*Section A-Research paper*

# Comparative Evaluation of Effects of Skeletal and Dental Parameters on Twin Block with Lip Bumper and Standard Twin Block: A Retrospective Cephalometric Study

**Dr. Santosh Kumar Goje[1], Dr. Niti Dharmendra Shah[2]**

[1]Professor and Head**,** Department of Orthodontics and Dentofacial Orthopaedics, K.M. Shah Dental College and Hospital, Piparia, Waghodia, Vadodara, Gujarat, India
[2]Third Year Post Graduate, Department of Orthodontics and Dentofacial Orthopaedics, K.M. Shah Dental College and Hospital, Piparia, Waghodia, Vadodara, Gujarat, India

**Corresponding Author:** Dr. Niti Dharmendra Shah
**Email:** Shahniti1396@gmail.com

## Abstract

**Introduction:** Deep curve of spee is associated with lower anterior crowding and deficient mandible and the treatment gets difficult when twin block is used alone as it does not increase arch length significantly and so lip bumper was added which helps in relieving lower anterior crowding by distalization and/or preventing mesial movement of molar.
**Aim:** To evaluate and compare the skeletal and dental effects of Twin Block with Lip Bumper and Twin Block.
**Study Design:** Retrospective study was carried out in 34 patients (20 females and 14 males). They were divided into two groups: group A (Twin Block) and group B (Twin Block with Lip Bumper) on the basis of functional appliance used.
**Results:** Comparison between the age of the patients among both the groups was done using unpaired t-test and between gender was done using chi square test. No significant difference was seen among the both groups in terms of age and gender (p-value is >o.o5). Significant difference is observed in skeletal and dental parameters before and after the treatment in group A and group B. On comparing between both groups, highly significant difference is seen wrt change in lower incisor position and SNB angle and significant difference was seen wrt FMIA and corpus length (Go-Pog). It was more evident in group B than in group A.
**Conclusion:** For group A, significant change is seen in position of mandible anteroposteriorly along with acceptable changes wrt anterior and posterior facial height. For group B, along with changes in mandible anteroposteriorly marked changes where seen wrt inclination of lower incisors, molar inclination and corpus length. On comparing between group A and B, highly significant difference was seen wrt to anteroposterior positioning of mandible, lower incisor inclination, molar inclination and corpus length and it was more evident in group B than in group A.
**Keywords:** Twin block, twin block with lip bumper.

## Introduction

Skeletal class II, with a 15% global prevalence rate.[1] which affects 37% of school children in Europe and 33% of all orthodontic patients in the USA, is thought to be the second most prevalent kind of malocclusion.[2] It represents between 1.9% and 15% of the population in different Indian states.[1] Class II div 1 malocclusion and crowding are frequently seen in school-aged youngsters requiring orthodontic treatment.[3] It mostly involves dental problems like class II molar relation, proclined maxillary anteriors, skeletal problems like convex profile and sometimes airway problems.

Extraoral headgears, functional appliances, and full fixed appliances with intermaxillary elastics and/or tooth extractions are the typical treatment options for growing patients. Severe Class II malocclusion can be treated with fixed appliances and orthognathic surgery in adults, whereas mild Class II malocclusion can be treated with fixed appliances combined with intermaxillary elastics and/or tooth extractions. While the effectiveness of these conventional therapy techniques has increased, particularly in growing patients, the majority of them still require patient compliance.[2]

Functional appliances have even been used for many years in the treatment of Class II Division 1 malocclusions.[2] They are indicated in the correction of mandibular deficiencies as they allow mandibular postural changes by holding the mandible forward and/or downward. The muscles and soft tissues are stretched with the generated pressure transmitted to the skeletal and dental structures potentially resulting in skeletal growth modification and tooth movement. Both fixed and removable Class II functional appliances are used to improve Class II malocclusions. Since the success with removable appliances largely depends on patient's compliance, using a more tolerable appliance can increase the chances of a favorable outcome.[3]Alteration of maxillary growth, possible improvement in mandibular growth and position, and change in dental and muscular relationships are the expected effects of these functional appliances. The effect of functional appliances on mandibular growth is controversial. Some authors suggested that mandibular growth can be increased with functional appliance treatment, but others believe the appliances have no real effect on mandibular length. Whenever the patient is in growing period, functional appliances like Activator, Bionator and Frankel.[1,2] are usually indicated for correction of Skeletal Class II malocclusion. A standardized technique for the functional appliance treatment of Class II division 1 malocclusion was described by Trenouth.[4] The technique consisted of three phases. First semi-rapid maxillary expansion and alignment of the upper arch. Second, correction of the Class II relationships using a modification of twin block functional appliance introduced by Clark and third, retention using an upper removable appliance with a very steep anterior acing bite plane.

