

# A Comparative Study of Skeletal and Dental Changes in Fixed Functional and Removable Functional Appliance Therapy

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DOI: [10.36348/sjodr.2020.v05i10.004](https://doi.org/10.36348/sjodr.2020.v05i10.004)

| Received: 08.10.2020 | Accepted: 16.10.2020 | Published: 21.10.2020

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## Abstract

**Background:** Functional appliance therapy has gained popularity and has been used with substantial amount of success in the management of skeletal class II malocclusion. Generally, functional appliances are utilized for the correction of retruded mandible in growing individuals. This study was used to compare and plot the skeletal and dental changes using fixed and removable functional appliance therapy in the treatment of class II malocclusion. **Materials and methods:** The study population consist of 50 growing individuals who have undergone treatment for skeletal class II malocclusion. The group are divided in to herbst group (n=25) and twin block group (n=25). The lateral cephalograms obtained from these patients and changes analyzed using students paired t –test. **Results:** The skeletal and dental changes showed statistically significant improvement in antero-posterior maxillomandibular measurement in both groups and but herbst unlike twinblock produce greater dental effects. Although treatment duration was faster in fixed appliance group, both studies showed improved facial profile. **Conclusion:** The treatment effects of both the functional appliances used in this study for skeletal class II cases are satisfactory and can effectively use for correction of retrognathic mandible in adolescents.

**Keywords:** Fixed Appliance, Removable Appliance, Skeletal, Dental, Orthodontic Therapy.

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## INTRODUCTION

The key to the successful management of skeletal class II malocclusion is by giving early orthodontic growth modification treatment. The major reason for class II malocclusion is retrognathic mandible and as per biological evidence all the orthopaedic interventions are aimed to bring the mandible forward with functional appliance therapy [1]. Since years several functional appliances have developed removable, fixed and hybrid appliance [2]. Functional appliances help in positioning the lower jaw forward to an edge-to-edge relationship, thereby disoccluding the posterior teeth, which are then free to erupt. There is numerous literatures which evaluates the effect of functional appliances in different phases of treatment. As discussed in a systematic review, the most advantageous of functional appliances are Herbst and Twin- block appliances [5]. To overcome the

shortcomings of removable functional appliances fixed functional appliance are incorporated. The present study was aimed to compare and assess the dentoskeletal effects of fixed and removable functional appliance in individuals with skeletal class II malocclusion.

## MATERIALS AND METHODS

The study population consist of 50 patients with skeletal class II malocclusion. The records of the treatment undergone were obtained from different dental colleges across country. The subjects were divided in to Herbst group (fixed functional appliance) and consisted of 25 subjects. The next group of 25 were subjects treated with twin block group (removable functional appliance). Out of 50 subjects 35 were male and 15 were female. The mean age of patients in the Herbst group is (12+/- 1.19 years) and mean age of patients in twin block group was (12.47 +/- 1.24 years). The inclusion criteria included patient who received

full orthodontic treatment and with quality pre and post treatment records available. The exclusion criteria involve patients with craniofacial syndromes and facial asymmetry. Lateral cephalometric radiographic films and data were collected before the beginning of treatment and after the treatment. Cephalogram films were traced with the Pancherz analysis and superimposed by the examiner unaware of the group to which the patient had been allocated the intergroup group evaluation and analysis done using paired t-tests.

## RESULTS

The total 50 subjects were enrolled in the study. The mean age of patients in the Herbst group is 12+/- 1.19 years) and mean age of patients in twin block group was 12.47 +/- 1.24 years. The data obtained

after superimposition were statistically analysed. Statistical comparison and descriptive comparison of herbst group and twin block group are given in table 1 and table 2. Significant difference was found in all the cephalometric measurements in both groups before and after treatment. With regard to dental changes, the results demonstrated that overjet and overbite is reduced in both treatment groups. The anterior-posterior skeletal discrepancy improved and the mandibular length increased significantly in both groups although duration of treatment was shorter for herbst group. The change in the vertical dimensions was reported and showed significant increase for Herbst and twin block in the lower anterior and posterior face height and ramus height.

