

Comparison of Skeletal Effects of Forsus Fatigue Resistant Device and Powerscope Treatment – A Cephalometric Study

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ABSTRACT

Aim- To evaluate and compare the skeletal effects of Forsus Fatigue Resistant Device and Powerscope Class II Corrector.

Materials and method- Lateral cephalograms of 48 (pre and post) class II patients in the post peak age group were taken and divided into three groups, 12 patients were treated as control group, 12 treated with Forsus Fatigue Resistant Device and 12 treated with Powerscope Class II Corrector. The skeletal analysis was done using Pancherz cephalometric analysis.

Results- Cephalometric analysis revealed that both the appliances stimulated mandibular growth, increased the anterior face height and posterior face height due to growth of temporomandibular joint.

Conclusion- Both the appliances were effective in the treatment of Class II malocclusion and revealed nearly same alterations in the skeletal parameters.

Keyword – Powerscope, Forsus FRD appliance, Skeletal change, Cephalometry

Introduction

Retrognathic mandible is one of the salient feature of class II malocclusion. Various treatment mechanisms are available to treat skeletal class II with retrognathic mandible. Growth modulation can be carried out in growing individuals in which the appliance directs the mandible in forward position and redirect growth in the correct direction.¹

Myofunctional appliances like activator, bionator, Frankel regulator has been used in growing individuals.^{2,3} whereas use of fixed functional appliance are most commonly used in post pubertal individuals namely herbst, jasper jumper, RITTO appliance, eureka spring, bite jumper, Forsus FRD, etc. Fixed functional appliance are tooth borne appliances thus, brings about dentoalveolar changes as well as skeletal changes, most common dentoalveolar change is lower incisor proclination.³

Forsus Nitinol Flat Spring was introduced in 2001, which was later modified by Bill Vogt to Forsus fatigue resistant device (Forsus FRD).⁴ Forsus FRD is semi rigid telescopic spring which is placed bilaterally in the patients mouth. The spring rod produces a force of 200g bilaterally to bring the mandible forward and also restricts the maxillary growth.⁵ The appliance is used after levelling and aligning the upper and lower arch. The appliance also limits lateral movement of the mandible.⁶

Powerscope class II corrector was developed in 2014 by Andrew Hayes. It has an internal Niti spring which delivers 260g of continuous force. This appliance has greater patient acceptance,

range of motion and installation is simple. It has a wire to wire attachment eliminating the need for headgear tube. It is an effective way to correct retrognathic mandible.⁷

In Pancherz analysis, alteration of occlusion is seen in sagittal and vertical direction.⁸ It consists of two components which are sagittal and vertical analysis. Sagittal analysis include 11 linear variables whereas vertical has six linear and four angular variables.⁸ The purpose of the present study was to make a qualitative evaluation on lateral cephalograms Of sagittal skeletal changes contributing to Class II correction with Forsus and Powerscope appliance treatment.

Methodology

The treatment sample consisted of 36 subjects, consecutively treated with Forsus FRD, Powerscope and Control group treated with class II elastics. Cephalograms are obtained from the archives of Department of Orthodontics and Dentofacial Orthopaedics. 72 cephalograms (Pre treatment and Post functional appliance therapy – T1 And T2) were collected . Since the names or the photographers of subjects included in the study were not required , hence informed consent was not necessary .

The selection criteria for treated subjects were patients in post peak growth period (Fishman's skeletal maturity assessment), normal or mildly prognathic maxillae (SNA : 83 ± 5), retrognathic mandible (SNB : less than 78), horizontal or normal growth pattern (Jarabak ratio : 66 and above), Angle's Class II molar relationship, overjet more than 5mm and permanent dentition. Exclusion criteria included craniofacial anomalies, prior history of orthodontic treatment or orthognathic surgery, any systemic diseases , periodontally compromised patients and history of facial or dental trauma.

The specific protocols for the fixed functional appliances were followed which includes proper diagnosis, VTO, assessing the growth status of the patients, treatment planning and appliance selection.

Sagittal skeletal changes occurring during the fixed functional treatment were evaluated cephalometrically on lateral cephalograms in centric occlusion. Pre and post treatment cephalograms were analysed . Lateral cephalograms of the patients were hand traced at single sitting in the same manner. Cephalograms were traced and landmark location is verified by the same investigator. Pancherz analysis was carried out in pre-treatment and posttreatment cephalograms and the values were tabulated.⁸

Statistical analysis was done on Microsoft Excel was used to compile the data. The means and standard deviations of the measured values were obtained using the One Way ANOVA test.. Post Hoc Tukey test was done to determine whether there was a significant difference among the three groups. All statistical analysis was performed using Statistical Package for Social Sciences software package. (SPSS for Windows - Version 20.0)

Result

Comparison of difference mandibular base (pg\olp) between the three groups shows that control group has the highest value of 4.0833 and Forsus has the least value of -1.5. This difference is statistically Significant with a test value of 7.269 and p value of 0.002. Posthoc Tukey tests comparing control and Forsus groups shows a mean difference of 5.58333* and is statistically significant with a p value of 0.004. Comparing control and Powerscope groups shows a mean

difference of 5.08333* and is statistically significant with a p value of 0.01. Comparing Forsus and Powerscope groups shows a mean difference of -0.5 and is not statistically significant with a p value of 0.949 as shown in table 1 and table 2.