Most commonly used functional appliance is Twin Block appliance which is given in 1987 by William J Clark. Twin block appliance is effective in correcting Skeletal Class II malocclusion and is better accepted by the patients when compared with other functional appliances. The twin block appliance enhances many changes in which dental changes including achievement of Class I from Class II, the skeletal changes showing reduction in ANB angle is seen. With passing time so many modifications has been done such as Sagittal Twin Block appliance, reverse Twin Block appliance and Magnetic Twin Block appliance. One of the modification in Twin block appliance is incorporating lip bumper in lower plate. This type of twin block appliance was used by William Clark in many of his class II cases for relieving moderate to severe crowding in lower anteriors by non-extraction method for well alignment of arch form[5]. Non-extraction approaches to treatment have help to the dental arch's create

additional space within the dental arch. For the treatment of crowding in the mandibular arch, the lip-activated lip bumper appliance has acquired popularity once again in recent years. Previous studies on the effects of lip bumper treatment have largely focused on the movement of molars posteriorly and incisors anteriorly.[6,7,8] Nevertheless, Cetlin and Ten Hoeve[9] and Ten Hoeve[10] claim that the main cause of the rise in arch circumference is an increase in arch width. Deep curve of spee is associated with lower anterior crowding and deficient mandible and the treatment gets difficult when twin block is used alone as it does not increase arch length significantly and so lip bumper was added which helps in relieving lower anterior crowding by distalization and/or preventing mesial movement of molar.[11,12] Therefore in order to evaluate and compare the skeletal and dental effects of Twin Block with Lip Bumper and Twin Block, present study was done.

## Materials and Methods

This retrospective study was started after obtaining ethical approval from the Sumandeep Vidyapeeth Institutional Ethics Committee (SVIEC/ON/Dent/RP/22014) to evaluate and compare the skeletal and dental effects of Twin Block with Lip Bumper and Twin Block. Sample size estimation was done using G Power Software and the estimated sample size was found to be 34. The effect size and power of the study were set at 0.80 with an alpha error of 0.05. The level of significance was also set at 5% and a p-value of ≤0.05 was considered to be significant. Patients between 10-16 years of age who have underwent functional appliance therapy with Twin block and Twin block with lip bumper and having pre and post-treatment cephalograms were included in this study. Syndromic patients, patients with faulty cephalograms and incomplete records were excluded from the study. A total of 34 patients who met the inclusion criteria were divided into two groups on the basis of the functional appliance used. Pre-treatment and post-treatment lateral Cephalograms for all the participants were obtained from the archives of the department. A detailed study of cephalogram was done using Dolphin Imaging Cephalometric software 11.5. Following cephalometric parameters were recorded (Table -1)

**Table 1:** Cephalometric parameters

| Sr. no. | Parameter | Unit | Description |
|---|---|---|---|
| 1. | SNA | ° | Angle formed by lines joining the points Sella, Nasion and,A-point |
| 2. | SNB | ° | Angle formed by lines joining the points Sella, Nasion and,B-point |
| 3. | ANB | ° | Angle formed by lines joining the points A-point, Nasion and B-point |
| 4. | SN-GoGn | ° | Mandibular place angle in relation to anterior cranial base |
| 5. | FMA | ° | Formed by the intersection of the Frankfort horizontal plane and the mandibular plane. |
| 6. | IMPA | ° | The inner angle formed between the long. Axis of mandibular central incisor and the mandibular. Plane. |
| 7. | FMIA | ° | Angle formed by the intersection of the Frankfort plane and the long axis of lower incisor |
| 8. | Saddle angle (N-S-Ar) | ° | Angle formed by lines joining the points Nasion, Sella and Articulare |

| | | | |
|---|---|---|---|
| 9. | Articular angle (S-Ar-Go) | ° | Angle formed by lines joining the points Sella, Articulare and Gonion |
| 10. | Effective gonial angle (Ar-Go-Me) | ° | Angle formed by lines joining the points Articulare, Gonion and Menton |
| 11. | Changes in molar inclination (Gn-Pg) perpendicular to occlusal plane | ° | Angular measurement of line intersecting mandibular plane (Gn-Pg) perpendicular to line tangent to cusp tips (functional occlusal plane), and bisecting furcation. |
| 12. | Maxillary length (Co-point A) | mm | Measures distance from condylion to point A |
| 13 | Mandibular effective length(Co-Pog) | mm | Measured from condylion to Pogonion |
| 14. | Ramal height(Go-Co) | mm | Measured from Gonion to Condylion |
| 15. | Anterior Facial Height(N-Me) | mm | Measured from Nasion to Menton |
| 16. | Posterior Facial Height(S-Go) | mm | Measured from Sella to Gonion |

