*Original Article*

# Dentoskeletal Effects and "Effective" Temporomandibular Joint, Maxilla and Chin Changes in Good and Bad Responders to van Beek Activator Treatment

**Sabine Ruf[a]; Margareta Bendeus[b]; Hans Pancherz[c]; Urban Hägg[d]**

**ABSTRACT**

**Objective:** To assess possible differences in dentoskeletal effects and ''effective'' temporomandibular joint, maxilla, and chin changes between good and bad responders to van Beek activator treatment.

**Materials and Methods:** The subject material consisted of 20 consecutive normodivergent male Class II division 1 patients treated with a van Beek activator. Because of insufficient cooperation, four patients were excluded. Lateral head films were taken 6 months before treatment, at start of treatment, and after 12 months of treatment. The patients were placed into a good responder group (successful, n = 8) and a bad responder group (unsuccessful, n = 8). An overjet reduction ≥4 mm was considered successful.

**Results:** During the van Beek treatment period, the good responders showed a significantly larger improvement in overjet and molar relationship than did the bad responders. The good responders exhibited a significant posterior development of condylion, less anterior mandibular autorotation, retrusion of upper incisors, protrusion of lower incisors, distalization of maxillary molars, and a mesial movement of mandibular molars. No significant dental movements were seen in the bad responders.

**Conclusions:** Although van Beek activator treatment affected the direction of condylar growth, as well as the direction of maxilla and chin changes, it can be concluded that skeletal changes did not contribute to the Class II correction. Instead, overjet reduction during van Beek activator treatment was found to be due to a favorable dental reaction.

**KEY WORDS:** Class II treatment; van Beek activator; Headgear activator; Dentofacial orthopedics; Treatment success

## INTRODUCTION

Functional appliance treatment is frequently undertaken with the objective of correcting a Class II malocclusion. Although most studies concentrate on the mode of action of the appliances, whether growth is modified or not, or how many dental and skeletal effects have been achieved, there are only a few studies dealing with the success rate of functional appliance therapy and possible reasons for treatment failure.[1–6]

The reasons for unsuccessful treatment are said to be poor cooperation, oropharyngeal irritation, mouth breathing, unfavorable sleeping position with increased free-way space, unfavorable growth pattern, and insufficient growth.[1,2,7]

For unknown reasons, despite the clinical impression of a good cooperation, the presence of nasal breathing, a normal growth pattern, and enough residual growth, there are patients who do not react favorably to removable functional appliances. It was the aim of this pilot study to analyze and compare the dentoskeletal changes and ''effective'' temporomandibular joint (TMJ) changes in good and bad responders to van Beek activator treatment.

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## MATERIALS AND METHODS

The original subject material consisted of 20 consecutive boys with a Class II division 1 malocclusion treated with a headgear activator according to van Beek.[8,9] The patient selection criteria included mixed dentition, fair shape of both dental arches, mild to moderate skeletal Class II (ANB = 4.5°–8°), a mandibular plane angle <39°, and no previous orthodontic treatment. The van Beek activator was constructed with the mandible advanced to an incisal edge-to-edge relationship and a vertical bite opening of 5 mm. All patients were instructed to wear the appliance 10–12 hours a day and to write a report. The cooperation of the patients was assessed after 2 months. Four patients who wore the appliance for less than the instructed time period were excluded from the study.

### Method

Lateral head films in habitual occlusion were analyzed at the following occasions:

- T0: 6 months before treatment (6.4 ± 1.1 months)
- T1: start of treatment
- T2: after 1 year treatment (13.1 ± 2.4 months)

The lateral head films taken after 1 year of van Beek activator treatment were used to place the 16 patients into a good responder group (successful, n = 8) and a bad responder group (unsuccessful, n = 8). An overjet reduction of ≥4 mm was classified as a good treatment response. The average overjet reduction was 5.5 mm for the good responder group and 1.1 mm for the bad responder group. The average age 6 months before treatment was 10.8 ± 1.3 years for the good responder group and 11.6 ± 1.4 years for the bad responder group.

Tracings of the radiographs were made, and linear and angular measurements were performed to the nearest 0.5 mm and 0.5°, respectively. No correction was made for linear enlargement (approximately 8% in the median plane).

The following observation periods were considered:

- T1 − T0: natural growth (no treatment performed)
- T2 − T1: van Beek activator treatment period (13 months)

The lateral head films were evaluated by the SO-analysis[10] (Figure 1) and a modified form of the Creekmore analysis[12] (Figures 2 and 3). For the analysis of mandibular autorotation, the inclinational change of the original occlusal line (RL) was assessed (Figure 4).