Comparison of difference condyle (ar\olp) between the three groups shows that Forsus group has the highest value of 1.0833 and control has the least value of -1.5. This difference is statistically Significant with a test value of 3.336 and p value of 0.048. Posthoc Tukey tests comparing control and Forsus groups shows a mean difference of -2.58333* and is statistically significant with a p value of 0.041. Comparing control and Powerscope groups shows a mean difference of -1.66667 and is not statistically significant with a p value of 0.242. Comparing Forsus and Powerscope groups shows a mean difference of 0.91667 and is not statistically significant with a p value of 0.642 as shown in table 1 and table 2.

Comparison of difference mandibular length (pg\olp+ar\olp) between the three groups shows that control group has the highest value of 3.25 and FORSUS has the least value of -0.6667. This difference is statistically Insignificant with a test value of 2.315 and p value of 0.115. Posthoc Tukey tests comparing control and Forsus groups shows a mean difference of 3.91667 and is not statistically significant with a p value of 0.13. Comparing control and Powerscope groups shows a mean difference of 3.33333 and is not statistically significant with a p value of 0.221. Comparing Forsus and Powerscope groups shows a mean difference of -0.58333 and is not statistically significant with a p value of 0.953 as shown in table 1 and table 2.

Table 1 – Comparison of skeletal effect of control, Forsus and Powerscope using one way ANOVA test

	GROUPS	N	Mean	Std. Deviation	Statistics/ mean squares	df2(welch) / F(Anova)	P VALUE
difference maxillary base (sp\olp)	CONTROL	12	4.5	4.23191	3.225	17.806	0.064
	FORSUS	12	2.3333	3.14305			
	POWERSCOPE	12	1.3333	1.30268			
	Total	36	2.7222	3.32618			
difference mandibular base (pg\olp)	CONTROL	12	4.0833	3.94181	114.528	7.269	<u>0.002</u> *
	FORSUS	12	-1.5	1.5667			
	POWERSCOPE	12	-1	5.41043			
	Total	36	0.5278	4.62593			
difference	CONTROL	12	-1.5	1.67874	20.583	3.336	<u>0.048</u> *

condyle (ar\olp)	FORSUS	12	1.0833	1.92865			
	POWERSCOPE	12	0.1667	3.45972			
	Total	36	-0.0833	2.6444			
difference mandibular length (pg\olp+ar\olp)	CONTROL	12	3.25	4.47468	53.583	2.315	0.115
	FORSUS	12	-0.6667	2.70801			
	POWERSCOPE	12	-0.0833	6.48717			
	Total	36	0.8333	4.98856			
difference maxillary	CONTROL	12	5.0417	3.9107	46.206	3.09	0.059
	FORSUS	12	1.3333	4.20678			

Table 2- *- Statistically significant

Comparison of skeletal changes within the group using Posthoc test

difference maxillary base (sp\olp)	CONTROL	FORSUS	2.16667	1.27986	0.223
		POWERSCOPE	3.16667*	1.27986	0.048 *
	FORSUS	POWERSCOPE	1	1.27986	0.717
difference mandibular base (pg\olp)	CONTROL	FORSUS	5.58333*	1.62044	0.004 *
		POWERSCOPE	5.08333*	1.62044	0.01
	FORSUS	POWERSCOPE	-0.5	1.62044	0.949
difference condyle (ar\olp)	CONTROL	FORSUS	-2.58333*	1.014	0.041 *
		POWERSCOPE	-1.66667	1.014	0.242
	FORSUS	POWERSCOPE	0.91667	1.014	0.642
difference mandibular length (pg\olp+ar\olp)	CONTROL	FORSUS	3.91667	1.96411	0.13
		POWERSCOPE	3.33333	1.96411	0.221
	FORSUS	POWERSCOPE	-0.58333	1.96411	0.953

* - Statistically significant

Discussion

MAXILLARY BASE

On analysis of the maxillary base post treatment to the fixed functional appliance therapy by either Forsus and Powerscope revealed a significant alteration in the maxilla with a mean difference of 2.2mm and 1.3mm respectively thus indicating a positive restrain in the forward growth of maxillae. Similar results is seen in the literature published by Pancherz et al (1993)⁹ and Cope et al (1994)¹⁰

Karacay et al (2006)¹¹ in his study produced a result contrary to this finding stating that fixed functional therapy had only a limited restrain in the forward maxillary growth. This may be due to the different treatment mechanics administered.

