

Skeletal and Dentoalveolar Effects Produced by Reverse Twin Block Appliance in Class III Malocclusion in Growing Patients-a Systematic Review

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Abstract: To evaluate the skeletal and dent alveolar effects produced by reverse twin block appliance in class III malocclusion in growing patients. A systematic search was conducted using electronic search of PubMed, Google Scholar, Google, manual search using Institutional library from 1st January 2000 to 31st December 015. RCT, Clinical trials and Case reports were selected. These studies evaluated the effectiveness of reverse twin block appliance. 9 articles have been used for detailed evaluation in this systematic review after assessment of full text. Results showed skeletal changes like increase in SNA, decrease in SNB and ANB, increase in anterior vertical dimensions, mandibular length and height along with (Frankfort mandibular angle) FMA and (Mandibular plane angle) MPA. Dental changes included: proclination of upper anteriors, retroclination of lower incisors, class I molar and canine relations. Soft tissue changes were improvement in the profile of the patient with reduction in the concavity of the profile. In developing class III cases having dental and skeletal imbalance, treatment should be recommended at an early age. Early treatment with reverse twin block reduces developing skeletal imbalance and decreases the need for comprehensive orthodontic treatment at a later age. The available evidence on this topic is scarce. No studies till now were found to be identical to this review describing the cephalometric soft tissue and hard tissue pre and post treatment changes with reverse twin block.

Keywords: reverse twin block; systematic review; class III malocclusion; growing patients

INTRODUCTION

Clark has described a version of the twin block that may be used for class III malocclusions, known as the class III twin block appliance or the reverse twin block. It consists of reverse angulation of blocks which harnesses occlusal forces to advance the maxilla and maxillary dentition while using the mandible as anchorage and restricting its development [6].

Treating skeletal and dental imbalance at an early age helps in decreasing the requirement for orthodontic treatment at a later stage of life. The diagnosis of pseudo class III malocclusion can be done

by observing the dual closure pattern of the patient, genetic tendency, incisor relationships, the cephalometric parameters and skeletal discrepancy aggravated by postural relation of mandible. The best cases to treat with early interventions are: the cases with CR-CO discrepancy, overclosure of mandible, and ability of the patient to close in most returned position and negative genetic influence.

Class III malocclusions [1, 2, 5] may be limited to dentoalveolar discrepancies but are more frequently skeletal in nature. The characteristic features of a class III malocclusion are present at an early age, usually

between 3 and 5 years of age [6]. A typical Class III malocclusion deteriorates with age [10].

It was found that 65-67 % of all Class III malocclusion were characterized by maxillary retrognathia. Thus maxillary protraction is an important paradigm in early management of Class III malocclusion [11]. Management of a Class III is always a clinical challenge [7]. Prognathism is a dominantly inherited trait, a trait that is dominantly inherited as a rule with local causes as exceptions, a dominant trait with incomplete penetrance, and a simple recessive trait [8]. Timing of treatment, especially for children with developing Class III malocclusions in the early mixed dentition, has always been controversial and hence the decision whether to treat early or to wait until the end of growth is difficult [4].

No systematic review has specifically focused on the skeletal and dent alveolar changes produced by reverse twin block appliance. The intent of this study is to possibly permit the orthodontist to evaluate the available evidence and discuss the usefulness of early treatment and reverse twin block appliance for correction of developing class III. Therefore, the objective of the present systematic review is to evaluate and to discuss clinical significance of dental and skeletal changes after the use of reverse twin block appliance in class III malocclusion cases.

MATERIALS AND METHODS

A systematic search was conducted using electronic search of PubMed, Google Scholar, Google, manual search using Institutional library .Resources were searched from 1st January 2000 to 31st December 2015 to identify appropriate studies. All cross reference lists of the selected studies were also screened. RCT, clinical trials and case reports were selected. Studies without any surgical intervention or syndromic characteristics undergoing twin block therapy were included. Studies on non-growing patients, review, abstracts, and letters to editors, editorial were excluded. Quality assessment of the trials was done. These studies evaluated the effectiveness of reverse twin block appliance.