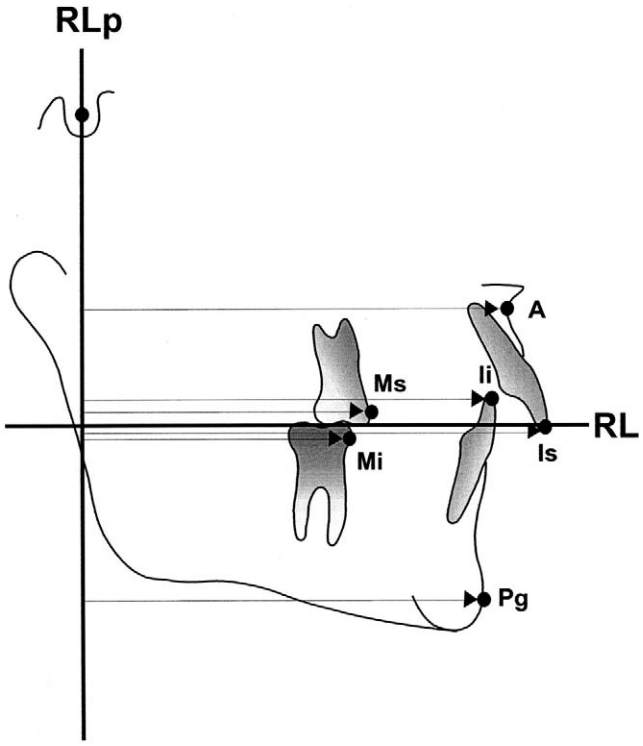


**Figure 1.** SO-analysis. For all recordings, the occlusal line (RL) and the occlusal line perpendicular (RLp) through sella from the first head film were used as a reference grid. The RL/RLp reference grid was transferred to the other films of a series after superimposition of the radiographs on the stable bone structures of the anterior cranial base.[11]

### Statistical Methods

The arithmetic mean and the standard deviation were calculated for the different variables. Student's *t*-tests for paired and unpaired samples were used to assess the significance of treatment changes and group differences, respectively. The statistical significance was determined at the probability levels of .001, .01, and .05. A probability level >.05 was considered not significant (ns).

### Method Error

The combined method error (ME) in locating the reference points, superimposing the roentgenograms and measuring the position of the variables in relation to the grid of the RL and occlusal line perpendicular (RLp), was assessed upon double registrations of the lateral head films of 10 patients with an interval of at least 2 weeks between the registrations. The formula of Dahlberg[13] was used in the calculations:

$$ME = \sqrt{\frac{\sum d^2}{2n}},$$

where $d$ is the difference between two registrations of

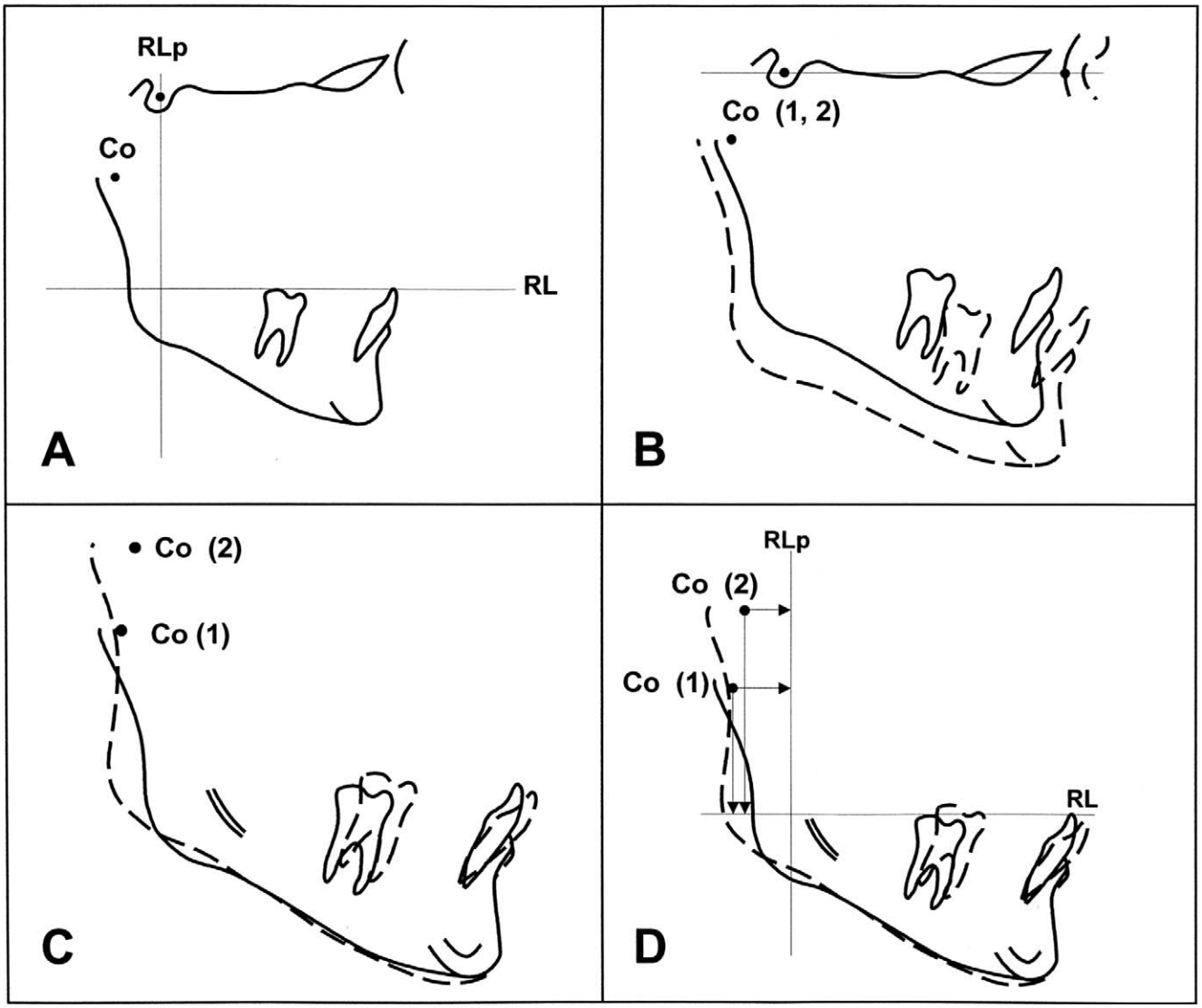


**Figure 2.** Measurement of the effective temporomandibular joint changes (summation of condylar modeling, glenoid fossa modeling, and condylar position changes in the fossa). (A) Definition of the Co-point: an arbitrary point in the area of the condylar head is marked on the first head film.[12] (B) The Co-point from the first head film (1) is transferred to the second head film (2) after superimposition of the films on the stable anterior cranial base bone structures.[11] The second head film (2) refers to the film from either T1 or T2. (C) For the assessment of the position changes of Co-point, the second head film (2) is superimposed on the first head film (1) with the stable mandibular bone structures.[11] The second head film (2) refers to the film from either T1 or T2. (D) Measurement of effective condylar growth (Co-point changes) in relation to the reference grid of the occlusal line (RL) and occlusal line perpendicular (RLp) (as defined on the first head film). The before-treatment values represented the 0-point in the grid.

a pair and *n* is the number of double registrations. The method error did not exceed 0.7 mm for any of the variables analyzed.

## RESULTS

### SO-Analysis

At 6 months before treatment (T0) and at start of treatment (T1) the two examination groups exhibited comparable cephalometric characteristics except for a significantly more retrognathic position of the mandible (Pg/RLp mean: T0 = 4.98 mm, $P < .05$; and T1 = 5.56 mm, $P < .01$) and of the maxilla (A/RLp mean: T1 = 2.73 mm, $P < .05$) in the bad responder group (Table 1). Furthermore, the bad responders showed a more distal position of the maxillary molars (Ms/RLp mean: T0 = 3.55 mm, $P < .05$; and T1 = 3.80 mm, $P < .05$).

After van Beek activator treatment (T2) the good responders presented a significantly smaller overjet

