A Systematic Review of Skeletal, Dental and Soft Tissue Treatment Effects of Twin Block Appliance.

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ABSTRACT

This systematic review aims to assess skeletal, dental and soft tissue treatment effects of the conventional Twin-block appliance compared to control in Class II malocclusion till date. The electronic databases of Medline, PubMed and Cochrane library were systematically searched until September 2019. The human studies that had used the conventional Twin block appliance with a control group evaluated by a Lateral Cephalogram were included. A total of 321 articles were examined. 10 articles were selected. Majority studies reported a significant improvement in the mandible and in the vertical height, maxillary restrictive effect was less consistently reported. A restrictive maxillary molar effect and an advancement in the mandibular molar has been suggested. Retroclination of the maxillary incisors and proclination of mandibular incisor inclination has been reported. There is some evidence to suggest a retrusive upper lip effect and a protrusive lower lip effect. Increase in Nasolabial angle and some decrease in the mentolabial sulcus to be expected. In conclusion the conventional Twin Block appliance have shown desirable skeletal, dental and soft tissue effects. However certain inevitable side effects are also seen mainly its effect on lower anterior proclination.

Keywords: Systematic review, Twin block appliance, Treatment effects.

INTRODUCTION

The Twin block was developed by Dr William J. Clark in 1977.[1] Even though it's a removable appliance requiring patient compliance, it's still one of the most widely used functional correctors.

Twin-block appliance consists of upper and lower acrylic bite blocks with interlocking occlusal inclined planes at 70° angle, which functions to bring the mandible in its desired forward and downward position.[2] It's mainly indicated in actively growing Class II division I malocclusions.[1,3]

Multiple authors have reported variable results with variable intensities till-date.[4-5] A recent systematic review reporting all the treatment effects of Twin Block was lacking.

The aim of this review is to assess the possible skeletal, dental and soft tissue treatment effects of the conventional Twin-block appliance compared to controls in Class II malocclusion individuals till date.

MATERIALS AND METHODS

Information sources

The electronic databases of Medline, PubMed and Cochrane library were systematically searched until September 2019. A limited grey-literature search was also done in Google Scholar.

Search strategy

Table 1 shows the terms used to carry out the search. Duplicate results were eliminated.

Inclusion criteria:

1. Human Cephalometric studies.
2. Use of conventional Twin-block appliance.
3. Cases treated with Non-extraction and Non-surgical approach to prevent introduction of any confounding factors.
4. Comparison with control group of untreated Class II malocclusion cases.[5]

Table 1: Search data and search strategies.

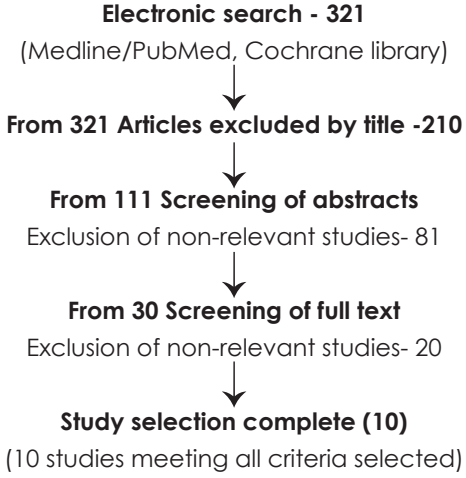
Database	Search strategy	Number of Results
Medline/PubMed: 1989 to present	(twin block OR twin-block OR twinblock) AND [(treatment outcome OR treatment effect$) OR (skeletal effect OR skeletal change) OR (dental effect OR dental change) OR (facial change or profile change or soft-tissue change)]	251
Cochrane library: 1989 to present		70
Google Scholar: 1989 to present		14,800