**Statistical Analysis**

Descriptive and inferential statistical analysis were carried out in the present study. The Statistical software IBM SPSS statistics 20.0 (IBM Corporation, Armonk, NY, USA) was used for the analyses of the data, and Microsoft word and Excel were used to generate graphs, tables, etc.

Results on continuous measurements were presented on Mean ± SD and results on categorical measurement were presented in number (%). The level of significance was fixed at p=0.05 and any value less than or equal to 0.05 was considered to be statistically significant. Chi-square analysis was used to find the significance of study parameters on a categorical scale. Student t-tests (two-tailed, paired, and unpaired) were used to find the significance of study parameters on the continuous scale within and between two groups (Intra and Intergroup analysis).

**Observation and Results**

The present retrospective study was carried out to evaluate and compare the skeletal and dental effects of Twin Block with Lip Bumper and Twin Block. The results are based on an analysis of 34 patients who met the inclusion criteria. Figure 1 shows the demographic characteristics of the study participants. A major proportion of the study participants were females (58%). The mean age of the male and female participants was found to be 13.17 ± 1.87 and 13 ± 1.45 years, respectively. As shown in Table 2: Group I (Twin Block), the comparison between skeletal and dental pre and post-treatment parameters was done. Changes wrt SNB°, ANB° were highly significant. ($P$<0.001) while Changes wrt Co-Cd, N-Me, and S-Go were statistically significant between pre and post-treatment records. ($P$<0.05). As shown in Table 3: Group II (Twin Block with Lip Bumper), the comparison between skeletal and dental pre and post-treatment parameters was done. Changes wrt SNB°, ANB°, FMIA°, IMPA°, Go-Pog ° were highly significant ($P$<0.001) while Changes wrt molar inclination °, Co-Cd, N-Me, S-Go were statistically significant between pre and post-treatment records.

($P$<0.05). On comparison between pre-treatment records between group I (Twin Block) and group II (Twin Block with Lip Bumper), as shown in Table 4: highly significant ($P$<0.001) is seen in the Lower Gonial angle. While a statistically significant difference ($P$<0.05) is seen wrt ANB°, N-Me, and S-Go($P$<0.05). On comparison between post-treatment records between group I (Twin Block) and group II (Twin Block with Lip Bumper), as shown in Table 5: Statistically significant difference ($P$<0.05) is seen wrt SNB°, IMPA°, FMIA°, Go-Pog°, N-Me($P$<0.05).