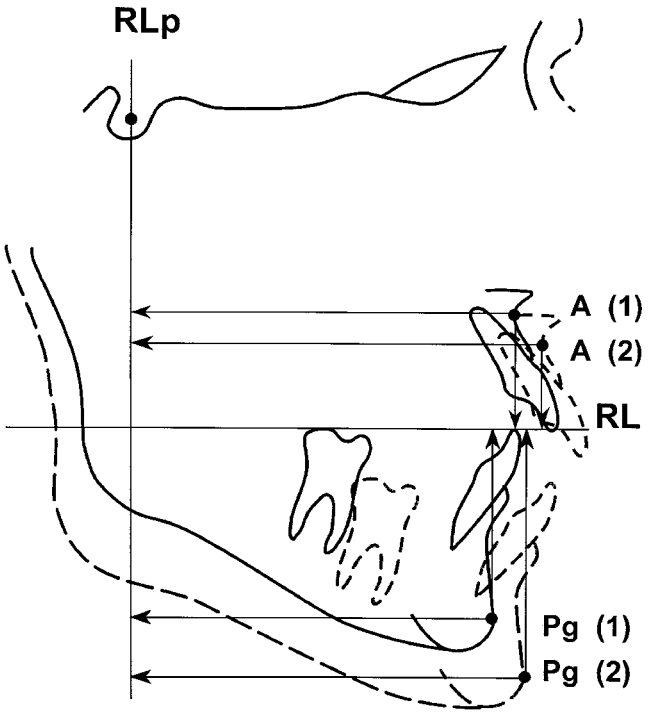


**Figure 3.** Measurement of maxilla changes (result of maxillary growth/growth restriction, maxillary rotation, and upper incisor inclination/position changes) and chin changes (result of effective condylar growth and autorotation of the mandible). The A-point (position of the maxillary jaw base) was defined as the deepest point of upper alveolar process (inferior to the anterior nasal spine). The A-point was located on each lateral head film. The Pg (pogonion = chin position) was defined as the most anterior point of the bony chin. The point was defined on the pretreatment head film (T0) and transferred to the following head films (T1, T2) after superimposition of the radiographs on the stable bone structures of the lower part of the chin.[11] For the assessment of the position changes, the head films were superimposed on the stable bone structures of the anterior cranial base.[11]

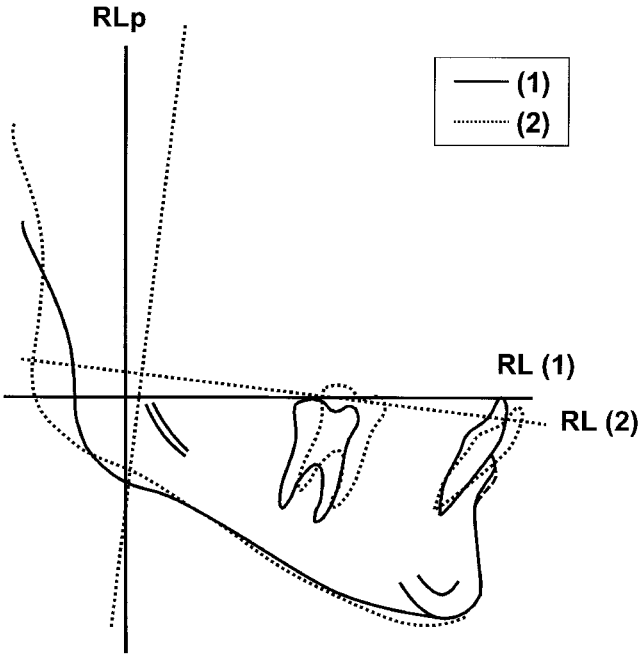


**Figure 4.** Measurement of mandibular rotation (result of effective temporomandibular joint changes, maxillary growth, dentoalveolar changes of the upper and lower teeth, and the amount of overbite correction and the steepness of incisal guidance). Assessment of the inclination change of the occlusal line (RL) relative to the original (T0) occlusal line perpendicular (RLp) was assessed after superimposition of the head films on the stable bone structures of the mandible.[11]

(mean = 3.13 mm, $P < .001$) and a better molar relationship (mean = 2.50 mm, $P < .05$) than did the bad responders.

### SO-Analysis Treatment Changes

During the pretreatment period (T1–T0) none of the variables exhibited any significant changes. No group differences existed (Tables 2 and 3).

During the van Beek treatment period (T2–T1) there was a significantly larger ($P < .001$) improvement in overjet (mean = 4.45 mm) and molar relationship (mean = 3.31 mm) in the good responders compared with the bad responders. In the good responders the upper incisors were retruded (mean = 2.57 mm, $P < .001$), the lower incisors were protruded (mean = 0.79 mm, $P < .05$), the maxillary molars were distalized (mean = 1.71 mm, $P < .05$), and the mandibular molars moved to the mesial (mean = 1.14 mm, $P < .05$). No significant dental changes were seen in the bad responders. In the good responders all dental and skeletal parameters in both jaws contributed to overjet and molar correction (Figures 5 and 6), whereas in the bad responders this was the case for mandibular forward development only. Although of different nature, the overall amount of skeletal changes was similar in both groups. Thus, the different amounts of overjet and molar correction in the two groups were the result of differences in dental changes.

