

# Cephalometric evaluation of treatment effect of twin block appliance in class II div 1 malocclusion

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## Abstract

*Objective:* The aim of the study was to assess the effectiveness of modified twin block appliance with acrylic covering on the lower incisors, in treatment of class II div 1 malocclusion.

*Materials and Methods:* before and after treatment lateral cephalometric radiographs of 25 class II div 1 malocclusion patients were traced. Intra-examiner reliability test was performed by tracing the lateral cephalometric radiographs at two different time periods of 1 week apart and the Kappa statistic accounted to 0.80. Treatment effect was calculated by subtracting the post-treatment cephalometric readings (T2) with the pre-treatment readings (T1). Students "t" test was executed to check the significance.

*Results:* Mean mandibular base length increased by 6.24mm which was measured from Ar-pog, mean angle SNA decreased by 1°, whereas angle SNB increased by 2° with decrease in the angle ANB by 3°. There was significant decrease in the pre-treatment and post treatment over jet, overbite and incisor inclination. Anterior facial height and posterior facial height increased significantly. Mandibular molars moved mesially by 4.36mm whereas maxillary molar moved distally by 0.76mm. Twin block appliance produced significant skeletal changes with increase in mandibular length, which is prime requirement in class II div 1 patients with mandibular retrognathism. Lower incisors were maintained in same axial position, as they were covered with acrylic extension.

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**Conclusion:** twin block with acrylic extension on lower incisors helped in maintaining the lower incisor tipping and thus producing more pronounced skeletal changes.

**Key words:** Twin Block, Cephalometric, Class II Div 1, Malocclusion.

### Introduction:

Class II malocclusion due to mandibular retrognathism in growing individual is not an uncommon thing to be seen in our daily practice and it needs an urgent attention of the clinician as utilization of growth for skeletal correction is utmost important. Twin block remains the most popular functional appliances still date for correction of class II malocclusion.

Since from its introduction to orthodontic community in 1870 by W.J Clark,<sup>1</sup> there were many studies addressing the effectiveness of this appliance<sup>2-8</sup>. But none of the studies were in coordination with one another and didn't come with non-controversial results. Even the studies done to prove the effectiveness of functional appliances, didn't show unison results, some studies proved only skeletal changes, some of them reported only dentoalveolar changes and the others the combination of both skeletal and dentoalveolar changes<sup>9-14</sup>. Methods of assessing the changes in lateral cephalogram might be one of the factors in inaccuracy of the results obtained<sup>10</sup>.

India is not an exception in accepting the growing popularity of twin block. Limited research publication in spite of its popularity demands more orderly scientific studies to be done to test the hypothesis whether twin block appliance produces skeletal changes or treatment effects are purely dentoalveolar. This study was taken up with the main aim to evaluate the clinical effects of twin block cephalometrically.

### Materials and methods:

Study comprised of 25 children who visited the private clinic of the authors, out of which 15 were males (10 to 15 years) and 10 were

females (9 to 13 years). The mean age of the sample was 10 years and 4 months. All the subjects fulfilled the following criteria,

1. Class II skeletal malocclusion with orthognathic maxilla and retrognathic mandible
2. potential growth still left
3. full cusp class II molar relationship with division 1 pattern
4. positive VTO
5. ANB angle more than 3 degrees
6. Average to horizontal growth pattern
7. Over jet more than 7mm
8. Standard twin block with acrylic covering for the lower incisors was given for all the subjects (Fig. 1) this is in keeping with the recommendations of Clark<sup>1</sup> to minimize lingual movement of the upper incisors during treatment. Similar to the original design by Clark, the maxillary appliances in this study had a midline expansion screw that was used to correct the transverse relationships as the mandible came forward with growth.



Figure 1a.



Figure 1b

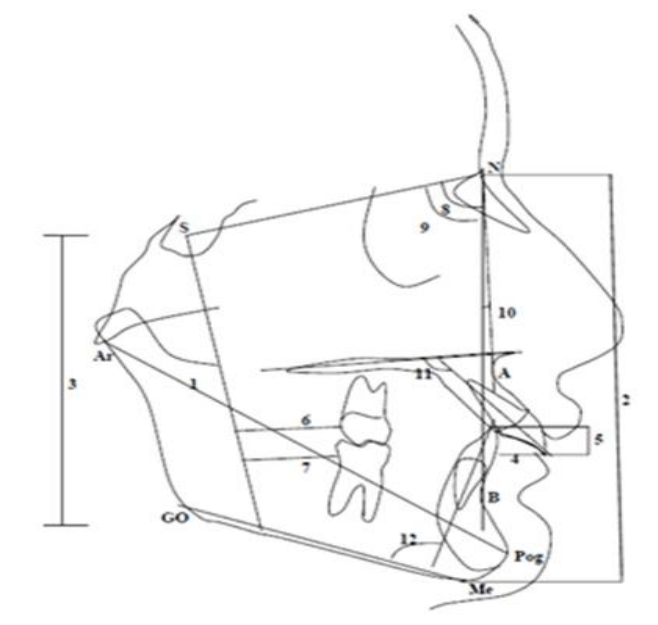
**Figure 1a & 1b.** Lateral view Twin block appliance with lower anterior capping.