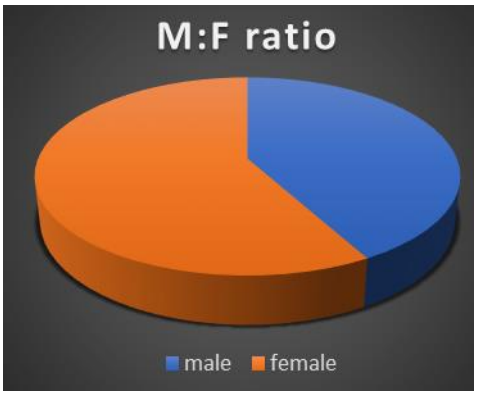


**Fig 1: Demographic data**

**Table 2:** Comparison Between Pre and Post Treatment Of Twin Block Using Paired T Test

| Parameters | Time interval | N | Mean | Std. Deviation | Mean difference | p value |
|---|---|---|---|---|---|---|
| SNA(°) | Pre | 17 | 81.764 | 1.75105 | -0.117 | 0.084 |
| | Post | 17 | 81.647 | 1.765686 | | |
| SNB(°) | Pre | 17 | 76.117 | 2.288077 | 2.824 | **<0.001** |
| | Post | 17 | 78.941 | 2.105665 | | |
| ANB(°) | Pre | 17 | 5.647 | 1.057188 | -2.942 | **<0.001** |
| | Post | 17 | 2.705 | 0.771744 | | |
| FMA(°) | Pre | 17 | 22.941 | 4.293463 | 0.529 | 0.087 |
| | Post | 17 | 23.470 | 4.109709 | | |
| SN-GoGn(°) | Pre | 17 | 30.058 | 4.436646 | 0.647 | 0.091 |
| | Post | 17 | 30.705 | 4.239173 | | |
| IMPA(°) | Pre | 17 | 102 | 5.488625 | 0.47 | 0.094 |
| | Post | 17 | 102.470 | 5.088193 | | |
| FMIA(°) | Pre | 17 | 52.176 | 7.755928 | 0.353 | 0.241 |
| | Post | 17 | 52.529 | 8.315029 | | |
| N-S-Ar(°) | Pre | 17 | 122.235 | 3.961209 | 0.294 | 0.061 |
| | Post | 17 | 122.529 | 3.642074 | | |
| S-Ar-Go(°) | Pre | 17 | 140.176 | 4.599393 | 0.235 | 0.084 |
| | Post | 17 | 140.411 | 4.583378 | | |
| Upper Gonial angle(°) | Pre | 17 | 56.470 | 3.466223577 | -1.294 | 0.063 |
| | Post | 17 | 55.176 | 4.220050181 | | |
| Lower Gonial angle (°) | Pre | 17 | 56.705 | 4.283175018 | 0.412 | 0.084 |
| | Post | 17 | 57.117 | 4.075572858 | | |
| Molar inclination(°) | Pre | 17 | 88.294 | 2.710274568 | 1.0 | 0.165 |
| | Post | 17 | 89.294 | 1.263165957 | | |
| ANS-PNS(°) | Pre | 17 | 48.411 | 3.001225 | -0.176 | 0.085 |
| | Post | 17 | 48.235 | 2.90537 | | |
| Go-Pog(°) | Pre | 17 | 66.411 | 5.136375 | 0.353 | 0.085 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Post | 17 | 66.764 | 4.64394 | | |
| Go-Cd (°) | Pre | 17 | 51.058 | 7.163018 | 1.53 | 0.011 |
| | Post | 17 | 52.588 | 7.168149 | | |
| N-Me(°) | Pre | 17 | 102.529 | 3.466224 | 4.823 | 0.032 |
| | Post | 17 | 107.352 | 3.58715 | | |
| S-Go(°) | Post | 17 | 70.470 | 7.220783 | 1.471 | 0.021 |
| | Pre | 17 | 71.941 | 7.301289 | | |

**Table 3:** Comparison Between Pre And Post Treatment Of Twin Block With Lip Bumper Using Paired T Test

| Parameters | Time interval | N | Mean | Std. Deviation | Mean difference | p value |
|---|---|---|---|---|---|---|
| SNA(°) | Pre | 17 | 81.882 | 3.238 | 0.118 | 0.081 |
| | Post | 17 | 81.764 | 3.211 | | |
| SNB(°) | Pre | 17 | 75.647 | 3.498 | 3.588 | <0.001 |
| | Post | 17 | 79.235 | -3.072 | | |
| ANB(°) | Pre | 17 | 6.235 | 1.032 | -3.588 | <0.001 |
| | Post | 17 | 2.647 | 0.606 | | |
| FMA(°) | Pre | 17 | 24.176 | 3.004 | 0.882 | 0.215 |
| | Post | 17 | 25.058 | 2.536 | | |
| SN-GoGn(°) | Pre | 17 | 30.705 | 4.194 | 0.824 | 0.067 |
| | Post | 17 | 31.529 | 4.048 | | |
| IMPA(°) | Pre | 17 | 102.176 | 3.678 | 4.588 | <0.001 |
| | Post | 17 | 106.764 | 3.800 | | |
| FMIA(°) | Pre | 17 | 53.647 | 4.300 | -5.353 | <0.001 |
| | Post | 17 | 48.294 | 3.653 | | |
| N-S-Ar(°) | Pre | 17 | 123.705 | 2.543 | 0.883 | 0.086 |
| | Post | 17 | 124.588 | 2.0328 | | |
| S-Ar-Go(°) | Pre | 17 | 139.647 | 3.390 | 0.764 | 0.093 |
| | Post | 17 | 140.411 | 3.483 | | |
| Upper Gonial angle (°) | Pre | 17 | 55.764 | 3.052 | 0.765 | 0.081 |
| | Post | 17 | 56.529 | 2.600 | | |
| Lower Gonial angle(°) | Pre | 17 | 64.058 | 3.071 | 0.883 | 0.093 |
| | Post | 17 | 64.941 | 2.536 | | |
| Molar inclination (°) | Pre | 17 | 88.294 | 2.910 | 0.706 | 0.011 |
| | Post | 17 | 89 | 2.622 | | |
| ANS-PNS (°) | Pre | 17 | 47.764 | 2.658 | -.0.294 | 0.09 |
| | Post | 17 | 47.470 | 2.648 | | |
| Go-Pog (°) | Pre | 17 | 63.647 | 4.045 | 1.882 | <0.001 |
| | Post | 17 | 65.529 | 3.448 | | |
| Go-Cd (°) | Pre | 17 | 47.941 | 5.249 | 0.588 | 0.023 |
| | Post | 17 | 48.529 | 4.624 | | |
| N-Me(°) | Pre | 17 | 99.941 | -4.308 | 4.117 | 0.02 |
| | Post | 17 | 104.058 | 5.355 | | |
| S-Go(°) | Pre | 17 | 69.705 | 10.849 | 1 | 0.041 |
| | Post | 17 | 70.705 | 10.646 | | |