### Effective TMJ Changes, Maxilla Position Changes, and Chin Position Changes

During all observation periods the Co-point changed its position significantly vertically upward in both groups. A significant ($P < .05$) horizontally backward movement (mean = 1.21 mm) was seen during the treatment period (T2–T1) in the good responders only. Overall, in both groups, the effective TMJ changes were quite comparable in terms of amount and direction (Tables 4 and 5; Figure 7).

The direction of chin changes during the pretreatment period (T1–T0) was opposite in the two groups (Figure 7). Although the Pg-point developed almost exclusively forward in the good responders (mean = 1.33 mm), it developed more vertically downward

**Table 1.** SO-Analysis—Cephalometric Parameters in 16 van Beek Activator Patients[a]

| | 6 mo before T0 | | | | | | | Start T1 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Good (n = 7) | | Bad (n = 8) | | Good-Bad | | | Good (n = 7) | | Bad (n = 8) | | Good-Bad | | |
| Variables (mm) | Mean | SD | Mean | SD | Mean | *t* | *P* | Mean | SD | Mean | SD | Mean | *t* | *P* |
| 1. Overjet Is/RLp–Ii/RLp | 9.64 | 2.48 | 8.75 | 1.67 | 0.89 | 0.82 | ns | 9.07 | 2.78 | 7.69 | 2.00 | 1.38 | 1.11 | ns |
| 2. Molar relation Ms/RLp–Mi/RLp | 2.71 | 1.38 | 1.69 | 0.96 | 1.02 | 1.69 | ns | 2.36 | 1.73 | 1.50 | 1.36 | 0.86 | 1.07 | ns |
| 3. Maxillary base A/RLp | 79.07 | 1.51 | 76.63 | 2.18 | 2.44 | 1.85 | ns | 79.79 | 1.73 | 77.06 | 2.88 | 2.73 | 2.17 | * |
| 4. Mandibular base Pg/RLp | 78.36 | 2.75 | 73.38 | 3.71 | 4.98 | 2.91 | * | 79.50 | 2.77 | 73.94 | 3.41 | 5.56 | 3.43 | ** |
| 5. Maxillary incisor Is/RLp | 87.79 | 3.15 | 84.63 | 2.72 | 3.16 | 2.08 | ns | 88.14 | 3.44 | 84.38 | 3.82 | 3.76 | 1.99 | ns |
| 6. Mandibular incisor Ii/RLp | 78.14 | 4.09 | 75.88 | 3.62 | 2.26 | 1.13 | ns | 79.07 | 3.95 | 76.69 | 2.96 | 2.38 | 1.33 | ns |
| 7. Maxillary molar Ms/RLp | 53.36 | 2.98 | 49.81 | 2.72 | 3.55 | 2.40 | * | 53.93 | 3.35 | 50.13 | 2.17 | 3.80 | 2.64 | * |
| 8. Mandibular molar Mi/RLp | 50.64 | 2.84 | 48.13 | 3.04 | 2.51 | 1.64 | ns | 51.57 | 3.03 | 48.63 | 2.71 | 2.94 | 1.98 | ns |

[a] Positive numbers imply Class II molar relation, whereas negative numbers imply Class I molar relation. RLp indicates occlusal line perpendicular; ns, not significant.

* $P < .05$; ** $P < .01$; *** $P < .001$.

**Table 2.** SO-Analysis—Mechanism of Class II Correction in 16 van Beek Activator Patients[a]

| | Good Responders | | | | | | | | Bad Responders | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | T1–T0 (n = 6) | | | | T2–T1 (n = 7) | | | | T1–T0 (n = 8) | | | | T2–T1 (n = 8) | | | |
| Variables (mm) | Mean | SD | *t* | *P* | Mean | SD | *t* | *P* | Mean | SD | *t* | *P* | Mean | SD | *t* | *P* |
| 1. Overjet Is/RLp–Ii/RLp | −0.50 | 1.41 | 0.85 | ns | −5.51 | 1.87 | 7.77 | *** | −1.06 | 2.09 | 1.43 | ns | −1.06 | 1.99 | 1.51 | ns |
| 2. Molar relation Ms/RLp–Mi/RLp | −0.42 | 0.86 | 1.16 | ns | −5.00 | 1.61 | 8.23 | *** | −0.19 | 0.96 | 0.55 | ns | −1.69 | 1.28 | 3.72 | ** |
| 3. Maxillary base A/RLp | 0.67 | 0.68 | 2.28 | ns | −0.29 | 0.95 | 0.79 | ns | 0.44 | 0.98 | 0.85 | ns | 1.00 | 1.31 | 2.16 | ns |
| 4. Mandibular base Pg/RLp | 1.33 | 1.37 | 2.28 | ns | 1.86 | 2.21 | 2.22 | ns | 0.56 | 0.98 | 1.62 | ns | 3.38 | 2.60 | 3.66 | ** |
| 5. Maxillary incisor Is/RLp | −0.17 | 1.08 | 0.37 | ns | −2.57 | 1.06 | 5.79 | *** | −0.69 | 1.62 | 1.19 | ns | 0.38 | 2.08 | 0.50 | ns |
| 6. Mandibular incisor Ii/RLp | −0.33 | 0.88 | 0.91 | ns | 0.79 | 0.64 | 3.10 | * | 0.25 | 0.65 | 1.08 | ns | −0.94 | 1.15 | 2.31 | ns |
| 7. Maxillary molar Ms/RLp | 0.42 | 1.20 | 0.83 | ns | −1.71 | 1.29 | 3.33 | * | −0.13 | 0.58 | 0.60 | ns | 0.31 | 1.46 | 0.60 | ns |
| 8. Mandibular molar Mi/RLp | 0.17 | 0.52 | 0.78 | ns | 1.14 | 1.18 | 2.47 | * | −0.06 | 0.62 | 0.28 | ns | −0.38 | 1.25 | 0.85 | ns |