Figure 1c.

**Figure 1c.** Frontal view of Twin block appliance with lower anterior capping

The patients were instructed to turn the maxillary expansion screw one turn per week to achieve coordination of the upper and lower arches in the transverse dimension. Upper bite blocks were trimmed to achieve the posterior occlusion. The treatment duration lasted for 6 to 12 months. The pre (T1) and post (T2) treatment lateral cephalometric radiograph were obtained in centric occlusion under standard conditions and traced manually on matte acetate paper using a 0.3mm pencil. The angular parameters measured were SNA, SNB, ANB, upper incisor to palatal plane and lower incisor to mandibular plane. The linear parameters included mandibular length (Ar-pog), anterior facial height (N-ME), posterior facial height (ptm-go), upper molar position, lower molar position, over jet and overbite (Fig.2).



**Figure 2.** Points, planes and angles used for cephalometric tracing.

**Points:**

- N Nasion
- S Sella
- Ar Articulare
- G Gonion

Me Menton

Pog Pogonion

A Point A

B Point B

**Planes and angles:**

- 1 Mandibular Base Length
- 2 Anterior Facial Height
- 3 Posterior Facial Height
- 4 Over Jet
- 5 Overbite
- 6 Maxillary Molar Position
- 7 Mandibular Molar Position
- 8 Angle SNA
- 9 Angle SNB
- 10 Angle ANB
- 11 Maxillary Incisor Angle
- 12 Mandibular Incisor Angle

Tracing was performed by single examiner to avoid the bias. The lateral Cephalogram were traced twice within a period of one week and checked for the intra examiner reliability and kappa statistics accounted for 0.80. Statistical analysis was performed utilizing the SPSS package for windows. All the angles and linear parameters of pre and post treatment lateral cephalometric radiographs were measured, the mean, standard deviation were calculated, The data was tabulated and comparison of T1 and T2 readings were made utilizing students t test for statistical significance. Pre and post mean values were subtracted to obtain the net change achieved.

## Results:

Cephalometric readings before and after twin block treatment, the net effect and the clinical significance are presented in table 1.

The mean Mandibular base length increased by 6.24mm, the mean anterior facial height and posterior facial height increased by 4.40 and 3.32mm respectively after the treatment and the increase was clinically highly significant. Over jet and overbite decreased significantly by 5.08 2.40mm respectively.

Lower molar moved mesially by 4.36mm and upper molar moved distally by 0.76mm adding to the correction of class II molar relationship. The positional change of molars was clinically significant. Mean angular change of SNA was 1degree and SNB was 2.12 degrees with ANB angle change of 3.12 degrees; all the changes were clinically significant.

Both Maxillary incisor inclination reduced by 4 degrees and the reduction was found to be clinically significant. Lower incisor after the treatment tipped forward and the angle between long axis of lower incisor and mandibular plane increased by 3 degree, which is minimal.

## Discussion:

The study aimed to compare and evaluate the treatment changes produced by twin block in class II division 1 malocclusion patient using lateral cephalometric radiographs. The primary objective of utilizing twin block therapy remains same as that of other functional appliance i.e inducing supplementary lengthening of the mandible by stimulating increased growth at the condylar cartilage and restriction of the maxillary growth<sup>15</sup>. The mandibular length (Ar-pog) increased significantly by 6.24mm which proved the above fact. Similar results have been reported by Antanas Šidlauskas<sup>8</sup>, who interprets that even though the outcome achieved is desirable, but whether it occurred due to growth or due to repositioning of the mandible, remained doubtful. This kind of favorable report have been reported by

Lund and Sandler<sup>4</sup>, Toth and McNamara<sup>3</sup>, Christine M. Mills,<sup>2</sup> Trenouth<sup>6</sup>, Illing et al.,<sup>7</sup> Ashok Jena et al<sup>16</sup>, who study the effects of twin block wear over an extended time interval and the later authors have compared the results with the controls also. Point Ar and condyion to pogonion are most commonly utilized for the judging the mandibular length, in this study we took Ar point as method of error for the condyion was more in comparison to articularae.<sup>17</sup>