The following criteria were chosen to initially select potential studies from the published articles results:

Inclusion criteria

- Studies published between 1st Jan 2000 to 31st Dec 2015
- Patients undergoing myofunctional appliance therapy of reverse twin block under pre-pubertal and pubertal stage
- Studies evaluated using lateral cephalogram

- Studies without any surgical intervention or syndromic characteristics undergoing reverse twin block therapy were included

Exclusion criteria

- Studies on non-growing patients
- Review, abstracts, letters to editors, editorial are excluded
- Studies not meeting the inclusion criteria

PICO

- P- participants: growing patients under pre pubertal and pubertal stage
- I - Intervention: reverse twin block
- C – Comparison: -
- O – Outcomes: dental and skeletal changes
- S-Study design: RCT/clinical trial/case reports

INFORMATION SOURCES

Internet sources of evidence were used in the search of appropriate papers satisfying the study purpose: the National Library of Medicine (MEDLINE PubMed), Google Scholar, Google, and manual search using library resources. The databases were searched from 1st January 2000 upto 31st December 2015 using the keywords and search strategy as follows: (Table 1 and Table 2)

Study selection

RCT, clinical trials and case reports were selected however, articles which mentioned the pre-treatment and post treatment changes of reverse twin block in growing patients were only included. The number of articles identified through the database searching were 10 in all. After thorough reading of titles the number of articles found relevant was only 9.

DATA COLLECTION PROCESS

Data collection process was done according to the consultation approved from our expert. Comparing the database results, PubMed showed all of the finally selected articles. Other articles were selected from institutional library. From the 10 studies, only 7 actually fulfilled the final selection criteria searched through PUBMED. An additional 2 articles were included from other sources. A final of 9 articles have been used for detailed evaluation in this systematic review after assessment of full text. A flow diagram of the literature search is shown below (Figure1).

RESULTS

According to the data collected and the records selected the remaining Excel sheet was filled only with the data that was related to this study and retained (Table 3). Each of the mentioned cases showed skeletal changes like increase in SNA, decrease in SNB and ANB and increase in anterior vertical dimensions, mandibular length and height increased along with

FMA and MPA. Hence there was improvement in the skeletal discrepancy. Dental changes included: proclination of upper anteriors, retroclination of lower incisors, class I molar and canine relationship. There

was correction of anterior crossbite and deep bite. Soft tissue changes included the improvement in the profile of the patient with reduction in the concavity of the profile.