**Table 4:** Comparison Between Pre Treatment Of Twin Block And Twin Block With Lip Bumper Using Unpaired T Test

| Parameters | Time interval | N | Mean | Std. Deviation | Mean difference | p value |
|---|---|---|---|---|---|---|
| Pre - SNA(°) | Group I | 17 | 81.764 | 1.751 | 0.118 | 0.448 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Group II | 17 | 81.882 | 3.238 | | |
| Pre - SNB(°) | Group I | 17 | 76.117 | 2.288 | -0.47 | 0.323 |
| | Group II | 17 | 75.647 | 3.498 | | |
| Pre -ANB(°) | Group I | 17 | 5.647 | 1.0571 | 0.588 | **0.05** |
| | Group II | 17 | 6.235 | 1.032 | | |
| Pre -FMA(°) | Group I | 17 | 22.941 | 4.293 | 1.235 | 0.169 |
| | Group II | 17 | 24.176 | 3.004 | | |
| Pre – Sn-gogn(°) | Group I | 17 | 30.058 | 4.436 | 0.647 | 0.332 |
| | Group II | 17 | 30.705 | 4.194 | | |
| Pre -IMPA(°) | Group I | 17 | 102 | 5.488 | 0.176 | 0.456 |
| | Group II | 17 | 102.176 | 3.678 | | |
| Pre -FMIA(°) | Group I | 17 | 52.176 | 7.755 | 1.471 | 0.250 |
| | Group II | 17 | 53.647 | 4.300 | | |
| Pre – N-s-ar(°) | Group I | 17 | 122.235 | 3.961 | 1.47 | 0.104 |
| | Group II | 17 | 123.705 | 2.543 | | |
| Pre – S-ar-go(°) | Group I | 17 | 140.176 | 4.599 | 0.529 | 0.352 |
| | Group II | 17 | 139.647 | 3.390 | | |
| Pre – Upper Gonial Angle (°) | Group I | 17 | 56.470 | 3.466 | -0.706 | 0.266 |
| | Group II | 17 | 55.764 | 3.052 | | |
| Pre – Lower Gonial angle (°) | Group I | 17 | 56.705 | 4.283 | 7.983 | <0.001 |
| | Group II | 17 | 64.058 | 3.071 | | |
| Pre – Molar inclination (°) | Group I | 17 | 87.942 | 2.710 | 0.352 | 0.451 |
| | Group II | 17 | 88.294 | 2.910 | | |
| Pre – Ans-pns(°) | Group I | 17 | 48.411 | 3.001 | -0.647 | 0.255 |
| | Group II | 17 | 47.764 | 2.658 | | |
| Pre – Go-pog (°) | Group I | 17 | 66.411 | 5.136 | -2.764 | 0.04 |
| | Group II | 17 | 63.647 | 4.045 | | |
| Pre – Go-cd(°) | Group I | 17 | 51.058 | 7.163 | -3.117 | 0.079 |
| | Group II | 17 | 47.941 | 5.249 | | |
| Pre – N-me(°) | Group I | 17 | 102.529 | 3.466 | -2.588 | 0.031 |
| | Group II | 17 | 99.941 | -4.308 | | |
| Pre – S-go(°) | Group I | 17 | 70.470 | 7.220 | -0.705 | 0.405 |
| | Group II | 17 | 69.705 | 10.849 | | |