[a] Positive numbers imply Class II molar relation, whereas negative numbers imply Class I molar relation. RLp indicates occlusal line perpendicular; ns, not significant.

* $P < .05$; ** $P < .01$; *** $P < .001$.

(mean = 2.00 mm) than horizontally forward (mean = 0.56 mm) in the bad responders. The group difference was statistically significant for the vertical chin changes (Pg/RL: $P < .05$) only. During the van Beek activator period (T2–T1) the chin changes in the good responders were twice as much vertically downward (mean = 3.79 mm, $P < .01$) than horizontally forward (mean = 1.86 mm, ns). In the bad responders, on the other hand, the direction of chin changes was 1.3 times more horizontally forward (mean = 3.38 mm, $P < .01$) than vertically downward (mean = 2.63 mm, $P < .001$). The group difference was, however, not statistically significant.

The position of the maxilla did not change significantly in any of the observation periods or groups. When looking at the direction of the mandibular and

**Table 1.** Extended

| After T2 | | | | | | |
|---|---|---|---|---|---|---|
| Good (n = 8) | | Bad (n = 8) | | Good-Bad | | |
| Mean | SD | Mean | SD | Mean | *t* | *P* |
| 3.50 | 1.00 | 6.63 | 1.77 | −3.13 | 4.35 | *** |
| −2.69 | 1.44 | −0.19 | 1.94 | −2.50 | 2.92 | * |
| 79.56 | 2.32 | 78.06 | 3.32 | 1.50 | 1.04 | ns |
| 81.63 | 3.20 | 77.31 | 4.92 | 4.32 | 2.07 | ns |
| 85.31 | 3.28 | 85.75 | 3.17 | −0.44 | 0.27 | ns |
| 81.81 | 3.14 | 79.13 | 3.96 | 2.68 | 1.50 | ns |
| 52.06 | 3.06 | 51.44 | 2.44 | 0.62 | 0.45 | ns |
| 54.75 | 2.84 | 51.63 | 3.58 | 3.12 | 1.93 | ns |

maxillary position changes (Figure 7), it becomes clear that the development of both the Pg-point and A-point was more vertically and less forward oriented in the good responders than in the bad responders. The posterior development of A-point from T1 to T2 compensated for the smaller amount of mandibular forward development in the good responders.

### Rotation of the Mandible

On average, the RL rotated anteriorly in both groups. Statistically significant changes were seen during the pretreatment period (T1–T0) in the good responder group and during the van Beek activator period (T2–T1) in the bad responder group (Tables 4 and 5). Although none of the group differences were statistically significant, it seems noteworthy that during the van Beek activator period the anterior rotation of the RL in the bad responder group exceeded that of the good responder group by 1.8°.

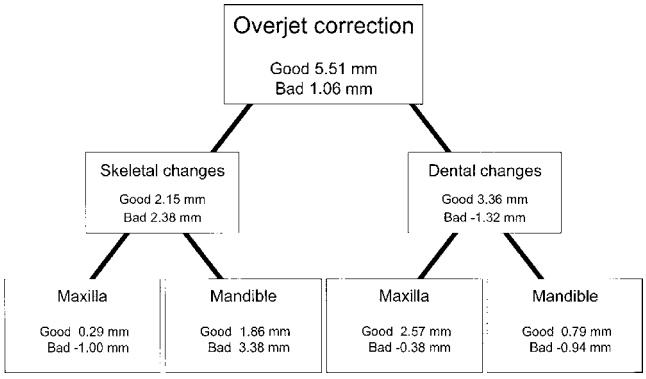


**Figure 5.** Mechanism of overjet correction in 16 boys with Class II division 1 malocclusion treated with van Beek activator. The amount of skeletal and dental changes during the treatment period (T2–T1) are given for the good (n = 7) and bad (n = 8) responders. Minus (−) implies unfavorable changes for overjet correction.

