



THE EFFICACY OF TWIN BLOCK AS A FUNCTIONAL APPLIANCE: AN OVERVIEW

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ABSTRACT

Functional appliance has been the topic of intension and eager to many researchers. The main objective of this review article is to create a clear conception on the effects of the Twin-block appliance and also compare its efficacy with other functional appliances. A systematic search of several electronic databases was conducted until March 2015. Human studies that used a Twin-block appliance were selected. Two authors reviewed and extracted the data independently and assessed the quality of the retrieved studies. The search strategy resulted in 4520 articles, of which 38 articles were selected finally based on the inclusion criteria. After analyzing the articles we were able to make a zest of the effect of Twin-block appliance (skeletal, dentoalveolar, soft tissue and psychological) on growing patients. The comparison of Twin-block appliance with other functional appliance was also noted. This article is motivated on understanding the influence and the efficacy of Twin-block appliance on malocclusion in different populations.

KEYWORDS: Twin-block; Functional appliance; Malocclusion; Dentoskeletal.



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INTRODUCTION

Twin Blocks are simple removable bite blocks with occlusal inclined planes which act as functional appliance, designed for full time wear. It was invented by Dr. William J. Clark in 1977¹ and since then it has been a very popular functional appliance in the correction of malocclusion in growing patients. Although Twin-block appliance is mostly used in correction of class II malocclusion, it has some modifications which can be used in other cases also. In comparison to other functional appliances, Twin-block (TB) has some advantages which made it popular among the clinicians. Its mechanism of function is very similar to the natural dentition. Free mandibular movement and less bulk bring better patient compliance. In addition, after the insertion of

the appliance the appearance is noticeably improved¹. There have been several studies evaluating the soft tissue changes, dentoskeletal changes, Temporomandibular joint (TMJ) changes and treatment effects produced by the twin block². Some studies have focused on the comparison of effect with other functional appliances. If the results of all these studies can be combined as a whole, it would be beneficial for both the clinicians and the researchers to understand the function, efficacy and implement of Twin-block appliance in details. Therefore, the objective of this review is to present an overview on the effect of Twin-block appliance in different cases and help to produce potential treatment effects by using this appliance.

MATERIALS AND METHODS

A systematic computerized search of electronic databases was carried out in PubMed, European Journal of Orthodontics, American Journal of Orthodontics and Dentofacial Orthopedics, Angle Orthodontist and ResearchGate was conducted until March 2015.

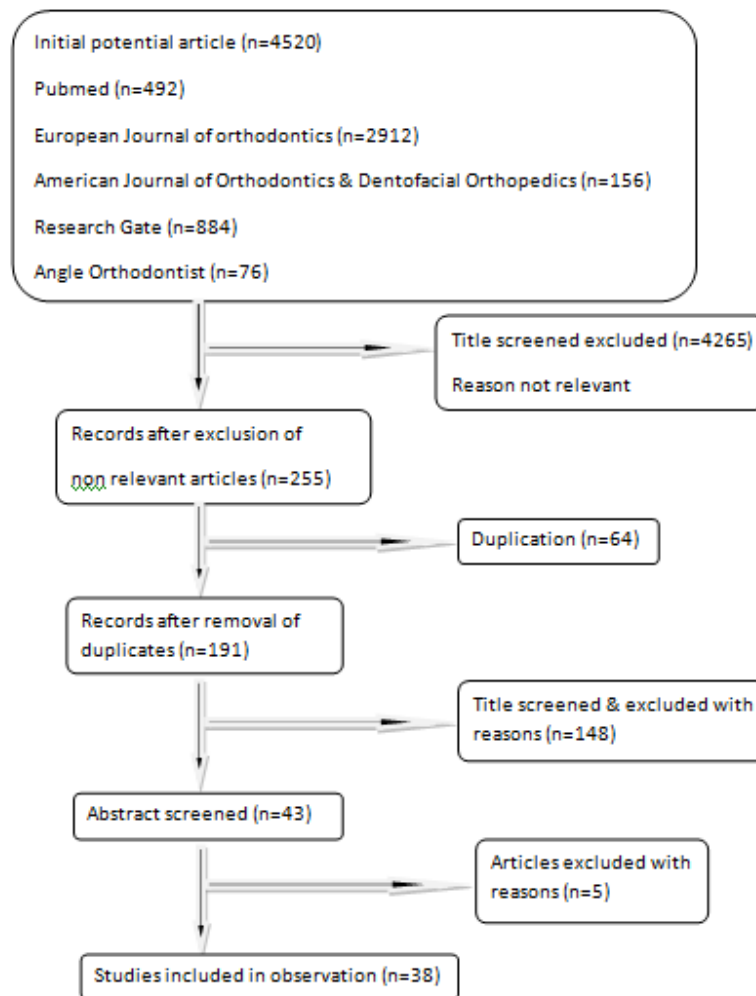
The inclusion criteria for the articles were:

- All journal articles, including clinical trials, abstracts
- Studies treated with Twin-block appliance
- In vivo human studies

Details of the terms and how they were combined per database can be found in flow chart. No restrictions were applied to the electronic searches. Duplicate results were removed upon identification. Titles and abstracts of the results were evaluated to identify the articles that met the initial selection criteria. Articles, based on the abstracts/titles,

which did not meet the inclusion criteria, were excluded. Then full texts of the articles were collected and scrutinized based on the abstracts/titles that met the inclusion criteria. If there were more than one publication for the same study, the one with more details, was selected. 38 articles were evaluated finally.

Flow chart



DISCUSSION

Functional appliances are considered to be primary orthopedic tools to influence the facial skeleton of the growing child in the condylar and sutural area. Patient compliance is always of great concern when treating patients with functional appliances. As Twin-block appliance is the functional appliance with most patient compliance, a detailed knowledge would always be appreciated. A summary on the outcomes of all the articles is shown in Table 1. Twin-block appliance is mostly used in treatment of Class II malocclusion. So the effects that are discussed below are mostly in class II malocclusion cases.

Effect on Dentoskeletal structure

Several studies have documented the dentoskeletal effect of Twin-block on growing patients³⁻²⁰. Mostly the effect was on mandible³. Twin-block appliance showed more sagittal changes than vertical changes³⁻⁶. The mostly noticed changes are-

- Increase in mandibular length (Co=Gn) which corrects the facial profile from convex to straight.
- Decrease in overjet.
- Correction of molar relationship, by mesial movement of lower molars and distal movement of upper molars.

- Maxillary forward movement/growth is restricted.
- To achieve maximum benefit, Twin-block appliance should be used in growing patients¹¹.

Effect on soft tissue

Some obvious changes or corrections of facial soft tissue are observed after the use of Twin-block appliance²¹⁻²⁴.

- Overall improvement of the soft tissue profile.
- Forward movement of chin.
- Increased anterior facial height.
- Increased lower lip length.
- Increased PAP (Pharyngeal Airway Passage) dimension.

Effect on Temporomandibular joint

Temporomandibular joint plays an important role in correction of malocclusion by a functional appliance in growing patients. Twin-block appliance has some significant effect on temporomandibular joint²⁵⁻²⁸.

- Anteroposterior diameter and height of condyle is increased.
- Forward positioning of condyle and backward movement of disk are observed.
- The growth of condyle is stimulated in upward and backward direction.

Effect on class III malocclusion

In case of class III malocclusion, reverse Twin-block appliance is used for treatment purpose²⁹⁻³². The effect of reverse Twin-block is completely different from conventional Twin-block.

- Reduced mandibular soft tissue protrusion.
- Correction of skeletal anterior cross bite.
- Increase in maxillary/mandibular plane angle.
- Reduced angle SNB
- Maxillary forward growth and mandibular retrusion.

Psychological Effect

Early orthodontic treatment with Twin-block is always beneficial. It also has a strong impact on patient's psychology. It has been observed that patients, who have been treated with Twin-block at early age, faced less negative experience. It improves appearance as well as lifting the level of self-esteem³³. Because of the higher self concept one becomes more confident in personal, social and every other aspect of life.