Study selection

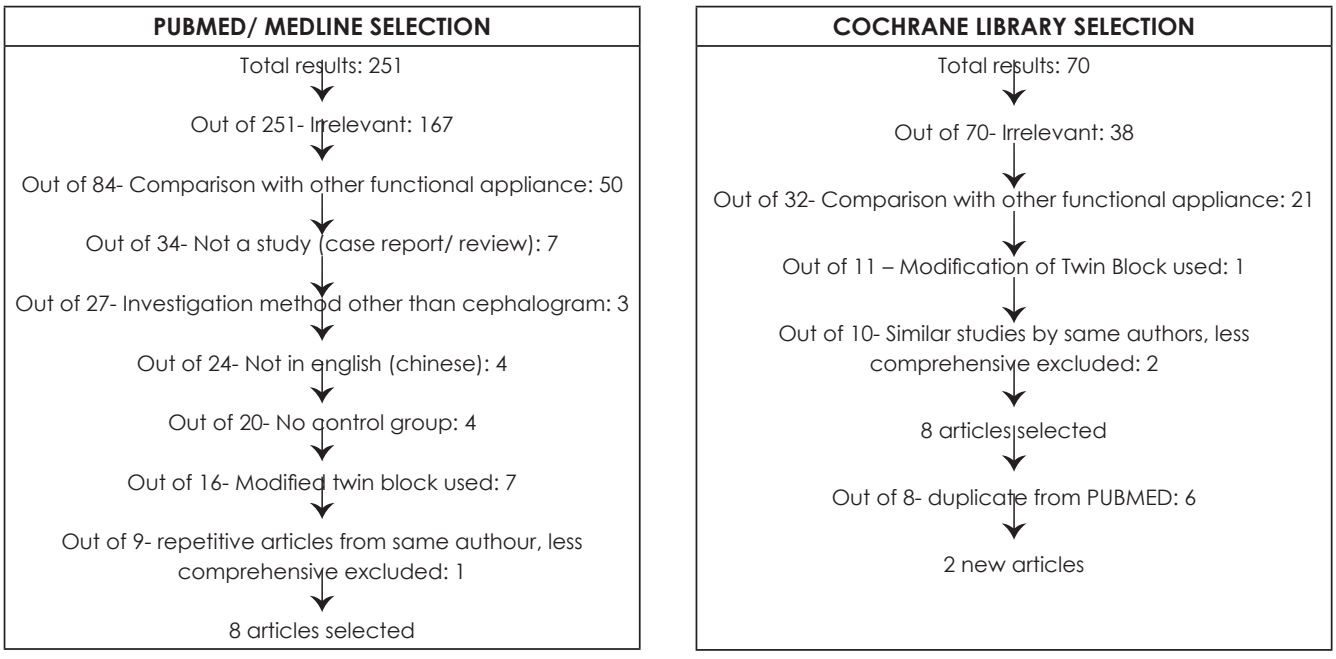
For each database search, first the titles and abstracts were evaluated. The articles that did not match the inclusion criteria, case reports, literature reviews, systematic reviews, editorial articles were all excluded. Articles including animal studies, modified twin block, non-cephalometric analysis were excluded.

Selected abstracts were further subjected to scrutiny of the complete text. Also, when the abstracts were found to be unclear, the full text was obtained.

The 10 articles (FLOW CHART 1) which met all the inclusion criteria were finally included in the systematic review. Google Scholar did not reveal any different results than those from Pubmed/ Medline or Cochrane library. (FLOW CHART 2).



Flow Chart 1



Flow Chart 2

Table 2: Methodological score used in the review.

I.	**Study design (6√)**
	A. Objective - objective clearly formulated (√)
	B. Sample size - considered adequate and estimated before collection of data (√)
	C. Baseline characteristics - similar baseline characteristics (√)
	D. Co-interventions (√)
	E. Randomization - random sampling (√); random allocation of treatment (√)
II	**Study measurements (5√)**
	F. Measurement method - appropriate to the objective (√)
	G. Blind measurement - blinding (examiner √, statistician √)
	H. Reliability - described (√), adequate level of agreement (√)
III	**Statistical analysis (5√)**
	I. Statistical analysis - appropriate for data (√); combined subgroup analysis (√)
	J. Confounders (co-interventions) - confounders included in analysis (√)
	K. Statistical significance level - P value stated (√); confidence intervals (√)
IV	**Other (1√)**
	L. Clinical significance (√)

Maximum number of √s = 17

√ = met; × = not met; / = partially met.

Table 3: Methodological scores for the selected articles.