## DISCUSSION

In the present study, considering the bad cooperation dropout, the success rate of the van Beek activator treatment amounted to 40%. Bondevik[4] reported that 70% of his patients treated simultaneously with an

**Table 3.** SO-Analysis—Mechanism of Class II Correction in 16 van Beek Activator Patients[a]

| | T1–T0 | | | | | | | T2–T1 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Good (n = 6) | | Bad (n = 8) | | Good-Bad | | | Good (n = 7) | | Bad (n = 8) | | Good-Bad | | |
| Variables (mm) | Mean | SD | Mean | SD | Mean | *t* | *P* | Mean | SD | Mean | SD | Mean | *t* | *P* |
| 1. Overjet Is/RLp–Ii/RLp | −0.50 | 1.41 | −1.06 | 2.09 | 0.56 | 0.57 | ns | −5.51 | 1.87 | −1.06 | 1.99 | −4.45 | 4.42 | *** |
| 2. Molar relation Ms/RLp–Mi/RLp | −0.42 | 0.86 | −0.19 | 0.96 | −0.23 | 0.46 | ns | −5.00 | 1.61 | −1.69 | 1.28 | −3.31 | 4.44 | *** |
| 3. Maxillary base A/RLp | 0.67 | 0.68 | 0.44 | 0.98 | 0.23 | 0.49 | ns | −0.29 | 0.95 | 1.00 | 1.31 | −1.29 | 2.14 | ns |
| 4. Mandibular base Pg/RLp | 1.33 | 1.37 | 0.56 | 0.98 | 0.77 | 1.23 | ns | 1.86 | 2.21 | 3.38 | 2.60 | −1.52 | 1.20 | ns |
| 5. Maxillary incisor Is/RLp | −0.17 | 1.08 | −0.69 | 1.62 | 0.52 | 0.68 | ns | −2.57 | 1.06 | 0.38 | 2.08 | −2.95 | 3.37 | ** |
| 6. Mandibular incisor Ii/RLp | −0.33 | 0.88 | 0.25 | 0.65 | −0.58 | 1.43 | ns | 0.79 | 0.64 | −0.94 | 1.15 | 1.73 | 3.51 | ** |
| 7. Maxillary molar Ms/RLp | 0.42 | 1.20 | −0.13 | 0.58 | 0.55 | 1.12 | ns | −1.71 | 1.29 | 0.31 | 1.46 | −2.02 | 2.82 | * |
| 8. Mandibular molar Mi/RLp | 0.17 | 0.52 | −0.06 | 0.62 | 0.23 | 0.73 | ns | 1.14 | 1.18 | −0.38 | 1.25 | 1.52 | 2.41 | * |

[a] Positive numbers imply Class II molar relation, whereas negative numbers imply Class I molar relation. RLp indicates occlusal line perpendicular; ns, not significant.

* $P < .05$; ** $P < .01$; *** $P < .001$.

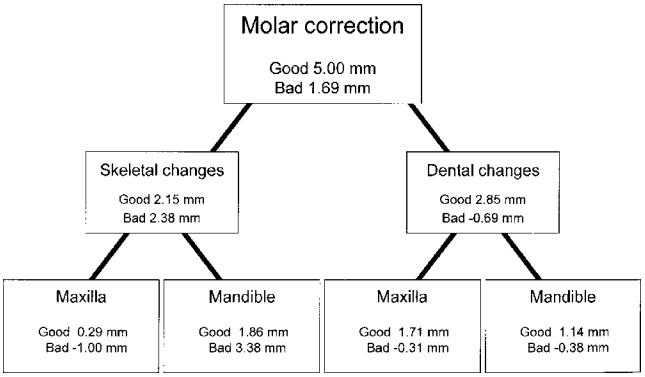


**Figure 6.** Mechanism of Class II molar correction in 16 boys with Class II division 1 malocclusion treated with van Beek activator. The amount of skeletal and dental changes during the treatment period (T2–T1) are given for the good (n = 7) and bad (n = 8) responders. Minus (−) implies unfavorable changes for Class II molar correction.