In Comparison with other functional appliances

- In comparison with X bow: Twin-block Increases mandibular corpus length whereas X bow causes lower incisor proclination³.
- In comparison with FRD- Twin-block produced greater mandibular advancement whereas FRD caused lower incisor proclination³⁴. The effect of Twin-block is mostly skeletal³⁵ thus it is more effective in correction of skeletal malocclusion⁷.
- In comparison with Herbst appliance- Twin-block showed only skeletal improvement, but Herbst appliance showed both dental and skeletal improvement⁹. Herbst appliance was more effective in reducing overjet³⁶. In cases with mandibular retrognathia TB is the appliance of choice but in cases with maxillary prognathism followed by the mandibular retrognathia Herbst appliance is the better choice.
- In comparison with bionator- Both Twin-block and bionator are effective in forward positioning of mandible. Twin-block showed slightly more efficacy^{20, 25}.
- In comparison with Dynamax appliance- Twin-block appliance is more effective than Dynamax appliance in reduction of overjet^{23, 37}.

- In comparison with miniblock-Twin-block appliance showed more improvement in correction of soft tissue profile and in overjet reduction^{12, 24}.
- In comparison with Bite-Jumping appliance- Twin-block appliance produced counter clockwise rotation of mandible which inhibits vertical growth and Bite-jumping appliance caused clockwise rotation of mandible resulting in vertical development⁶.

Table 1
An overview of all the articles included in the study with their outcomes

No	Year	Author	Material	Method	Outcome measures
1.	2015	Giuntini et al ³⁴ .	91 class II patients (28-TB, 36-FRD, 27-Control Group).	Cephalometric Evaluation.	The TBA produced greater skeletal effects in term of mandibular advancement & growth stimulation while the FRD caused significant proclination of the mandibular incisors.
2.	2015	Trivedi et al ³⁹ .	25 patients with class II div 1 treated by TB.	Cephalometric Evaluation.	All parameters considered in this study showed highly significant difference in pre & post treatment values, suggesting their reliability particularly angular parameters.
3.	2015	Ehsani et al ³ .	75 patients with class II malocclusion	Cephalometric evaluation.	Class II corrections using an Xbow or Twin-block followed by fixed appliances occurs through a relately similar combination of dental & skeletal effects. An increase in mandibular incisor inclination for Xbow group & an increased corpus length for Twin-block group were notable exceptions.
4.	2015	Chugh et al ³⁰ .	A 6 years & 8 months old girl.	Cephalometric evaluation.	Successful correction of skeletal class III malocclusion.
5.	2014	Daurawu et al ⁴ .	28 patients with skeletal class II malocclusion.	Cephalometric evaluation.	The overjet reduction & molar relation correction is more skeletal in nature.
6.	2014	Ghodke et al ²¹ .	38 patients with class II malocclusion.	Cephalomertic Evaluation.	Correction of mandibular retrusion by Twin-block appliance increased the PAP dimensions & maintained the pre-treatment thickness of posterior pharyngeal wall.
7.	2014	Chavan et al ²⁵ .	30 patients with class II div 1 malocclusion.	MRI.	The treatment group showed consistent forward positioning of condyle & backward movement of the disk.
8.	2014	Gong et al ⁵ .	31 patients with skeletal class II malocclusion.	Cephalometric evaluation.	Twin-block combined with fixed appliance treatment van efficiently promote mandibular growth, restrict forward growth of maxilla to some extent, correct incisor & ar relationship & improve skeletal profile in growing skeletal class II individuals with mandibular retrognathia.
9.	2014	Burhan AS & Nawaya FR ⁶ .	44 patients with skeletal class II div 1 malocclusion.	Cephalometric evaluation.	The Bite-Jumping appliance is recommended for clockwise rotation of mandible whereas Twin-block appliance is recommended to inhibit vertical development of mandible.
10.	2014	Mai et al ²⁶ .	60 class II div 1 patients with mandibular retrusion.	CBCT.	Condylar largest anteroposterior diameter & upper condylar height in class II div 1 malocclusion patients increased after treatment using Twin-block & class II elastics.