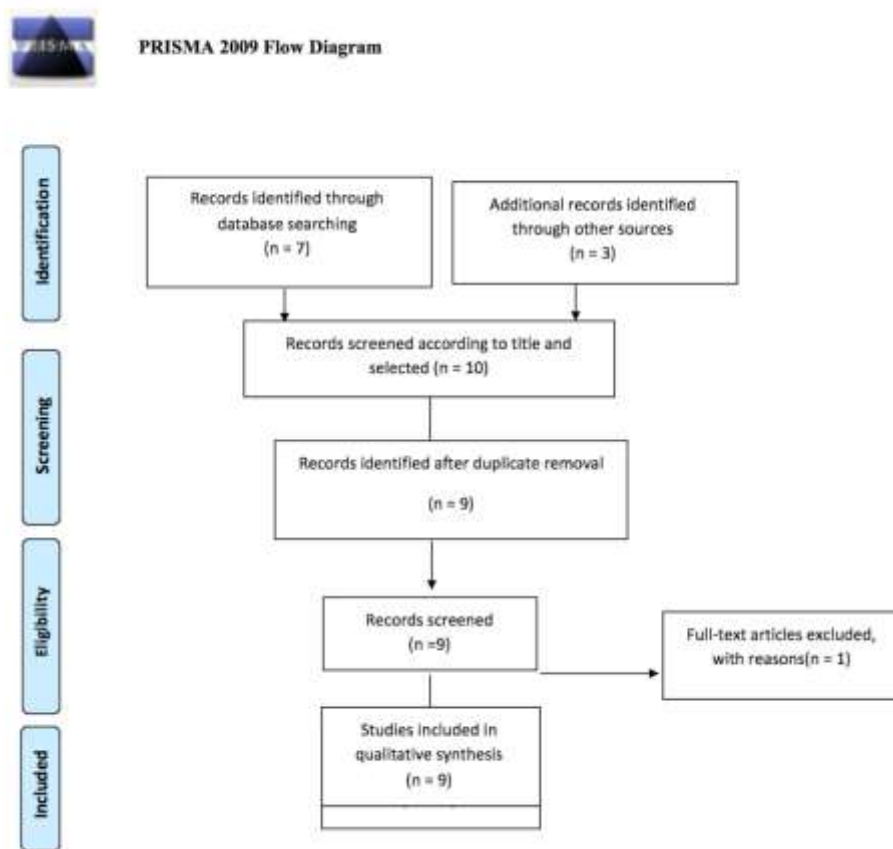


Table-1: keywords

Reverse Twin block	Functional appliance, myofunctional appliances, functional jaw orthopedics
Mandibular changes	Mandibular growth ,Skeletal and dentoalveolar changes
Cephalometric	Cephalometric changes, lateral ceph, cephalometric study
Class III molar relation	Class III malocclusion

Table-2: Search strategy

Sr No.	Search strategy	Number of articles	Number of selected articles	After duplicate removal
1	Reverse twin block	7	7	7
2	Other sources	3	2	2
	Total	10	9	9

Table-3: Data collection

STUDY ID	LOCATION	AUTHOR	YEAR OF PUBLICATION	STUDY DESIGN	SOFT TISSUE	PRE TREATMENT	POST TREATMENT	SKELETAL CHANGES	DURING TREATMENT	PRE TREATMENT	POST TREATMENT
1	UK	G. Kidner A. DiBiase D. DiBiase	2003	clinical trial				SNA SNB ANB Mandibular plane angle lower anterior facial height	0.179 -1.393 1.429 2.107 1.75		
2	peshawar, pakistan	Tallat Firdos	2006	clinical trial				SNA SNB ANB Y AXIS NL-ML NSL-ML		76.8 80 -2.5 65 20 31.5	79.9 79.4 0 65 20.5 31.9
3	Chandigarh	Kapur A,Chawla H.S.,Utreja	2008	case report				SNA SNB ANB FMA WITS SN length CO-A CO-Gn corpus length facial convexity	case1: 82 84 -2 26 -7 66.5 69 98 41 -2 case2: 75 78 -3 20 -4.5 71 76 98 40 -3 case3: 83 85,-2,23,-8 69,82,112,45,-3	84 84 0 27 -1 67 78 110 45 0 79 80 -1 22 -1 72 84.5 109 47.5 -2 83 85,-2,22 - 5,70,82,112,48,-3	
4	London,UK	Jadbinder	2010	case report							

		Seehra, Padhraig S. Fleming, Andrew T. Dibias										
5	London,UK	J. Seehra, P. S. Fleming, N. Mandall,A. T. DiBiased	2012	Randomised Control Trial					SNA SNB ANB Maxillary-mandibular Plane Angle Upper Facial height Lowee Facial height Lower anterior facial height%	1.2 -2.1 1 1.7 1.5 2.8 0.7	80 81.8 -1.8 23.3 48.2 57.8 54.4	
6	Mangalore,Karnataka	Sargod SS, Shetty N, Shabbir A	2013	case report								
7	Lucknow	Geeta Verma, Amit Nagar, Pradeep Tandon, Sneh Lata Verma	2014	case report	upper lip -E line lower lip-E line	1 3	2 1		SNA SNB ANB FMA SN-GoGn IMPA maxillary base mandibular base N-me		78 82 0 15 21 100 45.2 72 93	80 80 0 18 25 89 47 72.5 100
8	Sahidabad	Vineet Golchha and Pooja Sharma	2014	case report	nasolabial angle	98	101		SNA SNB ANB WITS SN-mandibular plane		75 77 -2 -5 31	76 76 0 -3 33
9	Lucknow	Dipti Shastri, Amit Nagar, Pradeep tandon	2015	case report					SNA SNB ANB SN-MP FMA FMIA WITS		83 89 -6 19 20 67 -8	83 85 -2 27 27 73 -4

DISCUSSION

The present review was performed to systematically analyze the skeletal and dentoalveolar changes that were produced by the reverse twin block appliance in patients with Class III malocclusions. Only a few studies evaluated the changes regarding the skeletal and dental effects produced by the reverse twin block appliance.

