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Manjeet Singh
MDS Orthodontics, Department of Orthodontics and Dentofacial Orthopaedics, Government Dental College and Hospital, Srinagar, Jammu and Kashmir, India

Syed Zameer Khurshaid
Associate Professor, Department of Orthodontics and Dentofacial Orthopaedics, Government Dental College and Hospital, Srinagar, Jammu and Kashmir, India

Corresponding Author:
Manjeet Singh
MDS Orthodontics, Department of Orthodontics and Dentofacial Orthopaedics, Government Dental College and Hospital, Srinagar, Jammu and Kashmir, India

Comparison of the effects of activator and twin block treatment on skeletal, dental and soft tissues

Manjeet Singh and Syed Zameer Khurshaid

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Abstract
Background: The aim of this study was to evaluate the effects of activator and Twin Block appliances on the patient's profile. To evaluate skeletal, dental and soft tissue changes after treatment of Class II division 1 malocclusion with activator and Twin block appliances.
Methods: The study included 30 skeletal Class II patients, 15 girls and 15 boys, mean age: 10.5 ± 0.15 years who were randomly allocated to one of two functional appliance treatment groups. Pretreatment (T0) and post functional appliance therapy (T1) lateral cephalograms of 30 patients were evaluated. The skeletal, dentoalveolar and soft tissue changes were evaluated in both groups on standardized lateral cephalograms taken with the same cephalostat before (T0) and after (T1) functional appliance therapy. The groups were compared at T0 and T1 using analysis of variance, and treatment/observation differences (T1−T0) were evaluated with the Kruskal–Wallis test. The Student's t test was used, with a significance level of $P<0.05$.
Results: The treatment group showed a statistically significant reduction in values of ANB angle and increase in SNB angle. Mandibular incisors showed significant proclination. There are significant changes of upper lip and lower lip in relation to E plane.
Conclusions: Both Twin Block and activator appliances treat Class II division 1 patients successfully by forward movement of the mandible. The changes produced by Activator and Twin Block are predominantly dentoalveolar.

Keywords: Class II, activator, twin block

Introduction
The aims of early treatment of class II malocclusion is to correct the sagittal relationship, modify the pattern of facial growth, and improve both hard- and soft-tissue profile. Improvement in aesthetics is highly valued by patients seeking orthodontic treatment [1-4]. Patients with a Class II malocclusion are often referred to orthodontists for aesthetic improvement. A class II malocclusion may be because of mandibular deficiency, maxillary excess, or combination of both [5, 6]. Many functional appliances are currently in use aiming to correct the skeletal imbalances. Two phase treatment is used in growing patients which involves growth modification with functional appliances followed by orthodontic treatment with fixed appliances. Activator is one of the most widely used functional appliances which was introduced by Andresen in 1935 for orthopaedic correction of Class II skeletal malocclusions. Twin Block is the another popular functional appliance which is very simple in design, can be worn 24 hours a day and takes full advantage of all the functional forces applied to the dentition, including those of mastication. The purpose of this study was to assess and compare the skeletal, dentoalveolar and soft tissue profile changes produced by the twin block and activator appliances.

Materials and Methods
The sample included thirty Class II division 1 children (15 boys and 15 girls) with a mean age of 10.5 ± 0.15 years. The patients were randomly assigned to either the twin block or activator treatment group for first-phase orthodontic treatment. The patients and their parents were informed and properly explained about the aim of the study, two-phase orthodontic treatment and the appliances, and informed consent was obtained.

Inclusion criteria for the patients included in the study were as follows:

1. Patients with Class II molar relationship
2. Patients with overjet ≥5 mm.
3. Patients having Skeletal Class II pattern (ANB>4) with retrognathic mandible (SNB<78°).
4. Patients with mandibular plane angle (GoGn/SN: 32 ± 2°).
5. Patients exhibiting maximal pubertal growth at the beginning of treatment and
6. There was no previous history of orthodontic therapy.

Hand-wrist radiographs were used to determine maximum pubertal growth of the subjects. Hand-wrist radiographs were included in the standard clinical records of the study. The included Patients were in the prepeak stages (CS1–CS3) of skeletal maturation before treatment and CS3–CS5 after treatment, according to the cervical vertebral maturation method [7].