**Table 5:** Comparison Between Post Treatment Of Twin Block And Twin Block With Lip Bumper Using Unpaired T Test

| Parameters | Time interval | N | Mean | Std. Deviation | Mean difference | p value |
|---|---|---|---|---|---|---|
| POST-SNA(°) | Group I | 17 | 81.647 | 1.765 | 0.117 | 0.44 |
| | Group II | 17 | 81.764 | 3.211 | | |
| POST-SNB(°) | Group I | 17 | 78.941 | 2.105 | 0.289 | <0.001 |
| | Group II | 17 | 79.23 | -3.072 | | |
| POST-ANB(°) | Group I | 17 | 2.705 | 0.771 | -0.058 | 0.40 |
| | Group II | 17 | 2.647 | 0.606 | | |
| POST-FMA(°) | Group I | 17 | 23.4 | 4.109 | 1.658 | 0.186 |
| | Group II | 17 | 25.058 | 2.536 | | |
| POST-SN-GoGn(°) | Group I | 17 | 30.705 | 4.239 | 0.824 | 0.328 |
| | Group II | 17 | 31.529 | 4.048 | | |
| POST-IMPA(°) | Group I | 17 | 102.47 | 5.088 | 4.29 | <0.001 |
| | Group II | 17 | 106.76 | 3.800 | | |
| POST-FMIA(°) | Group I | 17 | 52.529 | 8.315 | -4.235 | 0.04 |
| | Group II | 17 | 48.294 | 3.653 | | |
| POST-N-S-Ar(°) | Group I | 17 | 122.529 | 3.642 | 2.051 | 0.089 |
| | Group II | 17 | 124.588 | 2.032 | | |
| POST-S-Ar-Go(°) | Group I | 17 | 140.42 | 4.583 | -1.009 | 0.370 |
| | Group II | 17 | 139.411 | 3.483 | | |
| POST-Upper Gonial angle (°) | Group I | 17 | 54.941 | 4.220 | 1.588 | 0.248 |
| | Group II | 17 | 56.529 | 2.600 | | |
| POST-Lower Gonial angle (°) | Group I | 17 | 57.117 | 4.07 | 7.824 | 0.09 |
| | Group II | 17 | 64.941 | 2.53 | | |
| POST-Molar inclination (°) | Group I | 17 | 89.294 | 1.263 | -0.294 | 0.222 |
| | Group II | 17 | 89 | 2.62 | | |
| POST-ANS-PNS(°) | Group I | 17 | 48.235 | 2.905 | -0.765 | 0.228 |
| | Group II | 17 | 47.470 | 2.648 | | |
| POST-Go-Pog (°) | Group I | 17 | 66.764 | 4.643 | -1.244 | 0.048 |
| | Group II | 17 | 65.52 | 3.448 | | |
| POST-Go-Cd (°) | Group I | 17 | 52.588 | 7.16 | -4.059 | 0.07 |
| | Group II | 17 | 48.529 | 4.624 | | |
| POST-N-Me(°) | Group I | 17 | 107.352 | 3.58 | -3.302 | 0.05 |
| | Group II | 17 | 104.05 | 5.355 | | |
| POST-S-Go(°) | Group I | 17 | 71.941 | 7.30 | -1.236 | 0.391 |
| | Group II | 17 | 70.705 | 10.646 | | |

## Discussion

According to animal research, protracting the jaw in young animals can encourage the formation of the mandibular condylar cartilage, leading to noticeable alterations in the mandibular morphology as well as significant occlusal modifications. Thankfully, the animal researcher is able to take patient cooperation out of the equation and therefore has improved outcomes in comparison to those that might be achieved in a clinical setting. Furthermore, the growth rates of experimental animals like rats and monkeys are substantially faster than those of humans. So, in a few short weeks, animals wearing mandibular protraction devices can have their growth altered. Similar development changes in humans, however, take months or even years.[13-14] Recognizing these restrictions, many orthodontists use functional appliances with the aim of treating Class II skeletal malocclusions by promoting mandibular growth.[5] The fallacy of greater mandibular growth when the growth increments are exhibited in a vertical rather than a horizontal manner has been highlighted by ACreekmore and Rodney[15], DeVincenzo[16], and Mills.[5] If a functional appliance lengthens the mandible in a vertical direction, the patient may not benefit from the longer jaw. In actuality, the rise can be bad for the soft tissue profile. The Frankel appliance has been criticized for this.[15]

In comparison to other removable functional appliances, the Twin Block appliance, as utilized in this study, produced mandibular growth increments of a larger magnitude. Also, the mandibular growth pattern was advantageous, which greatly aided in the anteroposterior skeletal correction.