One of the RCTs compared the effectiveness of Reverse Twin-Block therapy (RTB) and protraction face mask treatment (PFM) with significant more proclination arising with RTB therapy. There was a tendency for a significant increase in MMPA (Maxillary mandibular plane angle) in both treatment groups, PFM (mean, 2.6°) and RTB (mean, 1.7°), but no difference was found between the two treatment groups. There were significant increases in overjet in both treatment groups. Thus it was concluded that: reverse twin block is capable of correction of Class III dental relationships; however, the relative skeletal and dental contributions may differ. The RTB appliance induced Class III correction, primarily as a result of dentoalveolar effects [6].

Kidner G, DiBiase A, DiBiase D [3] in a clinical trial evaluated 14 subjects with a mean age of 10.0 years (range 7.9–11.8, SD 1.2 years) at the start of the treatment. They were treated with modified reverse twin block appliance. It was proved that treatment with RTB or rapid maxillary expansion and protraction headgear during the deciduous or early mixed dentition provides more favourable skeletal changes. The appliance was well tolerated by most subjects and within 6 weeks of wearing of the appliances changes were seen. Treatment changes observed were: proclination of the upper incisors [mean 5.1°, SD 5.1], retroclination of the lower incisors [mean 4.5°, SD 3.9], reduction in angle SNB [mean 1.3°, SD 1.8] and an increase in the maxillary/ mandibular planes angle (mean 2.1°, SD 2.2). A randomly allocated prospective study with long-term evaluation is required to fully evaluate the efficacy of RTB. In this study they mentioned the pre-treatment and post functional appliance treatment measurement changes, with the reverse twin block appliance.

In other clinical trial patients with mild class III, having retrognathic maxilla, prognathic mandible; deep bite, anterior crossbite, lower lip prominence and a concave profile were selected for treatment with functional appliances, Frankel III and reverse twin block.

This study concluded that early treatment of developing class produce the following results: Forward and downward movement of maxilla and the maxillary dentition, downward and backward rotation of

mandible, decrease in the prominence of mandibular incisors and slight increase in the lower face height. Young children having mild class III problems when provided with functional orthopedic appliances can have better chances with camouflage treatment at a later age and the need of surgery can be eliminated [9].

Kapur A, Chawla H.S., Utreja A. and Goyal A [1]. Treated 3 cases with the similar Reverse twin block appliance and evaluated at within different timelines in the 1st case the patient wore the appliance for 10 months. There was significant improvement in the patient's profile. There was increase in the SNA angle from 82° to 84° but SNB remained same. The ANB changed from -2° preoperatively to 0° postoperatively. The patient was followed up to 2 years and it was seen that overjet and overbite remained same improving the long term stability of the case.

2nd case showed decreased SNA (75°) with normal SNB although it was less (78°). SNA increased by 4° after 18 months follow-up and SNB by 2°. The FMA increased by 2°, from 20° preoperatively to 22° postoperatively. In spite of ANB changing from -4° to -1° postoperatively. There was marked improvement in the patient's profile. This could be because of dentoalveolar as well as skeletal changes with RBT and downward and backward rotation of mandible.

In the 3rd case, soft tissue profile indicated maxillary deficiency but cephalometric readings for SNA was 83°. Within 3 months of wearing the appliance overjet was corrected. SNB was 85° with unrestricted mandibular growth with no heredity component. In the final correction of the malocclusion the cephalometric readings gave only an indication of the maxillo-mandibular position to the cranial base but may not influence the profile finally, in which the improvement was only slight.

A similar case report concluded in all the 3 cases that reverse twin block is a simple, durable, versatile, self-retaining and well tolerated appliance that can rapidly correct developing class III malocclusions involving multiple teeth in crossbite. Since long term follow up was not reported, further research is needed in this area. Also these cases require further treatment with fixed appliances to align the arches and to finish and detail the occlusion. Unfavourable future growth, leading to reestablishment of a Class III malocclusion, is therefore possible [2].

One of the 2 case reports provided an insight into the reverse twin block appliance and reported 2 cases of early class III malocclusion treated using reverse twin with class III malocclusion in deciduous dentition. In both the cases The patient developed a habitual closure of the mandible in a backward position,

and correction of the anterior crossbite was observed within 6 weeks of starting to wear the appliance. The patient was asked to continue with this appliance for another 6 weeks for retention purpose. At the end of 4–5 months, a significant improvement in the patient's profile was appreciable [5].