MANDIBULAR BASE

Mean difference of mandibular base is similar for both Forsus-1.75mm and Powerscope is 1mm in treated cases. Forsus being slightly significant than Powerscope. This may be regarded to the anterior positioning of the chin post treatment.

Mandibular changes achieved may be attributed to the anterior positioning of the mandible rather than the forward growth as stated by Ozotoprak et al (2012)¹²

Mandibular growth seems to occur to some extent according to Weil at al (1995)¹³

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MANDIBULAR LENGTH

No significant increase in mandibular length was seen associated with the use of Forsus-0.6mm or Powerscope-1.8mm in post peak growth period Class II treated patients. Both the appliances cause a downward and forward force to the mandible causing a slight posterior rotation.

Heinig¹⁴ and Weiland¹³ et al have also reported increase in mandibular length while Cope¹⁰ and Covell et al (1999)¹⁵ have concluded that Jasper Jumper appliance has no orthopaedic effect.

CONDYLAR POSITION

Change in condylar length is same for both the Forsus and Powerscope treated cases with a mean difference of 1.08mm and 1.8mm. Though the values is not significant it can be attributed to the change in mandibular position by relocating articular point in fixed functional therapy as stated by Chen at al (2002)¹⁶

ARTICULARE POINT

Improvement in the articular position is seen in Class II cases treated with Forsus and Powerscope appliances being 1.8mm and 0.16 respectively though not significant. Opening in articluare angle contributes to the forward positioning of the mandible thus reducing overjet and enabling molar correction . This result is similar to the study done by Pancherz et al (1993)¹⁷ using Herbst appliance .

Karacay et al (2006)¹¹ on the contrary stated in his study using Forsus Nitinol Flat Spring intreating class II cases that there is increased growth at the mandibular condyle , downward and forward remodelling of glenoid fossa and lateral expansion of maxillary molars. This difference might been seen due to difference in growth potential among the selected cases for treatment and the varied biomechanics administered.

Thus the merits of FORSUS and POWERSCOPE among other fixed functional appliances can be enlisted as :

1. Require no laboratory setup
2. Quick and easy installation
3. Compliance free
4. Low profile
5. Less bulky thus esthetic facial appearance
6. Easy to clean – better oral hygiene

To compare between Forsus and Powerscope :

1. Forsus require head gear tube for attachment where as Powerscope does not require one .
2. Powerscope can be used in bonded or banded molar tube where as Forsus is advisable to be used on banded molar tubes.
3. Bond failure of canine bracket is seen more in Forsus treated cases than Powerscope.
4. Powerscope has incorporated maximum lateral movement contrary to the Forsus appliance.
5. Disengagement of Powerscope appliance were seen more in comparison to the Forsus treated group as it is wire to wire installation.
6. Powerscope administers 260gm force which is more compared to the Forsus which administers a force of 200gm .

7. “Head gear effect” is seen more in Forsus compared to Powerscope appliance which can be both desirable or undesirable according to the case being treated.

Conclusion

The purpose of this study was to cephalometrically evaluate the skeletal and dental changes occurring in Class II cases treated with Forsus Fatigue Resistant Device and Powerscope Class II Corrector device .

The two dimensional cephalometric evaluation has its limitations and there is no literature till date evaluating the efficacy between the two appliances. Thus, the results of this research must be used cautiously in relation to other clinical findings.

The following results were obtained :

1. Head gear effect is seen more in the Forsus treated cases which is both desirable and undesirable depending on the case selected.
2. Skeletal changes indicated is more due to the anterior positioning of the pogonion, thus increase in mandibular length is not significant in both the appliances.
3. Forward positioning of mandible is due to the relocation of the articular point at the condylar region in both the appliances .
4. Patient compliance is more for Powerscope due to incorporated lateral movement of the jaw which is restricted in Forsus.
5. Dislodgement of appliance was seen higher in case of Powerscope due to its two point wire to wire application compared to Forsus having molar tube to wire application.

Forsus FRD and Powerscope Class II corrector are both efficient in the correction of Class II malocclusion. The dentoalveolar changes contribute to the forward positioning of the mandible and by improving the facial esthetics of the patient .

The appliance selection can be done based on the appropriate analysis of the case keeping in mind the merits and de-merits of the either appliance.

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Acknowledgement

Nil