11.	2014	Hanoun et al ³⁵ .	92 patients with class II div 1 malocclusion.	Cephalometric evaluation.	Both appliances are effective in correcting class II malocclusion. Skeletal changes are only seen in patients using Twin-block appliance.
12.	2014	Tarvade et al ⁷ .	20 patients with class II div 1 malocclusion.	Cephalometric evaluation.	Twin-block has more mandibular lengthening effect as compared to Forsus & thus was found to be more effective.
13.	2014	Saikoski et al ⁸ .	45 patients with class II div 1 malocclusion.	Cephalometric evaluation.	The Twin-block appliance has great effectiveness for correction of skeletal class II malocclusion individuals with growth potential. Most changes are dentoalveolar with a significant skeletal effect on mandible.
14.	2014	Yildirim et al ²⁷ .	30 patients.	CBCT.	Twin-block increases condylar volume, mandibular length & inter condylar distance by stimulating growth of condyle in an upward & backward direction.
15.	2014	Baysal A & Uysal F ⁹ .	60 patients.	Cephalometric evaluation.	In Twin-block group-mandibular skeletal changes are mainly observed. In Herbst group- both skeletal and dental changes are observed.
16.	2013	Vinoth et al ²² .	25 patients with class II div 1 malocclusion.	Cephalometric evaluation.	A definite improvement in airway dimension following Twin-block therapy.
17.	2013	Liu et al ²⁸ .	20 patients.	CBCT.	After Twin-block treatment the condylar height increased & resulted in adjustment in the condyle position within the glenoid fossa to more downward & forward position.
18.	2012	Yan L et al ¹⁰ .	A boy of 12 years & 2 months old with class II malocclusion.	Cephalometric evaluation.	Mandible is positioned forward, facial profile became straight from convex, maxillary expansion with labially tipped/inclined maxillary anterior teeth & good inter-incisal angle.
19.	2010	Badri Thiruvank atachari et al ³⁷ .	64 growing patients with class II div 1 malocclusion.	Study model, Intraoral & Extraoral photographs, Cephalometric evaluation.	The Twin-block appliance was more effective than the Dynamax appliance in overjet reduction.
20.	2010	Saud A. Al-Anezi ¹¹ .	A 13 year old male with class II malocclusion.	Study model & Cephalometric evaluation.	The effect of Twin-block appliance is mostly dentoalveolar with small skeletal component. To achieve maximum benefit it should be used in growing patients.
21.	2007	Lee et al ²³ .	62 patients with class II div 1 malocclusion.	Optical surface laser scanning, clinical & cephalometric evaluation.	Forward movement of chin. Increase in vertical facial height. Anterior face height is increased. Lower lip length is also increased.
22.	2005	LIU et al ³¹ .	15 growing patients with class III skeletal malocclusion.	Cephalometric evaluation.	Reduced mandibular soft tissue protrusion.
23.	2005	Liu et al ²⁹ .	30 growing patients with early Angle III skeletal malocclusion.	Cephalometric evaluation.	Angle III skeletal anterior crossbite can be corrected successfully with reverse Twin-block combined with maxillary protraction appliance by mandibular retrusion & maxillary forward growth.

