Original Article

The Evaluation and Clinical Efficiency of PowerScope: An Original Research

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Abstract

Aims and Objectives: Managing mild-to-moderate Class II malocclusion is one of the common and major challenges to orthodontists. Class II discrepancies with mandibular deficiency during active growth are usually treated using myofunctional appliances. Fixed functional appliances evolved due to the noncompliance with conventional myofunctional appliances. One of the latest Class II correctors is the PowerScope appliance. The purpose of this study was to determine the amount, time, and rate of molar correction and efficacy of PowerScope.

Materials and Methods: A total of 10 participants, between 15 and 19 years' age group (mean = 16.8 years; 5 males and 5 females), requiring treatment of Class II malocclusion were considered for this study. All routine records were made. After initial leveling and alignment, lateral cephalogram was taken in standardized natural head position using Planmeca ProMax unit. Later, PowerScope was installed and a patient was monitored every month for further adjustment and reactivation. On achieving Class I molar relation, skeletal, dental, and soft-tissue linear and angular parameters were measured using Dolphin Imaging Software. Amount, rate, and total treatment time for molar correction were measured. Molar correction was calculated by taking S vertical as reference plane. The obtained values were statistically analyzed using paired *t*-test.

Results: There were statistically significant changes seen in dentoalveolar parameters such as lower incisor proclination, mandibular molar advancement, and reduction in both overjet and overbite. In skeletal parameters, due to the anterior positioning of the mandible, sagittal parameters showed statistically significant changes. In the soft tissue, a significant improvement in facial profile was seen, due to the anterior movement of soft-tissue pogonion.

Conclusion: The results of this study have shown that statistically significant differences were found in dentoalveolar, soft-tissue, and skeletal parameters.

Keywords: *Fixed functional appliances, molar relation, paired t-test, planmeca software, PowerScope*

Introduction

Class II malocclusion presents a major and common challenge to orthodontists. It may be a dental Class II or may have an unseen skeletal component. Skeletal Class II jaw relation may be due to a prognathic maxilla, retrognathic mandible, or a combination of both. Mandibular retrognathism may be due to the small mandible and posterior placement of condyle in the glenoid fossa or may be due to functional retrusion of the mandible. Management of Class II malocclusion depends entirely on the severity of the problem and the age at which the treatment is carried out. According to McNamara, the most common characteristic of Class II malocclusion is mandibular retrusion, rather than

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maxillary prognathism. A functional appliance treatment for mandibular advancement is often advocated in Class II malocclusion due to mandibular re. In patients, who have not yet crossed the adolescent growth spurt, removable functional appliance such as Activator, Bionator, Twin Block, and Frankel may be used. If the patient reports after the pubertal growth spurt or during the late stages of puberty, fixed functional appliances such as fixed Twin Block, Jasper Jumper, Herbst, Universal bite jumper, Ritto, Eureka Springs, and Forsus fatigue-resistant device (FRD) would be a better choice.[1-5]

Efficiency of treatment mechanics of fixed functional appliance has been a major focus throughout the history of orthodontics. Fixed functional appliances are normally known as "noncompliance Class II correctors."[6,7] A number of fixed functional appliances have gained popularity in recent years to help to achieve better results in noncompliant patients. One such latest innovation is PowerScope Class II corrector and its unique features are patient-friendly design, ready to use one piece with no laboratory setup and no assembly. It has a simple attachment system with durable telescopic mechanism, a Ni–Ti internal spring system which reduces the treatment time compared to the other Class II correctors and a ball and socket joint system which maximizes lateral movement for patient comfort.

The aim of this study is to determine the clinical efficacy of PowerScope appliance by evaluating skeletal, dentoalveolar, and soft-tissue changes contributing to Class II malocclusion correction.

Aim of the study

This study aimed to evaluate clinical efficacy of PowerScope appliance.

Objectives of the study

- To evaluate the skeletal, dentoalveolar, and soft-tissue changes after treatment with PowerScope appliance
- To determine the amount of molar correction
- To determine the average time taken for the Class II correction
- To determine the rate of molar correction.

Clinical study

This study was conducted in the Department of Orthodontics and Dentofacial Orthopaedics, Yenepoya Dental College, Mangalore (From January 2015 to December 2016), in order to evaluate the clinical efficacy of PowerScope appliance by assessing skeletal, dentoalveolar, and soft-tissue changes and to determine average amount, time, and rate of molar correction in the treatment of Class II malocclusion.