While treating patients with functional appliances, patient compliance is always an issue. Due to its versatility and ability to be utilized as a fixed functioning appliance, the Herbst appliance has acquired great recognition.[17] The removable functional appliance has the benefit of being more tissue-born and less prone to cause dental adaptation alterations, whereas the fixed functional appliance has the advantage of minimising patient cooperation as a factor in treatment success.[5] The good success rate with the Twin Block appliance may be ascribed to the wide acceptance of this kind of equipment by patients. Patients can get used to it more quickly and speech disturbance is reduced because it is smaller than other functional appliances. When vertical elastics are worn at night, the patient may be more likely to remain immersed in the appliance while sleeping, extending the appliance's useful wearing time across a 24-hour period. The Twin Block appliance is an attractive appliance that lacks a maxillary labial bow and bulky acrylic in the front region. This aesthetic benefit could contribute to greater patient acceptability. Similarly, many studies have been carried out to ascertain the effects of Lip Bumper on dental arch dimensions due to the rising interest in Lip Bumper as an alternate strategy to reduce the risk of tooth extraction in cases of mild mandibular crowding in children and adolescents. The only therapy used in the included studies that directly affected the mandibular arch was Lip Bumper, in order to reduce the impact of other concurrent therapies on the results of Lip Bumper therapy.[18] By keeping the cheeks away from the buccal surfaces of the teeth, Lip Bumper allows the pressure from the tongue to work in the opposite direction to widen the transverse arch. Due to lip bumper's recurring expansion, It has been suggested that the posterior or canine region would experience the largest lateral gain following M1 derotation.[19-21]

According to earlier studies, the decrease in the ANB angle is caused by a combination of a decrease in the SNA angle and an increase in the SNB angle. The SN/GoGn and FMA angles were used to assess the rotational alterations of the mandible in relation to the cranial base. The SN/GoGn and FMA angles were not

increased statistically significantly in either group. And similar results were seen in many previous studies.[22-24] And this change can be seen in both Groups in our study. We can even see significant change in length of mandible i.e from Go-pog along with change in position of molar i.e movement of molar is more distally in patients with Twin Block with Lip bumper. This result was similar to study done by Scott.P Werner *et al*, [25] and joseph Ghafari[26] where they have concluded that lower anterior crowding reduces along with increase in arch circumference and they move the molars distally.[6,10,27,28] There is a decrease in need of extraction since tooth size/ arch size discrepancy gets reduced. Increase in Go-Pog length is because of the Lip Bumper applying force on the buccal musculature which gradually leads to shifting of pogonion point in forward direction.[29]

Lower incisor proclination is seen with gradual decrease in FMIA angle, which eventually leads to decrease in crowding in patients with Twin Block and Lip Bumper and similar results were observed in many previous studies.[6,27,28] While it has not significantly changed in Group I than in Group II as incisal capping was done for to prevent it group I (Twin Block). Significant changes wrt to anterior facial height and SNB angle i.e forward placement of mandible can be observed in both the groups with major change in group II (Twin Block with Lip Bumper).[27]

## Conclusion

This study evaluated and compared skeletal and dental effects between Twin Block with Lip Bumper and Twin Block. The following conclusions can be drawn: Significant change in the mandibular length i.e Go-Pog can be seen in Group II (Twin Block with Lip Bumper) than in Group I, Lower incisor proclination (IMPA) have significantly increased and FMIA angle have significantly decreased in Group II than Group I and change in the ANB angle can be highly significantly seen in Group II than in Group I.

## References

1. Andhare P, Datana S, Agarwal SS, Bhandari SK. An overview of management of skeletal class II Malocclusion: A Case Series; c2020 Jan-Apr, 16(1)
2. Papadopoulos MA. Non-compliance approaches for management of Class II malocclusion. Skeletal anchorage in orthodontic treatment of class II malocclusion. 2014 Sep 29:6-21.
3. Jena AK, Duggal R, Parkash H. Skeletal and dentoalveolar effects of Twin-block and bionator appliances in the treatment of Class II malocclusion: a comparative study. American journal of orthodontics and dentofacial orthopedics. 2006 Nov 1;130(5):594-602.
4. Trenouth MJ, Desmond S. A randomized clinical trial of two alternative designs of Twin-block appliance. Journal of Orthodontics. 2012 Mar;39(1):17-24.
5. Mills CM, McCulloch KJ. Treatment effects of the twin block appliance: a cephalometric study. American Journal of Orthodontics and Dentofacial Orthopedics. 1998 Jul 1;114(1):15-24.
6. Bergersen EO. A cephalometric study of the clinical use of the mandibular labial bumper. American Journal of Orthodontics. 1972 Jun 1;61(6):578-602.
7. Subtelny JD, Sakuda M. Muscle function, oral malformation, and growth changes. American journal of orthodontics. 1966 Jul 1;52(7):495-517.
8. Lusterman EA. Cephalometric evaluation of orthodontic therapy involving the use of tissue-and tooth-borne anchorage. American Journal of Orthodontics. 1957 Jun 1;43(6):429-53.