					RANDOMIZATION			BLINDING		RELIABILITY TESTING								
	Objective	Sample Size	Baseline	No Co-interventions	Random Sampling	Random Allocation	Measurement Method	Examiner	Statistician	Intra-rater	Inter-rater	Statistical Analysis	Confounders Included in Analysis	P value	Confidence Interval	Clinical Significance	Total *Score (Out of 1(7))	Risk of Bias
1) Illing et al.[7]	√	/	√	√	x	√	√	√	x	√	√	√	√	√	√	√	14	L
2) Jena et al.[8]	√	/	√	√	x	x	√	x	x	√	√	√	√	√	√	√	12	M
3) Lund & Sandler[9]	√	√	√	√	x	x	√	x	x	√	√	√	√	√	√	√	12	M
4) Morris et al.[10]	√	/	√	√	x	√	√	√	x	√	√	√	√	√	√	√	14	L
5) Varlik et al.[11]	√	√	√	√	x	√	√	x	x	√	√	√	√	√	√	√	13	L
6) Dauvravu et al[12]	√	/	√	√	x	x	√	x	x	x	x	/	x	√	√	√	9	H
7) Khoja et al[13]	√	√	√	√	x	x	√	x	x	√	x	√	√	√	√	√	11	H
8) Baysal et al [14]	√	√	x	√	x	x	√	x	x	√	x	√	√	√	√	√	10	H
9) Baysal et al [15]	√	√	x	√	x	x	√	x	x	√	x	√	√	√	√	√	10	H
10)Tümer et al[16]	√	/	x	√	x	x	√	x	x	x	x	√	√	√	√	√	9	H

Table 4: Summary of selected articles.

		Sample Size					
	Study Type*	Total	Twin Block	Control	Mean age of combined groups at T1 (years)	Skeletal maturity indicators	Treatment duration (months)
1) Illing et al[7]	P	36	16	20	11.2	-	9
2) Jena et al[8]	P	35	25	10	11.4	-	12.78
3) Lund and Sandler[9]	P	63	36	27	12.4	-	14.4
4) Morris et al[10]	P	36	16	20	11.2	-	9
5) Varlik et al[11]	P	50	25	25	11.9	MP3 H stage	8
6) Dauvravu et al[12]	P	28	17	11	10-14 years	CVMI- III and IV MP3-H stage	11.5
7) Khoja et al[13]	P	113	53	60	11.3	CVMI- II, III, IV	8-12
8) Baysal et al[14]	P	40	20	20	12.58	MP3 S and H2 stage	15.89
9) Baysal et al[15]	P	40	20	20	12.58	MP3 S and H2 stage	15.89
10) Tümer et al[16]	P	26	13	13	13	-	7-14

**P= prospective, R= retrospective; - =not mentioned*

Data items and collection

Skeletal cephalometric findings denoting antero-posterior maxillary changes, mandibular changes, vertical changes, dental findings denoting effects on maxillary and mandibular molars and incisors, overjet and soft tissue findings such as the nasolabial angle, mentolabial sulcus and the position of upper and lower lip were collected.

Risk of bias in individual studies

Risk of bias was assessed through the evaluation of methodological quality study characteristics (Table 2).[5, 17]

Intra-rater reliability, interrater reliability, and blinding of examiner and/or statistician were considered. The studies were labeled as low risk, medium risk and high risk for bias. (Table 3).

Summary measures

Basic study characteristics for each of the 10 studies are mentioned in Table 4.

RESULT

Selection and study characteristics

A total of 10 articles meeting the inclusion criteria were selected as shown in Flow Chart 1 & 2.

Risk of Bias within Studies

Out of the 10 studies 3 studies[7,10,11] have a low risk of bias, 5 studies[12-16] have a high risk of bias and remaining[8, 9] have a medium risk of bias.

Antero-posterior effects on maxilla (Table 5)

Illing et al,[7] Dauvravu et al,[12] Baysal et al[15] have reported a significant headgear effect. Whereas, Jena et al,[8] Lund and Sandler,[9] Khoja et al,[13] Baysal et al[14] and Tümer et al[16] have reported maxillary restrictive effect which were statistically insignificant. Varlik et al[11] reported no maxillary restrictive effect.

Antero-posterior effects on mandible (Table 6)

All authors have reported statistically significant increase in mandible.

Vertical effects (Table 7)

Illing et al,[7] Lund and Sandler,[9] Khoja et al,[13] Baysal et al[14] and Tümer et al[16] have stated statistically significant increase in the vertical height and Baysal et al[15] have reported insignificant findings.

