EFFECTS OF TWIN-BLOCK APPLIANCE TREATMENT ON SKELETAL AND DENTOALVEOLAR CHANGES IN CLASS ll DIVISION 1 MALOCCLUSION CASES

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ABSTRACT

Objective: To assess reduction of profile convexity, correction of molar and canine relationship and achievement of normal over jet using Clark's Twin Block appliance in growing subjects having skeletal class II patterns.
Study Design: Descriptive case series.
Place and Duration of Study: The study was conducted at KRL General Hospital Orthodontic department from Aug 2017 to Jan 2018.
Material and Methods: Fifty patients between 11-14 years of age were recruited having cervical maturation (CVM) stage 3 as diagnosed by their lateral cephalogram. Only Skeletal class II patients as confirmed by ANB values of >4 and SNB values of <78 having low angle (SN-MP) are included in this study. Good quality radiographs and study models are obtained at start of treatment T and at the end of achievement of results T1. Data was recorded in specially made proforma and analyzed using SPSS 20.0. Analysis included frequencies, Mean ± standard deviation (SD) and paired t test. A *p*-value <0.05 was considered significant.
Results: Results have established positive impact of Twin-Block appliance therapy in patients with CVM stage 3 Paired. T-test has revealed significant reduction in values of over jet and correction of class II molars and canines. Skeletal profile convexity has also been reduced by a significant reduction in angle of convexity.
Conclusion: This study has demonstrated that successful management of the first phase of treatment of a patient with Angle's Class II Division I malocclusion using the twin block appliance can be achieved with significant outcomes.

Keywords: ANB, Curve of Spee, Maxillo-mandibular discrepancy.

INTRODUCTION

One of the most commonly observed problems in orthodontics is class-II malocclusion that affects approximately one third of the patients all over seeking orthodontic treatment. In a study conducted in Pakistan it was found that the frequency of class-I, class-II and class-III malocclusions was found to be 18.6%, 70.5% and 10.9% respectively. Thus, class-II malocclusion with increased overjet is the most common malocclusion pattern prevalent in population of Pakistan[1]. Patients with class-II malocclusions can present with either maxillary protrusion, mandibular retrusion or both along with abnormal dental relationships and profiles. According to research done by McNamara, mandibular retrusion is the most common characteristic associated with class-II cases[2]. In patient's having growth tendency with class-II malocclusion associated with mandibular retrusion, functional appliance therapy can be used to stimulate the mandibular growth by forward positioning of the mandible[3]. Functional appliances are used to correct the abnormal jaw functional relationships responsible for the abnormal growth and development of the underlying hard tissues. Functional appliance therapy aims at redirecting the neuromuscular activity of the oral cavity to normal limits. In the cases of mandibular retrognathism associated with class-II cases positioning the mandible forward is believed to enhance its growth[4]. In 1982 clark devised the twin block appliance, which became a commonly used functional appliance therapy due to its high acceptability by class-II patients having retrusive mandible[5].

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Its popularity has enhanced due to high patient adaptability and its ability to produce rapid overjet reduction, both Twin block and Bionator appliances were effective in correcting molar relationships and reducing overjets in class-II division 1 subjects[6].

However further researches have proved that twin block has been more efficient than the bionator appliance in correcting molar relationships as well as in decreasing increased overjet associated with class-II Division 1 malocclusion[7].

The main changes associated with twin block functional appliance therapy are of dentoalveolar nature including distalization of maxillary posterior segment, lingual inclination of maxillary incisors, mesialization of the mandibular posterior segment and buccal inclination of mandibular incisors which results in increased overjet correction as well as correction of molar relationships[8].

Twin Block appliance has been documented to encourage adaptive skeletal growth by maintaining corrected mandibular corpus length for significant period[9]. Along with dental and skeletal improvements, improvements in airway dimensions have also been observed in patients using Twin-Block therapy[10].

A systemic review done on twin block therapy suggests that there occurs an increase in mandibular body length whereas impact on face profile is reduced due to increase in angle[11]. Twin block appliance therapy with extraoral traction is also considered in high angle cases requiring intrusive effects[12,13].

This therapy is associated with reduction of traumatic bite associated in class-II Division 2 cases[14]. Studies have suggested that effect of functional appliances like twin block is best achieved in Peak CVM group compared to post peak CVM group[15].

