. 2014, 3, e49–e54

11. Shendy, MM.; Ibrahim, SA.; Salama, AE. Evaluation of the Treatment Outcomes for Class II Malocclusion by Using Powerscope appliance. ADJ for Girls. 2017. 4, 409- 416.
12. Shetty P, Shetty M, Chalapati M, Kori C, Soans CR and MuraliPS. Comparative Evaluation of Hard-Tissue and Soft-Tissue Changes following Fixed Functional Appliance Treatmentin a Skeletal Class II Malocclusion Using Forsus andPowerScope. J Allied Health Sci. Pract. 2021, 11,87-92.
13. Suryasa, I. W., Rodríguez-Gámez, M., & Koldoris, T. (2021). The COVID-19 pandemic. International Journal of Health Sciences, 5(2), vi-ix. https://doi.org/10.53730/ijhs.v5n2.2937
14. Veeroo, Helen J.; Cunningham, Susan J.; Newton, Jonathon Timothy; Travess, Helen C. Motivation and compliance with intraoral elastics. American J. Orthod. and Dentofac. Orthoped.2014, 146, 33–39. doi:10.1016/j.ajodo.2014.03.02