24.	2005	Daljith S. Gill & Robert T. Lee ¹² .	70 adolescents with class II div 1 malocclusion.	Cephalometric evaluation.	The Twin-block group experienced a significantly greater reduction in overjet compared with mini-block group.
25.	2004	Ashvin A. Sharma & Robert T. Lee ²⁴ .	70 adolescents with class II div 1 malocclusion.	Study model & cephalometric evaluation, Optical scanning.	The Twin-block appliance produced a greater overall improvement in the soft tissue profile than the mini-block appliance.
26.	2003	O'Brien et al ³⁶ .	215 patients with class II malocclusion.	Study model & cephalogram evaluation.	Herbst appliance is more effective in reducing overjet.
27.	2003	O'Brien et al ¹³ .	174 growing children with class II div 1 malocclusion.	Study model & cephalometric evaluation.	Mostly dentoalveolar changes are observed.
28.	2003	O'Brien et al ³³ .	176 children with class II div 1 malocclusion.	Data/ Questionnaire.	There was an increase in self-concept. Improved self-esteem. A reduction in negative social experience.
29.	2003	Kidner et al ³² .	14 children.	Cephalometric evaluation.	Proclination of upper incisors, Retroclination of lower incisors, Reduction in angle SNB, Increase in maxillary/mandibular plane angle.
30.	2001	Parkin et al ⁴⁰ .	63 patients with class II malocclusion.	Cephalometric evaluation.	Both type of Twin-block appliance were very effective in correcting class II malocclusion. The addition of the high pull headgear to the Twin-block allowed effective vertical & sagittal control of the maxilla.
31.	2000	Christine M. Mills & Kara J. McCulloch ¹⁴ .	26 treated class II patients.	Cephalometric evaluation.	Although there was a slight reduction in mandibular growth rate after treatment, much of the significant increase in mandibular length was still present 3 years later when the subject had matured into permanent dentition stage.
32.	2000	M. J. Trenouth ¹⁵ .	30 children with class II div 1 malocclusion.	Cephalometric evaluation.	The Twin-block appliance reduced the overjet by a combination of upper incisor tipping & bodily correction of the dental-base relationship. Both statistically & clinically significant.
33.	1999	Susi Caldwell & Paul Cook ¹⁶ .	43 children with class II div 1 malocclusion.	Study model & cephalometric evaluation.	49% patient failed to wear the appliance due to non-compliance. In others there was reduction in overjet.
34.	1999	Linda Ratner Toth & James A. McNamar Jr ⁴⁰ .	120 patients with class II div 1 malocclusion.	Cephalometric evaluation.	Overbite & overjet are decreased. Increase in mandibular length (more in TBA) Increase in lower anterior facial height. More dentoalveolar change in TBA than in FR-2.
35.	1999	Nazli Tumer & Ali. S. Gultan ¹⁷ .	39 growing patients with Angle class II div 1 malocclusion.	Clinical examination & Cephalometric evaluation.	In the Twin-block group-the SNA & Co-ANS values are decreased, mandibular plane angle & gonial angle are increased & decrease in the degree of overbite occurred. The lower incisors showed a greater degree of protrusion. In the monoblock group-upper incisors demonstrated a greater degree of retrusion & inter-incisor angle is increased.
36.	1998	David Ian Lund & Paul Jonathan Sandler ¹⁸ .	63 children with class II div 1 malocclusion.	Cephalometric evaluation.	Twin-block appliance is a very effective & efficient tool with which overjets can be reduced. Quantitatively the changes are impressive but qualitatively they leave something to be desired, which can be finished with fixed appliance.

37.	1998	Christine M. Mills & Kara J. McCulloch ¹⁹ .	28 patients with skeletal class II malocclusion treated by using TBA.	Cephalometric evaluation.	Mandibular growth in the treatment group was greater than in the control group. Some dentoalveolar changes caused overjet correction. Mostly it was skeletal change.
38.	1998	Illing et al ²⁰ .	67 children.	Cephalometric evaluation.	Anterior movement of mandible. Significant increase in total facial height. Restriction of anterior movement of point A. Significant reduction of ANB. Significant reduction in the inclination of upper incisors to the maxillary plane.

In the studies cephalometric evaluation is the mostly used method. Radiographic cephalometrics is the most suitable and therefore the most commonly used⁴¹.

CONCLUSION

From this study, it can be concluded that Twin-block appliance is an important tool in the treatment of skeletal malocclusion in growing patient. Whether it is class II or class III malocclusion, modifications can be done on Twin-block appliance. From this above discussion it will be easier to decide on which

cases Twin-block appliance can be used. It will also help in choosing among different types of functional appliance depending on their efficacy.

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