Effects on maxillary molar (TABLE 8)

Jena et al,[8] Lund and Sandler,[9] Dauvravu et al[12] and Tümer et al[16] have revealed statistically significant restrictive effect on the maxillary molars and, Baysal et al[14] have reported otherwise.

Effect on mandibular molar (TABLE 9)

Lund and Sandler,[9] Dauvravu et al[12] and Tümer et al[16] have reported statistically significant advancement of the mandibular molar. Baysal et al[14] and Jena et al[8] have reported statistically insignificant findings.

Effect on maxillary incisors (TABLE 10)

Except for Baysal et al[14] and Baysal et al,[15] all other studies have reported statistically significant decrease in maxillary incisors inclination.

Effect on mandibular incisors (TABLE 11)

Except for Baysal et al[14] and Baysal et al,[15] all

Table 5: Skeletal antero-posterior effects on maxilla.

Study	Parameter	Changes Reported		P Value	Significance S / NS
		Control group	Treatment group		
1) Illing et al.[7]	SNA	0.3	-1.4	p< 0.01	S
2) Jena et al[8]	-	2.04	-1.64	p=0.259	NS
3) Lund and Sandler[9]	SNA	0.3	-0.1	p>0.05	NS
4) Varlik et al[11]	Point A to Y axis(Se to ptm)	0.2	1.2	p>0.05	NS
5) Dauvravu et al[12]	Ss/rlp (Pancherz analysis)	-	-0.67	p=0.022	S
6) Khoja et al[13]	SNA	0.04 ± 1.01	-0.19 ± 1.10	p=0.168	NS
7) Baysal et al[14]	Point A/olp (Pancherz analysis)	1.35	-0.45	p>0.05	NS
8) Baysal et al[15]	SNA	0.20	-0.75	p=0.004	S
9) Tümer et al[16]	SNA	0.05	-0.23	p>0.05	NS

S= significant, NS= not significant

Table 6: Skeletal antero-posterior effects on mandible.

Study	Parameter	Changes Reported		P Value	Significance
		Control group	Treatment group		
1) Illing et al.[7]	Ar to Gn	1	3.2	(p<0.05)	S
2) Jena et al[8]	-	3.54mm	5.52mm	(p<0.01)	S
3) Lund and Sandler[9]	SNB	0.4	1.9	(p<0.001)	S
4) Varlik et al[11]	B to Y axis(Se to ptm)	0.4	4.2	(p<0.001)	S
5) Dauvravu et al[12]	pg/ OLp (Pancherz analysis)	-	4.88mm	(p= 0.000)	S
6) Khoja et al[13]	SNB	0.17 ± 1.03	1.73 ± 1.22	(p<0.001)	S
7) Baysal et al[14]	pg/OLp (Pancherz analysis)	2.12	4.62	(p=0.009)	S
8) Baysal et al[15]	SNB	0.45	2.07	(p<0.001).	S
9) Tümer et al[16]	SNB	0.31	1.77	(p<0.01).	S

S= significant, NS= not significant

Table 7: Vertical skeletal effects

Study	Parameter	Changes Reported		P Value	Significance
		Control group	Treatment group		
1) Illing et al.[7]	Lower anterior facial height	-0.3	+2.7	(p<0.01)	S
2) Lund and Sandler[9]	Total anterior facial height	2.3	4.9	(p<0.001).	S
3) Khoja et al[13]	Sn-GoGn	-0.19 ± 1.09	0.60 ± 2.45	(p=0.029)	S
4) Baysal et al[14]	Lower anterior facial height	2.05	3.85	(p=0.022)	S
5) Baysal et al[15]	Sn-GoGn	-0.62	− 0.25	(p>0.05).	NS
6) Tümer et al[16]	Ar-Go-M	-0.73	2.31	(p<0.01)	S

S= significant, NS= not significant

Table 8: Effects on maxillary molar

Study	Parameter	Changes Reported		P Value	Significance
		Control group	Treatment group		
1) Jena et al[8]	-	-0.36mm	-1.36mm	(p<0.05)	S
2) Lund and Sandler[9]	U6 -horizontal	0.9	-0.7	(p= 0.05-0.01)	S
3) Dauvravu et al[12]	(mi/RLp by Pancherz analysis)	-	-0.133 ± 1.245mm	(p=0.014)	S
4) Baysal et al[14]	mi/OLp-pg/OLp (Pancherz analysis)	0.27	-0.52	(p>0.05)	NS
5) Tümer et al[16]	U6 to Ptv	1.50	-0.54	(p<0.01)	S