The working bites were taken with the incisors in an edge-to-edge relationship. The bite opening was about 3–4 mm between the central incisors for both activator and Twin block appliances. The patients were recommended to wear the Twin Block full-time and the activator for 12-14 hours per day. Treatment was stopped when a Class I molar relationship or slight hypercorrection was achieved. The mean treatment time was 9-12 months for the activator and 8-9 months for the Twin Block patients. After the first-phase treatment was complete, fixed orthodontic treatment was initiated.

Pretreatment (T0) and post functional appliance therapy (T1) lateral cephalograms of 30 patients were evaluated. The skeletal, dentoalveolar and soft tissue changes were evaluated in both groups on standardized lateral cephalograms taken with the same cephalostat before (T0) and after (T1) functional appliance therapy. All the radiographs were taken from the same X-ray machine with the subjects in the natural head position, with teeth in maximum intercuspation and lips at repose to have standardized cephalometric radiographs. All the lateral cephalometric radiographs were taken from the standardized Orthophos XG5 DS CEPH (SIRONA) on a standard Konica Minolta 8 × 10 inch film with patient at 5 feet distance by the same operator. Subjects were asked asking to look straight ahead such that the visual axis was parallel to the floor to obtain Natural head position. All the films were exposed with 64 KVp, 8 mA and an exposure time of 0.9 seconds.

Pre and post functional appliance therapy Lateral cephalogram were traced upon an A4 size acetate paper with a 3HB hard lead pencil over well-illuminated viewing screen. The linear measurements were recorded with a measuring scale up to a precision of 0.5 mm. The angular measurements were analysed with a protractor up to a precision of 0.5°.

Results

The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 20.0 (SPSS Inc., Chicago, Illinois, USA) and a p value of <0.05 was considered to be statistically significant. To ensure landmark identification accuracy and tracing accuracy, 15 randomly selected radiographs were re-measured four weeks after the first measurements. No significant intra-operator differences were observed. The combined method error for linear and angular measurements was found to be insignificant. The Dahlberg formula was used to calculate mean method error. The values changed from 0.55 to 0.91 and were within acceptable limits. The Shapiro-Wilk normality test and the Levene variance homogeneity were applied to the data collected from the lateral cephalograms measurements. The independent t test was used to evaluate pretreatment measurement comparisons, intragroup comparisons were evaluated by using the paired sample t test, and intergroup changes were analyzed using ANOVA. Pretreatment measurement values of the activator and Twin Block groups of and the statistical comparisons are presented in Table 1. The results shows that these two groups were equally matched because the measurements were not significantly different. The results of the intragroup comparisons of the measurements are presented in Table 2. Treatment with both functional appliances resulted in increase in SNB angle (p value <0.001) and significant reduction of the ANB angle (p value <0.001). The reduction in ANB angle is mainly due to change in maxillomandibular differential length and increase in the SNB angle. There is significant reduction in convexity of hard and soft tissue in both treated groups. The retroclination of the maxillary incisors was also noticed in both treatment groups. The retroclinication of upper incisors were slightly but insignificantly more pronounced in the Activator group whereas the proclination of the lower incisors was significantly more pronounced in the Twin block group

Table 1: Comparison of mean differences of pretreatment values of treatment groups

	Twin block group		Activator group		
	Mean	**SD**	**Mean**	**SD**	***P* value**
Skeletal measurements					
SNA, degrees	80.45	2.00	80.22	2.35	NS
SNB, degrees	77.35	1.98	78.25	1.55	NS
ANB, degree	5.01	1.64	4.8	1.65	NS
Y-axis, degrees	60.65	2.85	63.15	2.85	NS
SN-GoGn, degrees	34.20	3.25	32.85	3.20	NS
Dental measurements					
U1-NA, mm	5.00	2.55	5.65	2.45	NS
U1-NA, degrees	26.45	4.15	25.25	4.50	NS
L1-NB, mm	5.55	1.95	5.05	2.05	NS
L1-NB, degrees	26.65	4.50	27.75	3.85	NS
IMPA, degrees	97.75	5.05	97.25	6.15	NS
Soft tissue measurements					
UL-E plane, mm	0.45	1.55	0.25	1.85	NS
LL-E plane, mm	0.95	2.55	2.00	1.54	NS

Table 2: Comparison of pre-treatment and post-treatment mean values of each group