**Table-1: Comparison of baseline cephalometric measurements after treatment**

Skeletal measurements	HERBST		TWIN BLOCK	
	MEAN	S.D	MEAN	SD
SNA	80.88	1.13	80.33	0.94
SNB	72.18	2.07	74.74	1.77
ANB	7.6	1.54	6.08	1.18
Overjet (is/OLp minus ii/OLp)	8.92	2.82	8.24	2.31
Maxillary baseA/OLp	80.89	4.67	81.55	5.23
Mandibular basePg/OLp	81.92	3.87	83.43	6.08
(A/OLp-Pg/OLp) (skeletal discrepancy)	-0.88	3.17	-1.77	4.14
Co/OLp	11.22	2.56	12.06	3.46
Comp mandi length Pg/OLp + Co/OLp	92.90	3.98	95.32	4.86
Ramus height (Co-Go)5	52.76	4.85	54.96	3.42
Effective mandibular lengthGo-Gn	112.67	5.79	114.34	5.52
Lower anterior face height	67.34	5.46	66.34	5.63
Lower posterior face heightS-Go	77.85	4.93	78.12	4.91
Dentoalveolar measurements	Herbst		Twin block	
	MEAN	SD	MEAN	S.D
Ils/NL	-1.00	7.11	-4.40	12.3
Ili/ML	5.65	4.16	1.40	8.40
Ils-NL	1.35	2.23	2.45	2.75
Ils-ML	-0.80	1.31	0.80	3.06
Ms-NL	-0.90	1.98	1.30	3.29
Mi-MI	2.15	2.51	1.05	2.60

**Table-2: Change in Pancherz analysis variables**

SKELTAL	TWIN BLOCK		HERBST	
	MEAN	95%CI	MEAN	95% CI
Maxillary base (A point to OLp)	1.85	1.2 to2.4	1.22	0.70 to1.74
Mandibular base (Pg/OLp)	4.42	3.63 to5.2	3.66	2.89 to4.43
Condylar head (Co/OLp)	-0.96	-0.51 to-1.39	-0.30	0.67 to0.08
Mandibular length (Pg/OLpCo/OLp)	3.46	2.45 to4.47	3.36	2.51 to4.21
DENTAL				
Maxillary incisor (Is/OLpSs/OLp)	-3.11	-2.31 to-3.91	-2.43	-3.00 to-1.85
Mandibular incisor (Ii/OLpPg/OLp)	0.56	-0.29 to1.13	0.94	0.37 to1.51
Maxillary molar (Ms/OLpSs/OLp)	0.40	-0.21 to1.020	0.48	0.19 to1.14
Mandibular molar (Mi/OLpPg/OLp)	1.45	.66 to2.55	1.07	0.61 to1.53

## DISCUSSION

One of the important therapeutic implications of functional appliance is the management of skeletal calss II malocclusion in growing individuals. According to Bacetti *et al.*, functional appliance has optimum

therapeutic effect in the peak of pre-pubertal period. The present study evaluated and compared dental and skeletal changes in patients with skeletal classII malocclusion in two treatment groups. Herbst appliance which is one of the the historically prominent rigid

fixed appliance was used in one group. It was invented by Herbst in 1900's (40) and reintroduced by Pancherz at the end of 1970's. The other group were delivered removable twin block appliance after finishing the active treatment period and the patients were instructed to wear the appliance to achieve stable mandibular position. We found that considerable correction of class II malocclusion was achieved in both treatment groups. Interpretation of the values from the lateral cephalogram and dent skeletal effects evaluated by Pancherz analysis which is gold standard for functional appliance studies [8], Herbst and Twin Block appliances both result in significant and similar improvement of the facial profile. It was found that Herbst and Twin-block appliances showed increased anteroposterior positioning of mandibular jaw, but the prominent changes are mostly dent alveolar. As observed from our study upper incisor protrusion (overjet) is reduced to normal limits and it was statistically significant. In case of Herbst appliance it favours results not by growth of mandible but by distalizing the maxillary molars and restricting maxillary growth called as 'headgear effect'. Significant incisor correction and dental change were seen in Herbst group in our study which is consistent with findings of other literatures [9]. For patients in growth period, when the skeletal and dental contributions to overjet and molar correction percentages were evaluated, two-thirds of overall treatment effects of twiblock therapy could be attributed to skeletal changes. In twin block group, correction can cause equal and opposite forces in the maxilla as a response to mandibular downward and forward movement. In our study after 6 month period a decrease in SNA angle was seen, but neither of these appliances restricts the growth of maxilla. However, controversial results have reported in many literatures [10, 11]. With regard to mandibular changes, we saw that twin block therapy led to greater increase in the forward positioning of the mandible compared with Herbst therapy. In our study the difference in effective increase in mandibular measurement between two groups is  $1.57 \pm 3.03$  mm. In a study Schaefer *et al.* Twin block group showed additional increase in mandibular growth [12] which were similar to our results. It was shown that twin block group also resulted in greater improvement compared to Herbst group, when skeletal discrepancy was evaluated. This overall increase in mandibular length can be attributed to ramus height increase. While Herbst group also showed improvement in mandibular length, increase in SNB angle and Go-Gn length, but statistically significant greater increases were found for mandibular base, composite mandibular length, and effective mandibular length compared to twin block group

## CONCLUSION

The functional devices regardless of their type successfully reduced the overjet to within normal limits

and the end of treatment both the appliance provided significant improvement in skeletal mandibular parameters. The findings from our study suggest that Twin-block appliance showed more skeletal changes and the Herbst appliance showed more dental changes.

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