Criteria for patient selection

In this study, 10 participants between 15 and 19 years' age group (mean = 16.8; 5 males and 5 females), visiting the Department of Orthodontics and Dentofacial Orthopaedics, Yenepoya Dental College, requiring correction of Class II malocclusion were considered. After patient selection, informed consent was obtained and routine records were made. (The sample size of 10 participants was determined after a power analysis based on the mean values derived from a previous pilot study evaluating the Class II molar correction involving restraining effect on the maxilla and resultant forward push of the mandible using this Class II corrector appliance [PowerScope]. To overcome the attrition rate of 20%–30%, the overall recruitment goal was set for 10 participants).

Inclusion criteria

The inclusion criteria of this study were as follows:

1. Convex profile
2. Retrognathic/deficient mandible
3. Class II molar relationship
4. Positive visual treatment objective
5. Normal dentition for the age.

Exclusion criteria

The exclusion criteria of this study were as follows:

1. Patients with previous history of orthodontic treatment
2. Patients with neuromuscular disorder
3. Patients with temporomandibular joint disorder
4. Patients with cleft lip and palate
5. Patients with skeletal open bite
6. Patients with Class I and Class III malocclusion
7. Patients with poor periodontal health.

Armamentarium

- MBT™ Versatile + Bracket prescription (0.022 inch slot) (3M Unitek)
- PowerScope kit containing:
- PowerScope right arm
- PowerScope left arm
- Crimpable shims (2 and 3 mm)
- Hex head driver
- Replacement attachment.
- Rectangular stainless steel archwires (0.019" × 0.025 inch)
- Ligature wire (0.009 inch)
- Lateral cephalogram.

Materials and Methods

The treatment was planned using 0.022" slot preadjusted edgewise appliance. After leveling and alignment using initial wires (MBT sequence), 0.019" × 0.025" stainless

steel wire was placed in both the arches. Lower anterior labial root torque was incorporated in the archwire. The entire lower arch was consolidated and cinch back was given to prevent the lower anterior proclination. A pretreatment lateral cephalogram was taken in standardized natural head position using Planmeca ProMax unit, prior to PowerScope installation. (The ethical clearance was obtained from the Yenepoya University Ethical Society having reference letter no. YUEC 293/30/12/2014).

Installation of PowerScope appliance

Appliance insertion

Unlike other Class II correctors, there was no need for assembly, taking measurements or appliance manipulation. The appliance allows wire-to-wire installation with attachments placed mesial to the first molar in the maxillary arch and distal to the canine in the mandibular arch, generating a horizontal directed force.

Appliance activation

Activation dot marking for visual reference is provided at the push rods of the appliance (right and left) which helps us to determine if the appliance is activated or not. If the dot mark is exposed, it indicates the appliance is inactive, and to reactivate the appliance, crimpable shims are added to the shaft.

Collection of data

After PowerScope installation, patients were recalled every 3 weeks for checkup and activation was done, if needed. On achieving Class I molar relation, PowerScope appliance was removed and posttreatment lateral cephalogram was made. The pre- and posttreatment cephalometric values were obtained using Dolphin software (Dolphin Imaging System). The obtained values were statistically analyzed using paired *t*-test. Amount, rate of molar correction, and total treatment time were calculated from the time and the appliance was placed until removal.

Measurements were carried out by measuring mean difference from pre- and postparameters.

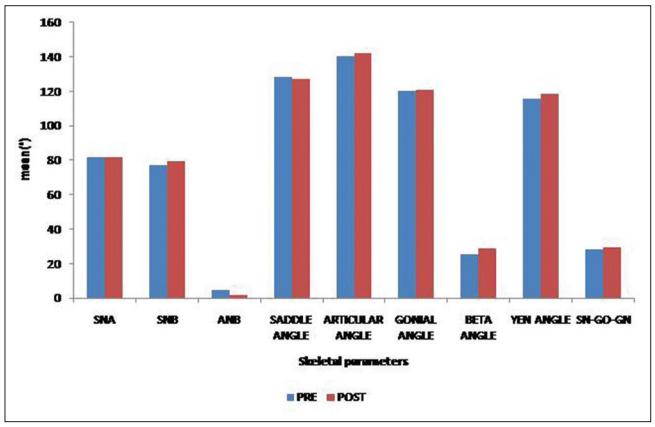
1. Distance between S vertical line to upper molar mesial cusp tip [Ms]
2. Distance between S vertical line to lower molar mesial cusp tip [Mi]
3. Class II molar correction (mean difference) = Ms(d) + Mi(d).