MATERIAL AND METHODS

It was a descriptive case series study conducted in the orthodontic department of KRL (Kahuta Research Laboratories) General Hospital, Islamabad after the approval from institutional review and ethics committee for a period of six months, from Aug 2017 till Jan 2018. Fifty patients were included using non-probability consecutive sampling technique. Sample size was calculated on the basis of prevalence and duration of study period using WHO calculator[16]. Patients between age group 11-14 years having cervical stage 3 (as diagnosed by lateral cephalogram) with skeletal class 2 pattern (ANB >4, SNB <78) were included in the study. Patients having Normal SN-MP angle (32 ± 4) with Angle's class 2 division-1 malocclusion was made essential inclusion criteria. Presence of good quality radiographs at start (T 0) and end (T1) of twin block treatment were made essential. Patients having breathing difficulties, history of mouth breathing/deviated nasal septum/airway surgeries were not included in this study. Patients with dento-facial syndromes or trauma or having history of previous orthodontic treatment were also excluded from the study. All the patients fulfilling the inclusion criteria were treated consecutively. The initial lateral cephalo-metric radiographs and impression for initial study models of subjects were taken prior to the start of treatment (T0). The end-treatment radio-graphs and study models were taken after the removal of the Clarks Twin block appliance (T1) (figure). Reference marks were made on study models using 0.3mm fine liner black pointer for all the measurements like overjet, molar and

Figure: Twin block appliance design.

canine relations. The study models were placed in occlusion on a flat granite table top to accurately access molar and canine relationships. A metal ruler accurate to 0.5 mm, was used to measure over jet from the middle of the incisal edge of the most prominent upper central incisor to the labial surface of the corresponding lower incisor, on study model parallel to the occlusal plane. Lateral cephalograms for all the subjects were taken with teeth in maximum intercuspation, standing in an upright position with FH plane being parallel to the floor. All radiographs were exposed from the same cephalostat with standard film to tube distance and patient to source distance was standardized to 5 feet. Cephalograms were traced manually with a 0.5-mm lead pencil, on acetate sheets on an illuminator, and landmarks were identified. The angular measurements to evaluate the profile convexity were then made on it. Linear and angular readings were measured with the help of a mill metric ruler and a protractor, respectively. Corrected values of linear measurements were recorded to eliminate a magnification error of 10%. All the acquired data was then entered in SPSS 21 for data processing. Analysis included frequencies, mean ± standard deviation (SD) and Paired t-test. A *p*-value <0.05 was considered significant.

RESULTS

Results have established a positive effect of twin block therapy on skeletal and dentoalveolar components of class-II division 2 cases. A total of 50 patients were selected to participate in the study and of these 25 were male and 25 were female. The mean age of the patients was 12 years and 8 months with SD ± 13. Paired t test showed that overjet and angle of convexity decreased after twin block appliance treatment significantly. The dental molar and canine relationships also improved with significant results. Overjet decreased from 8.11 millimeters (SD ± 1.52) to 1.75 millimeters (SD ± 0.29). Hence, a significant decrease in overjet with a mean of 6.36 (SD ± 1.44) with *p*-value <0.001 was achieved (table-I). Angle of convexity decreased from 10.9 degrees (SD ± 1.01) to 6.78 degrees (SD ± 0.93) after twin block appliance treatment showing a mean decrease of 4.12 degrees (SD ± 1.08) with *p*-value <0.001. (table-I). Molar relation improved from 5.60 millimeters (SD ± 0.57) to 0.50 millimeters (SD ± 0.25) class II relationship, thus showing a mean decrease of 5.55 millimeters (SD ± 0.59) with *p*-value <0.001 (table-I). Canine relation also showed improvement from before treatment being 5.53 millimeters (SD ± 0.52) to 0.02 millimeters (SD ± 0.09) class-II relationship, thus showing a mean decrease of 5.52 millimeters (SD ± 0.53) with *p*-value <0.001. (table-II). The 't' value for paired t-test was high and positive showing that the net difference between scores of each variable pre-treatment and post-treatment is relatively large and hence, treatment modality is effective in correcting class II division 2 malocclusions.

Table-I: Comparison of variables before and after twin block appliance therapy.