S= significant, NS= not significant

Table 9: Effects on mandibular molar

Study	Parameter	Changes Reported		P Value	Significance
		Control group	Treatment group		
1) Jena et al[8]	-	0.36mm	1.53mm	(p>0.05)	NS
2) Lund and Sandler[9]	L6- horizontal	1.0	4.7	(p=0.05-0.01)	S
3) Dauvravu et al[12]	mi/RLp(d) minus pg/RLp(d) (Pancherz analysis)	-	0.666±1.496mm	(p<0.01)	S
4) Baysal et al[14]	mi/OLp-pg/OLp	–0.22	0.35	(p>0.05)	NS
5) Tümer et al[16]	L6/Ptv	2.04	4.89	(p<0.01)	S

S= significant, NS= not significant

Table 10: Effects on maxillary incisor

Study	Parameter	Changes Reported		P Value	Significance
		Control group	Treatment group		
1) Illing et al[7]	U1 to maxillary plane	-1.9	-9.1	(p<0.01)	S
2) Jena et al[8]	-	-0.53mm	-1.43mm	(p<0.001)	S
3) Lund and Sandler[9]	U1 to maxillary plane	-0.2	-11	(p<0.001)	S
4) Morris et al[10]	-	-	-	-	-
5) Varlik et al[11]	U1- SN	0.2	-2.6	(p<0.001)	S
6) Dauvravu et al[12]	is/RLp (Pancherz analysis)	-	0.866±1.125mm	(p=0.054)	S
7) Khoja et al[13]	U1- SN	1.12 ± 4.19	-4.66 ± 5.44	(p<0.001)	S
8) Baysal et al[14]	is/OLp- A/OLp	0.75	0.45	(p>0.05)	NS
9) Baysal et al[15]	U1- SN	1.62	−1.47	(p>0.05)	NS
10) Tümer et al[16]	U1/Ptv	1.58	-1.50	(p<0.01)	S

S= significant, NS= not significant

Table 11: Effects on mandibular incisor

Study	Parameter	Changes Reported		P Value	Significance
		Control group	Treatment group		
1) Illing et al[7]	Lower incisor to mandibular plane	-0.7	+2	(p<0.001)	S
2) Jena et al[8]	-	-0.59mm	+1.44mm	(p<0.001)	S
3) Lund and Sandler[9]	Li- mandibular plane	0.9	4.4	(p<0.001)	S
4) Varlik et al[11]	IMPA	No change	1.3	(p<0.001)	S
5) Dauvravu et al[12]	li/rlp		1.40±1.638mm	(p=0.012)	S
6) Khoja et al[13]	IMPA	1.05 ± 3.45	4.30 ± 3.91	(p=0.001)	S
7) Baysal et al[14]	li/olp- pg/olp	–0.40	0.15	(p>0.05)	NS
8) Baysal et al[15]	IMPA	0.57	0.92	(p>0.05)	NS
9) Tümer et al[16]	L1/ptv	1.19	5.73	(p<0.01)	S

S= significant, NS= not significant

other authors have reported statistically significant proclination of mandibular incisors.

Effects on the Overjet (Table 12)

All studies have reported a statistically significant decrease in the overjet.

Soft tissue effects of Twin Block (Table 13)

Morris et al,[10] Varlik et al,[11] Khoja et al[13] and Baysal et al[15] have reported statistically significant retrusive upper lip effect with a significant increase in nasolabial angle, whereas insignificant findings were reported by Morris et al[10] and Baysal et al.[15] Morris et al,[10] Khoja et al[13] and Baysal et al[15] have narrated a statistically significant lower lip protrusion, whereas, Varlik et al[11] reported otherwise. Of these four studies, Morris et al[10] revealed insignificant change whereas Varlik et al[11] and Baysal et al[15] reported statistically significant increase in the mentolabial sulcus depth.