Results

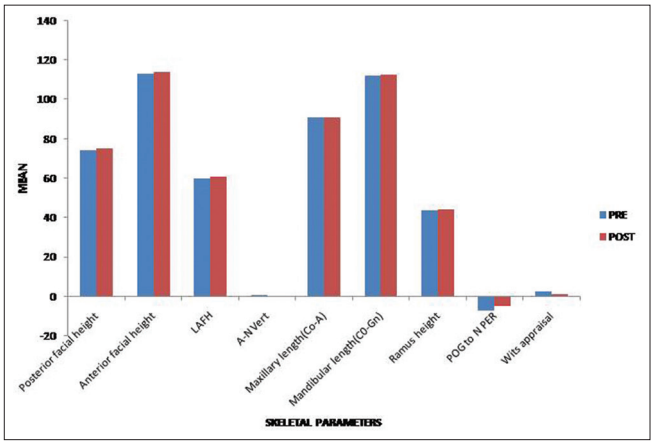
This study evaluated the clinical efficacy of PowerScope Class II corrector appliance using lateral cephalograms. A total of 10 patients between 15 and 19 years of age (mean = 16.8) were selected for this study. After leveling and alignment, PowerScope was installed and a constant force of 260 g was delivered. The patient was monitored every month for further activations and adjustments. The amount of skeletal, dental, and soft-tissue changes was evaluated once the desired stable molar relation was achieved lateral cephalograms, which were taken before placement and after the removal of PowerScope appliance. These lateral cephalograms were analyzed using Dolphin Imaging Software (DIS) with selected parameters and were subjected to statistical analysis. The average amount, rate, and time taken for Class II correction were also determined in this study. The result of statistical *t*-test based on the *P* value for different parameters is shown in Graphs 1-8.

Discussion

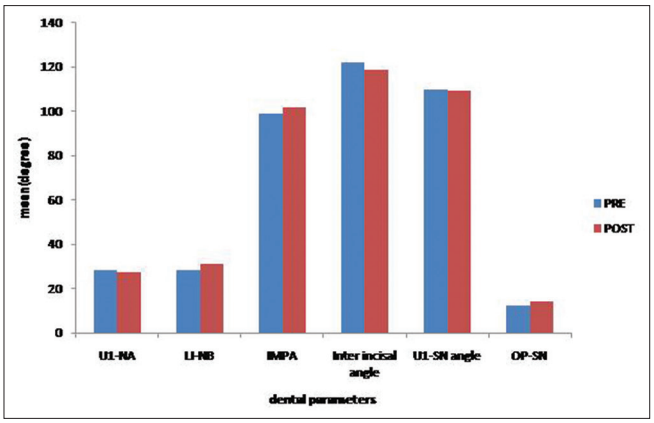
Among all malocclusions, Class II malocclusion presents a constant challenge to the orthodontists. Many treatment approaches and various appliances have been endeavored for correcting the Class II malocclusion which can be as a result of skeletal abnormalities. Class II malocclusions due to mandibular retrusion are most commonly treated with functional