	Twin block group			Activator group		
	T0 Mean±SD	**T1 Mean±SD**	***P* value**	**T0 Mean±SD**	**T1 Mean±SD**	***P* value**
Skeletal measurements						
SNA	80.45±2.00	79.8 ± 3.6	0.118	80.22±2.35	81.7 ± 2.7	0.432
SNB	77.35±1.98	79.3 ± 3.5	<0.001	78.25±1.55	80.4 ± 2.2	<0.001
ANB	5.01±1.64	4.0 ± 1.8	<0.001	4.8±1.65	3.98 ± 1.8	<0.001
Y axis	60.65±2.85	60.25±2.25	0.105	63.15±2.85	62.58±2.55	0.112
SN-GoGn	34.20±3.25	32.50±3.00	0.135	32.85±3.20	31.50±3.10	0.165
Dental measurements						
U1-NA, mm	5.00±2.55	4.55±2.40	0.12	5.65±2.45	4.35±2.40	0.11
U1-NA, degrees	26.45±4.15	25.80±4.10	0.135	25.25±4.50	22.20±4.30	0.120
L1-NB, mm	5.55±1.95	7.25±1.80	<0.001	5.05±2.05	7.0± 2.00	<0.001
L1-NB, degrees	26.65±4.50	30.20±4.50	<0.001	27.75±3.85	30.50±3.85	<0.001
IMPA, degrees	97.75±5.05	100±5.05	<0.001	97.25±6.15	101.50±6.15	<0.001
Soft tissue measurements						
UL-E plane, mm	0.45±1.55	-2.00±1.55	<0.001	0.25±1.85	-1.90±1.05	<0.001
LL-E plane, mm	0.95±2.55	-1.00±2.55	<0.001	2.00±1.54	-0.15±1.54	<0.001

Discussion

The aim of this study was to assess and compare the skeletal, dentoalveolar and soft tissue profile changes produced by the twin block and activator appliances. The sample included thirty Class II division 1 children (15 boys and 15 girls) with a mean age of 10.5 ± 0.15 years. The patients were randomly assigned to either the twin block or activator treatment group for first-phase orthodontic treatment.

One of the main goal of orthodontic treatment is esthetic improvement. An unfavorable convex profile may lead to negative feelings in Class II patients with retrognathic mandible with an increased overjet [8], therefore, the main goal of treatment in these patients, ideally, should be directed toward solving this disharmony. The treatment goal and philosophy of the activator and Twin Block appliances are usually the same. The significant forward movement of the mandible; temporomandibular joint adaptation are the main treatment effects of both appliances [9]. The most common and significant side effect of these appliances is that mandibular incisor undergo proclination which may contribute to the forward movement of the lower lip [10]. This have been reported in several studies [11, 12, 13].

In this study, the mandibular incisors proclinated significantly in both treatment groups. Both functional appliances Twin Block and Activator successfully reduced the severity of class II malocclusion by a combination of dental and skeletal changes. In this study SNB, and ANB angles were significantly improved in both groups. The SNB angle significantly increased in both groups which is in agreement with other studies [14, 15, 16].

Both appliances had little, insignificant restraining effect on the maxilla with SNA angle showing insignificant changes. Previously several investigations have reported that forward growth of the maxilla may be inhibited during Activator treatment [17, 18]. Whereas others could not confirm this effect [19]. The labial bow in twin block which is used to increase retention and control the maxillary incisors might have made the maxillary incisors retroclined. This may also affect the position of the A point. So, it may be possible that the restraining effect on maxilla was more pronounced but it was underestimated due to a forward movement of the A point.

Retroclination of maxillary incisors is one of the consistent finding reported in many Twin block [17, 18], and Activator studies [20, 21]. The retrusion of the upper incisors was more in the Activator group. This is because of the additional headgear forces acting posteriorly on the maxillary apical base and alveolar structures. In this study the proclination and protrusion of lower incisors was significant in both groups. The proclination of lower incisors was more in twin block group as compared to activator group patients. The changes in the inclination of the lower incisors because of functional appliance therapies are contradictory and probably not sufficiently controlled by their capping with acrylic [22, 23].

In this study, both treatment groups showed reduction of the profile retrusion of the upper lip and lower lip in relation to E plane.UL-E plane AND LL-E plane both shows significant changes, these results are in agreement with previous studies [24, 25, 26].

Conclusion

Both Twin Block and activator appliances treat Class II division 1 patients successfully by forward movement of the mandible.

The changes produced by Activator and Twin Block are predominantly dentoalveolar.

Twin Block appliance leads to more pronounced protrusion and proclination of the mandibular incisors than the Activator appliance

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