Table 12: Effects on the overjet

Study	Parameter	Changes Reported		P Value	Significance
		Control group	Treatment group		
1) Illing et al[7]	Overjet	0.8	-5.7	(p<0.01)	S
2) Jena et al[8]	Overjet	0.37mm	-6.75mm	(p<0.001)	S
3) Lund and Sandler[9]	Overjet	-0.3	-7.9	(p<0.001)	S
4) Dauvravu et al[12]	is/RLp-ii/RLp		-6.54±1.12mm	(p<0.000)	S
5) Khoja et al[13]	Overjet	-0.30 ± 1.25	-6.50 ± 2.46	(p<0.001)	S
6) Baysal et al[14]	is/OLp-ii/OLp	0.38	–4.48	(p=0.000)	S
7) Tümer et al[16]	Overjet	0.27	-7.46	(p<0.01)	S

S= significant, NS= not significant

Table 13: Soft tissue effects

Study	Parameter	Changes Reported		P Value	Significance
		Control group	Treatment group		
1) Morris et al10	1. Upper lip to E line	0.7	-1.4	p<0.01	S
	2. Lower lip to E line	0.8	3.8	p<0.05	S
	3. NLA:	6	3.8	p>0.05	NS
	4. MLS:	12.1	-0.6	p>0.05	NS
2) Varlik et al11	1. Upper lip: Ls to Y Line	0.03	-2.23	P< 0.001	S
	2. Lower lip: Li to Y axis	0.23	3.10	p≤0.001	S
	3. NLA:	0.10	6.23	p< 0.05	S
	4. MLS:	0.50	16.35	p<0.001	S
3) Khoja et al13	1. Upper lip to E-line	-0.62 ± 3.47	-0.81± 2.41	p=0.015	S
	2. Lower lip to E-line	-0.55 ± 4.24	0.37 ± 1.57	p=0.082	NS
	3. NLA:	-3.72± 14.17	3.64 ± 9.83	p=0.001	S
	4. MLS:	-	-	-	-
4) Baysal et al15	1. Upper lip to E line	0.22	− 2.72	p<0.001	S
	2. Lower lip to E line change	− 0.32	− 0.9	p<0.001	S
	3. NLA:	2.35	− 0.35	p>0.05	NS
	4. MLS:	− 10	22.6	p<0.001	S

S= significant, NS= not significant

DISCUSSION

According to the results, restrictive maxillary effects of Twin block were reported by a few studies,[7,12,15] whereas most studies reported no restrictive maxillary effect.[8,9,11,13,14,16] All the studies reported a significant increase in the mandibular jaw base.[7-16]

Out of the 10 studies, only 6 studies have registered vertical skeletal changes. All have found statistically significant increase in vertical dimensions[7,13-16] except for one study which gave insignificant results.[9]

Out of the studies that reported maxillary molar and mandibular molar changes only one study 14 reported insignificant changes while others showed a statistically significant maxillary molar restrictive effect and a mandibular molar advancement.[8,9,12,16]

Except for Two studies[14,15] all other studies reported a significant decrease in the inclination of the maxillary incisors.[7-9,11-13,16] Most of the studies reported a significant mesial mandibular incisor movement.[8,9,11-13,16] Some studies have reported insignificant mandibular incisor change.[7,14,15]

Except for the 3 studies that did not report changes in the overjet,[10,11,15] all have reported a significant decrease in the overjet. [7-9,12-14, 16]

Studies reporting soft tissue parameters were only four.[10,11,13,15] Equal number of studies found significant[11,13] and insignificant[10,15] changes in the Nasolabial angle. Two studies found significant[11,15] change in the Mentolabial sulcus whereas one study found an insignificant result.[10] All studies found a significant posterior positioning of the Upper lip,[10,11,13,15] and anterior positioning of the Lower lip position,[10,11,15] except for one.[13]

CONCLUSION

This systematic review has aimed to find out the dental, skeletal and soft tissue effects of the conventional Twin Block appliance as compared with the control. From this systematic review it can be safely concluded that the conventional Twin Block appliance is indicated for individuals diagnosed with a Class II malocclusion with a horizontal growth pattern and a frank mandibular retrognathism. The use of this appliance is contraindicated in the cases of maxillary prognathism. Effective and favourable soft tissue changes are seen. However, some inevitable dental changes mainly lower anterior proclination are strongly reported which need to be timely addressed.

OJN

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