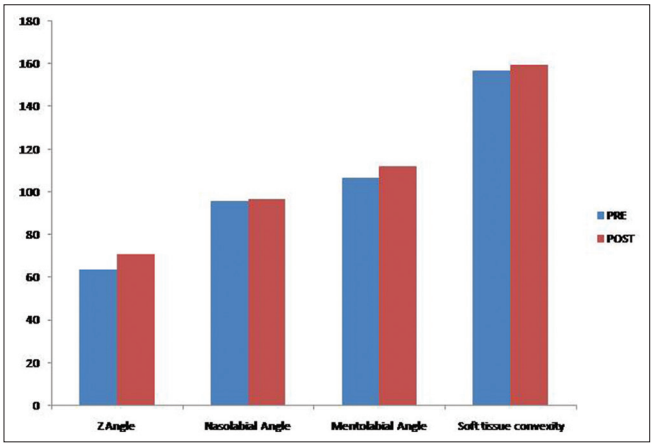
Graph 1: Skeletal angular parameters



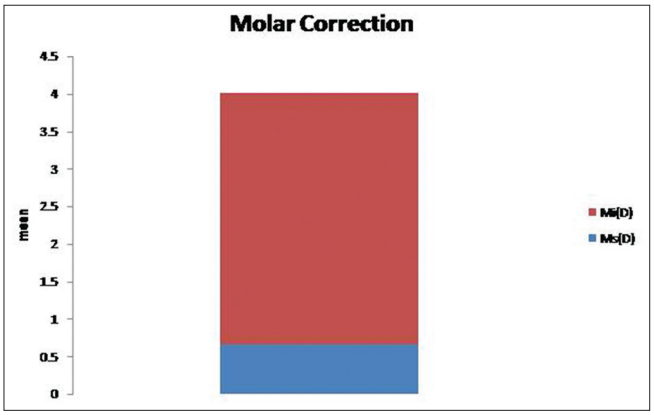
Graph 2: Skeletal linear parameters



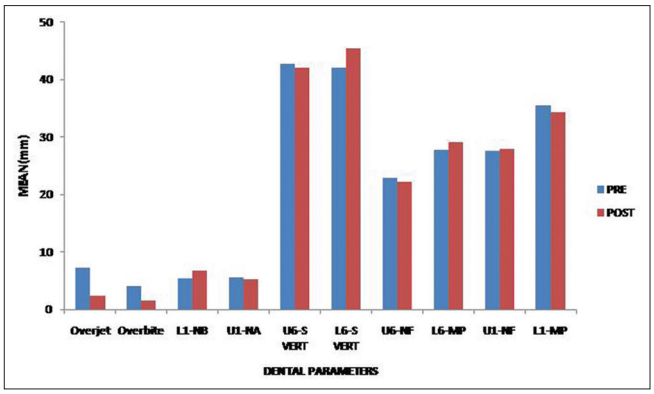
Graph 3: Dental angular parameters



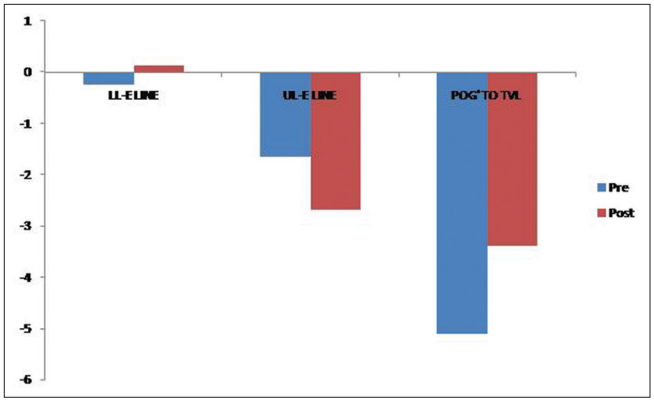
Graph 5: Soft-tissue angular parameters



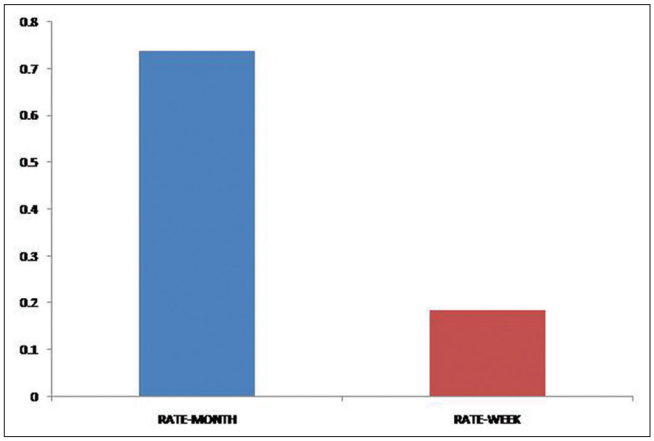
Graph 7: Mean molar correction



Graph 4: Dental linear parameters



Graph 6: Soft-tissue linear parameters



Graph 8: Mean molar correction week/month

orthodontic appliances. A functional appliance creates orthopedic force directed at the mandibular condyle. These appliances produce skeletal correction by initiating remodeling changes at the mandibular condyle and glenoid fossa as well as repositioning the mandibular condyle in the glenoid fossa and autorotation of the mandibular bone. They can be of two types – removable or fixed appliances.[8-12] Among fixed functional appliance, PowerScope has been added to the inventory recently by American Orthodontics. Literature is abundant with studies on many fixed functional appliances such as Jasper Jumper, Herbst, Universal bite jumper, Eureka Springs, and Forsus FRD, but no reports are currently available with regard to PowerScope.[13] The PowerScope allows the quick and easy wire-to-wire installation preventing bond failures of bracket and buccal tube. The ball and socket joint at the two ends of the appliance allows excellent jaw movements reducing much of patient discomfort.