9. Cetlin NM, Ten Hoeve A. Nonextraction treatment. J Clin Orthod 1983;17:396-413.
10. Ten Hoeve A. Palatal bar and lip bumper in nonextraction treatment. J Clin Orthod. 1985;19:272-91.
11. Subtelny JD, Sakuda M. Muscle function, oral malformation, and growth changes. American journal of orthodontics. 1966 Jul 1;52(7):495-517.
12. Lusterman EA. Cephalometric evaluation of orthodontic therapy involving the use of tissue-and tooth-borne anchorage. American Journal of Orthodontics. 1957 Jun 1;43(6):429-53.
13. McNamara Jr JA. Neuromuscular and skeletal adaptations to altered function in the orofacial region. American Journal of Orthodontics. 1973 Dec 1;64(6):578-606.
14. Mills JR. The effect of functional appliances on the skeletal pattern. British Journal of Orthodontics. 1991 Nov;18(4):267-75.
15. Creekmore TD, Radney LJ. Fra¨ nkel appliance therapy: Orthopedic or orthodontic?. American Journal of Orthodontics. 1983 Feb 1;83(2):89-108.
16. DeVincenzo JP, Huffer RA, Winn MW. A study in human subjects using a new device designed to mimic the protrusive functional appliances used previously in monkeys. American Journal of Orthodontics and Dentofacial Orthopedics. 1987 Mar 1;91(3):213-24.
17. Pancherz H. The mechanism of Class II correction in Herbst appliance treatment: a cephalometric investigation. American journal of orthodontics. 1982 Aug 1;82(2):104-13.
18. Santana LG, de Campos França E, Flores-Mir C, Abreu LG, Marques LS, Martins-Junior PA. Effects of lip bumper therapy on the mandibular arch dimensions of children and adolescents: A systematic review. American Journal of Orthodontics and Dentofacial Orthopedics. 2020 Apr 1;157(4):454-65.
19. Werner SP, Shivapuja PK, Harris EF. Skeletodental changes in the adolescent accruing from use of the lip bumper. The Angle Orthodontist. 1994 Feb;64(1):13-22.
20. Ferris T, Alexander RG, Boley J, Buschang PH. Long-term stability of combined rapid palatal expansion–lip bumper therapy followed by full fixed appliances. American journal of orthodontics and dentofacial orthopedics. 2005 Sep 1;128(3):310-25.
21. Vargo J, Buschang PH, Boley JC, English JD, Behrents RG, Owen III AH. Treatment effects and short-term relapse of maxillomandibular expansion during the early to mid mixed dentition. American Journal of Orthodontics and Dentofacial Orthopedics. 2007 Apr 1;131(4):456-63.
22. Buyukcavus MH, Kale B. Skeletal and dental effects of twin-block appliances in patients treated with or without expansion. Turkish Journal of Orthodontics. 2021 Sep;34(3):155.
23. Tümer N, Gültan AS. Comparison of the effects of monoblock and twin-block appliances on the skeletal and dentoalveolar structures. American journal of orthodontics and dentofacial orthopedics. 1999 Oct 1;116(4):460-8.
24. Türkkahraman H, Sayın MÖ. Effects of activator and activator headgear treatment: comparison with untreated Class II subjects. The European Journal of Orthodontics. 2006 Feb 1;28(1):27-34.
25. Al-Anezi SA. Class II malocclusion treatment using combined Twin Block and fixed orthodontic appliances–A case report. The Saudi Dental Journal. 2011 Jan 1;23(1):43-51.

26. Ghafari J. A lip-activated appliance in early orthodontic treatment. Journal of the American Dental Association (1939). 1985 Nov 1;111(5):771-4.
27. Singla M, HOD PK, Dungarwal N, Bolya P. Management of Severe Class II Division 1 Malocclusion with Hybrid Functional Appliance by Double Advancement.
28. Clark W, Clark WJ. Twin block functional therapy. JP Medical Ltd; c2014 Sep 30.
29. Fouda M, Hafez A, Al-Awdi M. Soft tissue profile changes in growing patients having class II division 1 malocclusion treated by modified activator with lip bumper. Indian Journal of Orthodontics and Dentofacial Research. 2017 Apr;3(2):103-6.