Variables	Before	After	*p*-value
Overjet	8.1 ± 1.53	1.7 ± 0.29	<0.001
Angle of convexity	10.9 ± 1.01	6.7 ± 0.93	<0.001
Molar relation	5.6 ± 0.57	0.1 ± 1.82	<0.001
Canine relation	5.5 ± 0.52	0.0 ± 0.09	<0.001

Table-II: Mean values of standard deviation.

Variables	Mean Std. Deviation	*p*-value
Overjet before–Overjet after	6.3 ± 1.44	<0.001
Angle of Convexity before-Angle of Convexity after	4.1 ± 1.08	<0.001
Molar relation before-Molar relation after	5.5 ± 0.59	<0.001
Canine relation before-Canine relation after	5.5 ± 0.53	<0.001

DISCUSSION

Selection of twin block appliance therapy as a treatment modality is dependent upon numerous factors viz patient factors like CVM stage, age and patient compliance issues. However its effect in reducing overjet in class-II patients has been documented to have exceptional social impact in increasing patients confidence as stated in a study done by O'Brien *et al*., 2003. The findings of this study showed that with the use of Twin-Block appliance therapy in class-II division 2 patients not only their overjet got reduced to significant levels. Also the dento-alveolar effects were achieved which made class II molars and canines to become class I effectively. Skeletaly acceptable results corres-ponded to a decrease in angle of convexity in all the patients included in the study. A study conducted by Khoja *et al*., in 2016 also concluded reduction in overjet in class-II division 2 cases along with skeletal and dentoalveolar changes. Due to convenience of appliance design, ease of repair and activation, and ability of being used easily with minor modifications[17] in both mixed and permanent dentition as documented by Harradine and Gale, 2000; twin block appliance has become a treatment of choice in biphasic class-II treatment modalities. An important consideration while planning twin block appliance therapy should be upper incisor inclinations as tipping and incisor retractions can be achieved by incorporating labial bow in twin block appliance as confirmed by a study done by lund and sandler *et al*[18] as opposed by a study done by Mills and McCulloch[19] that did not used labial bow and hence found no changes in upper incisor inclinations. Various studies performed on functional appliances used for class II correction shows that effects of class-II correctors are not limited to mandibular advancement only their maxillary growth restricting effect has also been documented. A systemic review and meta analysis done to check the effectiveness of class-II correctors showed that these appliances have little inhibitory effect also on maxilla but they do not affect rotation of maxillary plane[20]. Effect of functional appliances on increase in mandibular length has also been documented in a systematic review and meta analysis according to which randomied controlled trials (RCT) to determine functional appliances efficacy in improving mandibular length has been documented[21]. Case reports on effects brought about by class II correctors like twin block in effectively reducing overjet, correcting molar relation and increasing effective length of mandible were found to be stable even 2 years post retention[22]. A study conducted on effects of twin block appliance therapy on cervical spine posture showed that a backward inclination of middle portion of cervical column is associated with advancement of mandible caused by twin block appliance therapy[23]. With the evolution of CBCT patients having retrognathic mandible treated with twin block appliance therapy were evaluated to have enlargement of volume, cross-sectional area and area distribution along with increased pharyngeal airflow pressure distribution and resistance response after manbibular advancement following twin block therapy[24]. Another clinical trial study conducted on mandibular advancement appliances like twin block in controlling symptoms of sleep disordered breathing in children showed massive improvement in symptoms and an overall reduction of apnea-hypopnea index after their use[25]. CBCT evaluation studies also showed that patients treated with twin block appliance therapy showed significant skeletal, dentoalveolar and condylar changes[26] in all dimensions and positions. The effect of class II correctors during pre-pubertal and pubertal growth phase needed clarification. Hence, a study conducted by Giuseppe Perinetti[27] concluded that class II correctors can bring about effective changes if used during the pubertal growth phase. A proper construction bite is required for optimal results of twin block appliance therapy. studies show that facial soft tissue from pre-treatment to completion were more stable than with a usual modified twin-block appliance[28]. In this study we couldn't make control groups on the basis of skeletal age so we

couldn't quantify the amount of change as part of natural growth process.

CONCLUSION

Results concluded from data of this study shows that twin block appliance therapy has been effective in reducing profile convexity, correction of molar and canine relationships and achievment of normal overjet in class-II division 2 cases.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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