Customization of the appliance could be done with the help of crimpable shims supplied along with PowerScope armamentarium.

This study illustrates the skeletal, dental, and soft-tissue changes after treatment with PowerScope appliance. This study was carried out in an age group between 15 and 19 years (mean = 16.8) to evaluate the amount, time, and rate taken for Class II correction.

Amount and rate of Class II molar correction

This study evaluated the rate of Class II molar correction using PowerScope Class II corrector. A sample size of 10 participants was considered with a mean age of 16.8 years with Class II malocclusion and was treated with PowerScope appliance. The amount of molar correction was evaluated using lateral cephalograms taken before PowerScope placement and other one after desired molar relation is achieved. Measurements were carried out using DIS.

The results obtained from the present study are as follows:

- Average amount of molar correction is 4.04 mm
- Average time taken for molar correction is 5.5 months
- Average rate of molar correction is 0.73 mm/month.

Cephalometric analysis

Skeletal, dental, and soft-tissue changes contributing to Class II correction in PowerScope appliance treatment were evaluated quantitatively on lateral cephalogram taken in standardized natural head position using DIS.

Skeletal parameters

Maxilla

SNA value showed that it had no effect on maxilla in this age group. The insignificant decrease in A to N perpendicular and effective maxillary length showed that there is only limited restraint of forward maxillary growth.

Mandible

Anterior positioning of chin takes place, which is explained by statistically significant change in Pog to N perpendicular value, which explains the increase in SNB and decrease in ANB angle, which is inversely correlated. There is no statistically significant increase in effective length of the mandible.

Maxilla to Mandible

In this study, Wits appraisal and Yen and Beta angle showed statistically significant change. SNB angle has a positive correlation with Beta and Yen angle and a negative correlation with Wits value. The increase in SNB angle contributed for increase in Beta and Yen angle and decrease in Wits value, which contributed for the correction of Class II malocclusion.

Vertical changes

There was no statistically significant vertical change during the appliance wear. A slight increase was seen in AFH (Anterior facial height), PFH (Posterior facial height), and ramus height, but all were not significant changes, and this can be due to distal movement of maxillary molar causing a wedging effect. All the skeletal changes were found in accordance with the prior hypothesis which had set limited skeletal changes as a result of using Class II corrector appliance (PowerScope).

Dental parameters

The Class II malocclusion correction was achieved by mainly dentoalveolar changes. The maxillary dentition exhibited modest changes which were not significant while mandibular dentition exhibited significant changes during treatment.

Mandibular dentition

The PowerScope appliance produced a large amount of mesial movement of mandibular molar with lower incisor proclination of 1.4 mm, which is a relevant amount. Mandibular molar extrusion was seen, which was not significant that indicated compensation for maxillary molar intrusion and clockwise rotation of occlusal plane. The increase in the occlusal plane to SN plane inclination is related to the protrusion and intrusion of lower incisors.

Maxillary dentition

The clockwise rotation of occlusal plane was produced by the intrusion of upper molar due to the headgear effect acting on the maxillary molar area. Since the dentition was blocked together, this force also influenced the maxillary incisors causing slight extrusion. There was distal movement of maxillary molar and slight lingual tipping of maxillary incisors due to the headgear effect, but the effect was not significant.

Interdental

The treatment regimen proved to be effective on occlusal parameters. The overjet and overbite decreased and was statistically significant. A net reduction of 5.3 and 2.56 mm was recorded for overjet and overbite, respectively, while a net improvement of molar relationship was achieved by mandibular molar mesial movement and maxillary molar distalization. The overjet reduction is contributed by the mandibular molar mesial movement and by the lower incisor proclination. Due to the lower incisor proclination, interincisal angle was decreased but was not statistically significant.