Over jet decreased significantly after twin block therapy in this study; this effect was due to the forward growth of the mandible, decreased angulation of the upper incisors. Similar results have been reported by Antanas Šidlauskas<sup>8</sup>, Eden Y. Lau et al<sup>18</sup>, but they reported backward tipping of the upper incisors by 6.7<sup>0</sup> and 5.3<sup>0</sup>, whereas in our study only 4.72<sup>0</sup> of backward tipping was observed and they also reported forward tipping of the lower incisors, Similar protrusive effects have been reported in the previous literature also<sup>2,4</sup>, in contrast forward tipping of the lower anteriors was less in this study suggesting more of skeletal changes then the dentoalveolar changes. Trenouth<sup>6</sup> reported similar restrained lower anteriors and he had used acrylic labial bow on the lower anteriors. The cause for the significant decrease of upper incisor proclination was the placement of labial bow in the upper plate of the twin block, the use of labial bow is not recommended by the originator of the appliance, as it may retrocline the upper anteriors thus leading to decline in the maxillary base restraining effect.<sup>1</sup> Opposing this view O' Brien et al, provided data were the incisor angulation remained same in pre and post treatment lateral ceph<sup>2</sup>. Lower incisor tipping got reduced due to the modification of the lower plate by incorporating the incisal capping.

Even though studies have shown demineralization of the mandibular incisal edge<sup>20</sup>, which have been capped to reduce the lower incisor forward tipping, we didn't notice any such finding in our study.

**Table 1. Pretreatment and post treatment cephalometric readings.**

Variable	Pretreatment	Post treatment	Changes	Std Error Of Mean	P Value
Mandibular Base Length	98.60±6.76	104±7.38	6.24±3.46	0.53	0.000
Anterior Facial Height	112.40±5.12	116.80±5.12	4.40±1.26	0.25	0.000
Posterior Facial Height	75.92±6.12	79.24±5.92	3.32±1.07	0.21	0.000
Over Jet	9.80±1.91	4.72±1.40	5.08±1.38	0.28	0.000
Overbite	5.20±1.85	2.80±1.29	2.40±0.91	0.18	0.000
Maxillary Molar Position	24.48±5.41	23.72±5.22	0.76±0.60	0.12	0.000
Mandibular Molar Position	21.40±4.62	25.76±4.47	4.36±1.29	0.26	0.000
Angle SNA	81.80±2.53	80.80±2.42	1.00±0.71	0.14	0.000
Angle SNB	75.20±2.89	77.32±2.84	2.12±0.44	8.79	0.000
Angle ANB	6.60±1.55	3.48±1.61	3.12±0.73	0.15	0.000
Maxillary Incisor Angle	31.88±4.33	27.16±3.83	4.72±2.62	0.52	0.000
Mandibular Incisor Angle	20.36±3.80	23.06±5.60	3.30±2.2	0.21	0.000

Twin block is a versatile appliance which can be modified effectively in number of ways like incorporating torquing spurs for controlling upper incisor torque<sup>21</sup>, addition of expansion screws for crossbite corrections, combing it with head gears, Concorde face bows, upper incisor capping<sup>1</sup> etc. other appreciable thing about the twin block is, it is user friendly in comparison to the other removable functional appliances, as it's less bulky and has got both upper lower plate which are separated.

Over bite got decreased significantly, because of the selective eruption of the lower posteriors. Both anterior as well as the posterior

facial height increased significantly, but greater increase of anterior facial height was observed, which is a desirable outcome for the horizontal to average growing patients, but this can add negative effect on the profile of the vertical growing patient.

Class I molar relationship was achieved partly because of the mandibular growth and partly because of mesial movement of the mandibular first molar and slight distal movement of the maxillary molar. Anterio-posterior relationship of maxilla and mandible improved, as angle ANB decreased to 3.48±1.61 degrees from 6.60±1.55 degrees. Maxillary forward growth was restrained and the mandibular apical base moved forward in

relation to cranial base, which proved that twin block produced head gear effect, like all the other functional appliances, but the maxillary restraining effect was to the lesser extent. Similar less restraining effect on the maxillary apical base have been reported by Tulloch et al.,<sup>22</sup> Keeling et al.,<sup>23</sup> Trenouth<sup>6</sup>, O'Brien et al.,<sup>19</sup> the former two did the study on bionator and the later two studied the effects of twin block. Similar results in favor of twin block appliance were reported by the Lilling et al.<sup>7</sup>, who compared bass, bionator and twin block appliance with the control group. They concluded that the twin block and to lesser extent bionator produced most effective sagittal and vertical changes in the class II malocclusion in mandibular retrognathic faces.

### Conclusion:

The study focused on the effects twin block in the treatment of class II div 1 malocclusions and the results of the study can be summarized as;

1. Significant increase in mandibular length was achieved by twin block appliance.
2. Lower and upper incisors tipped backward significantly
3. Even though it was to a lesser extent but, significant maxillary restraining effect.
4. Significant decrease in over bite was achieved by selective eruption of the lower posterior teeth.
5. Significant decrease in over bite was achieved partly because of mandibular forward growth and partly due to backward tipping of the upper and lower anterior teeth
6. Class II molar relationship was corrected by mandibular forward growth and by distal movement of upper molar.
7. Both anterior and posterior facial height increased significantly.

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