A case series was presented, in which treatment of an 11 year 3 month-old girl having mild Class III malocclusion took place, due to combination of deficient maxilla and mandibular excess. She had concave profile with horizontal growth pattern and reverse overjet of 3 mm. Treatment plan included reverse twin block with face mask appliance. The cephalometric superimposition showed that the antero-posterior relationship of the jaw bases was improved (ANB -4° to 0°) due to forward maxillary growth (SNA 78° to 80°) and autorotation of mandible in downward and backward direction (FMA 15° to 18° , SNB 82° to 80°)[10].

Vineet G, Pooja S [11]. Treated a patient with skeletal class III using a Face mask and Reverse Twin block appliance. At the end of the treatment the patient had a good functional occlusion, a consonant smile and the prognosis for stability was good. In post treatment results : Class I Incisor relationship was achieved, overjet of 2mm and overbite of 2mm with buccal segment relationship Class I on left and right side. The patient's concavity of profile was reduced. Cephalometric readings revealed that an increase of 1° was seen in SNA and 1° decrease was seen in SNB with mandibular plane angle increased by 2° , inferring downward and backward rotation of mandible, thus correcting ANB angle. Nasolabial angle increased by 3° and maxillary incisors proclined significantly but no significant changes were seen in mandibular incisor proclination.

A case report demonstrated the treatment of pseudo-Class III malocclusion of a 14 yr old using a modified reverse Twin Block and fixed appliances. It was concluded that treatment of a pseudo-Class III malocclusion with a modified reverse Twin Block and fixed appliances is helpful in: Eliminating mandibular displacement, thus allowing the permanent dentition to be guided into a proper Class I relationship, Creating space for the eruption of canines and premolars. Eliminating traumatic occlusion. Dramatically improving aesthetic appearance [7].

The available evidence on this topic is scarce. A randomly allocated prospective study with long-term evaluation is required to fully evaluate the efficacy of this appliance. No other studies till now were found to be identical to this review describing the cephalometric soft tissue and hard tissue pre and post treatment changes with reverse twin block.

CONCLUSION

- Developing class III cases having dental and skeletal imbalance, treatment should be recommended at an early age with a number of available techniques keeping in mind that good targets can be achieved if growth, good tissue response and patient co-operation is available.
- Early treatment can reduce the obvious developing skeletal imbalance and also decreases the need for comprehensive orthodontic treatment at a later age. Treatment of a pseudo-Class III malocclusion or true class III with a modified reverse Twin Block or fixed appliances is helpful in correction of dentoalveolar, skeletal and soft tissue parameters.
- The ideal cases for the treatment include the possibility of the patient to bring the bite to an edge to edge relationship which is important to decide the RTB appliance especially for the treatment of pseudo class III cases with horizontal growth pattern, retroclined upper anteriors , proclined lower anteriors and anterior crossbite.
- The studies mentioned in this review showed skeletal changes like increase in SNA, decrease in SNB and ANB and increase in anterior vertical dimensions, mandibular length and height increased along with FMA and MPA. Hence there was improvement in the skeletal discrepancy.
- Dental changes included: proclination of upper anteriors, retroclination of lower incisors, class I molar and canine relationship. There was correction of anterior crossbite and deep bite. Soft tissue changes included the improvement in the profile of the patient with reduction in the concavity of the profile.
- Long term evaluation after correction of positive overjet and overbite is necessary for favourable results.

LIMITATIONS

The limitations of this review are that with limited literature available, it is difficult to assess the efficiency of the appliance. The prevalence of Angle class III malocclusion ranges from 0% to 3% in different populations reported in the literatures, thus the studies related to these subjects are also scarce. Long term stability of the appliance with the correction of dent alveolar, skeletal and soft tissue changes is unpredictable as the post treatment long term evaluation of each case is not done.

Another flaw noted during the course of compiling this systematic review was the limited number of studies fulfilling our selection criteria, indicating that the vast majority of published studies have inherent design flaws in the conduct and reporting of their scientific investigations, along with small sample sizes upon which results are based. All the articles did not mention the cephalometric changes seen

in each of the cases. There was a lack of high-quality studies, small sample sizes, limited follow-up period, and flaws in statistical analysis in some of the included studies, and insufficient evidence on treatment duration.

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