Soft-tissue parameters

In this study, overall improvement in the facial profile was seen and changes related were to a lesser extent than the dentoalveolar changes. There was an increase in N-Sn-Pg' angle. This finding is related to the forward positioning of soft-tissue pogonion. The decrease in E line-labrale superius measurement occurred as a result of retrusion of the upper lip due to the lingual tipping of maxillary incisors and the anterior positioning of soft-tissue pogonion. There was an increase in the nasolabial angle that was not statistically significant. The lower lip protrusion was found to be statistically insignificant. A statistically significant increase was seen in mentolabial angle, which contributes to improvement in facial profile. Both the dentoalveolar and soft-tissue changes are suggesting that the values are higher than the assumed changes through the prior hypothesis.

The advantages of PowerScope appliance could be enumerated as follows:

1. Fixed one-piece appliance available in one size suiting all Class II patients
2. Require no laboratory setup
3. Quick and easy wire-to-wire installation
4. Compliance free
5. Internal Ni–Ti spring delivers 260 g of force for continuous activation during treatment
6. No headgear tube or special band assemblies required
7. Can be used with banded or bonded molar tube
8. No bond failure of canine bracket or buccal tube
9. Low profile and less bulky for more esthetic facial appearance
10. Smooth, rounded patient-friendly design for better patient comfort
11. Easy to clean-better oral hygiene
12. Ball and socket joint allowing maximum lateral movement
13. Telescopic device that does not displace or disengage during treatment.

Controversies raised by this study

1. As the other studies on fixed functional appliances on the correction of Class II malocclusion still are not clear with the fact that the favorable changes using fixed functional are purely skeletal, dentoalveolar, and/or combination. Our study also is surrounded by the same controversies as we cannot delineate the effect of skeletal changes to see any secondary and favorable dentoalveolar or soft-tissue changes. Although the skeletal changes are not so obvious, the overall soft-tissue results are acceptable due to the secondary effects seen on the dentoalveolar components[14-20]
2. The criteria for diagnosing a typical Class II malocclusion used in this study
3. The pubertal growth assessment done may be controversial as no single method is reliable enough.[8-13]

Conclusion

The purpose of this study was to determine the clinical efficacy of PowerScope appliance by evaluating the skeletal, dental, and soft-tissue changes and to determine the total amount, rate, and time taken for Class II correction. Since sample size was small and two-dimensional cephalometric evaluation has its limitations and there is no literature till date evaluating the efficacy of PowerScope appliance individually, the results of this research should be used cautiously in relation to other clinical findings.

The results of this study led to the following conclusions:

1. There were statistically significant changes seen in dentoalveolar, skeletal, and soft-tissue parameters after using PowerScope. Even though the skeletal correction was due to anterior positioning of pogonion, the increase in the mandibular length was not significant
2. Average amount of molar correction was 4.04 mm
3. Average time taken for molar correction was 5.5 months
4. Average rate of molar correction was 0.73 mm/month
5. Average amount of maxillary molar distalization was 0.66 mm
6. Average amount of mandibular molar advancement was 3.38 mm, which was statistically significant.

The PowerScope appliance was efficient in the correction of Class II malocclusion. We found that Class II correction is mainly dentoalveolar with some significant changes in both skeletal and soft-tissue parameters. PowerScope application showed improvement in the soft-tissue profile and esthetic appearance of the patient by the forward positioning of the mandible.[19]

Summary

This study was conducted to evaluate and determine the clinical efficacy of PowerScope appliance by assessing skeletal, dentoalveolar, and soft-tissue changes and to determine total amount, rate, and time taken for Class II correction. In this study, 10 participants between 15 and 19 years' age group (mean = 16.8; 5 males and 5 females) were considered for correction of Class II malocclusion. The informed consent was obtained and documentation of pretreatment records was done. Lateral cephalometric radiographs were taken before placement and after removal of the PowerScope appliance. Skeletal, dental, and soft-tissue changes were analyzed using DIS. Statistical analysis was done using paired *t*-test. Based on the statistical

findings, significant changes were seen in dentoalveolar, skeletal, and soft-tissue parameters. Total treatment duration was 5.5 months, with a molar correction of 4.04 mm achieved at a rate of 0.73 mm/month. The PowerScope appliance was efficient in correction of Class II malocclusion mainly by dentoalveolar changes and showed improvement in the soft-tissue profile and esthetic appearance of the patient by the forward positioning of the mandible.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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