Andresen activator and a headgear achieved an overjet <4 mm. However, it must be taken into account that his subject inclusion criteria was an original overjet of ≥4 mm. Furthermore, he did not report of any mean values or treatment changes. Ahlgren[1] had a 24% dropout attributed to bad cooperation and described a considerable improvement in overjet for the remaining 76% of the Andresen activator patients. However, he did not define any criteria for success.

The absolute amount of skeletal changes contributing to overjet and molar correction were comparable in the good and bad responder groups. However, the mandibular changes were less favorable (less forward development of the Pg-point) in the good responder group. There are three possible explanations for this. The first is that van Beek activator treatment failed to control the vertical position of the upper incisors, thus resulting in a tilt of the occlusal reference plane and a

**Table 4.** Effective Temporomandibular Joint Changes (Co), Chin Position Changes (Pg), and Maxilla Position Changes (A) in 16 van Beek Activator Patients[a]

| | Good Responders | | | | | | | | Bad Responders | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | T1–T0 (n = 6) | | | | T2–T1 (n = 7) | | | | T1–T0 (n = 8) | | | | T2–T1 (n = 8) | | | |
| Variables (mm) | Mean | SD | *t* | *P* | Mean | SD | *t* | *P* | Mean | SD | *t* | *P* | Mean | SD | *t* | *P* |
| Co/RL | 2.08 | 0.97 | 5.25 | ** | 4.43 | 2.76 | 4.24 | ** | 2.13 | 1.25 | 4.82 | ** | 6.25 | 2.31 | 7.63 | *** |
| Co/RLp | 0.50 | 0.77 | 1.58 | ns | 1.21 | 0.95 | 3.37 | * | 0.69 | 1.07 | 1.82 | ns | 0.44 | 2.11 | 0.58 | ns |
| Pg/RL | 0.17 | 1.25 | 0.32 | ns | 3.79 | 2.18 | 4.60 | ** | 2.00 | 1.36 | 4.15 | ** | 2.63 | 0.99 | 7.49 | *** |
| Pg/RLp | 1.33 | 1.37 | 2.28 | ns | 1.86 | 2.21 | 2.22 | ns | 0.56 | 0.98 | 1.62 | ns | 3.38 | 2.60 | 3.66 | ** |
| A/RL | 0.08 | 0.80 | 0.25 | ns | −1.50 | 1.80 | 2.20 | ns | −1.00 | 1.28 | 2.20 | ns | −0.75 | 1.07 | 1.98 | ns |
| A/RLp | 0.67 | 0.68 | 2.28 | ns | −0.29 | 0.95 | 0.79 | ns | 0.44 | 0.98 | 0.85 | ns | 1.00 | 1.31 | 2.16 | ns |
| RL | −1.31 | 1.25 | 3.80 | * | −0.63 | 1.96 | 0.49 | ns | −0.50 | 1.19 | 1.18 | ns | −2.44 | 1.42 | 4.84 | ** |

[a] Positive numbers imply upward movement of Co, backward movement of Co, forward movement of Pg and A, and downward movement of Pg, whereas negative numbers imply downward movement of A, backward movement of A, and anterior rotation of OL. RL indicates occlusal line; RLp, occlusal line perpendicular; and ns, not significant.

* $P < .05$; ** $P < .01$; *** $P < .001$.

**Table 5.** Effective Temporomandibular Joint Changes (Co), Chin Position Changes (Pg), and Maxilla Position Changes (A) in 16 van Beek Activator Patients[a]

| | T1–T0 | | | | | | | T2–T1 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Good (n = 6) | | Bad (n = 8) | | Good-Bad | | | Good (n = 7) | | Bad (n = 8) | | Good-Bad | | |
| Variables (mm) | Mean | SD | Mean | SD | Mean | *t* | *P* | Mean | SD | Mean | SD | Mean | *t* | *P* |
| Co/RL | 2.08 | 0.97 | 2.13 | 1.25 | 0.05 | 0.06 | ns | 4.43 | 2.76 | 6.25 | 2.31 | −1.82 | 1.39 | ns |
| Co/RLp | 0.50 | 0.77 | 0.69 | 1.07 | −0.19 | 0.36 | ns | 1.21 | 0.95 | 0.44 | 2.11 | 0.77 | 0.89 | ns |
| Pg/RL | 0.17 | 1.25 | 2.00 | 1.36 | −1.83 | 2.57 | * | 3.79 | 2.18 | 2.63 | 0.99 | 1.16 | 1.36 | ns |
| Pg/RLp | 1.33 | 1.37 | 0.56 | 0.98 | 0.77 | 1.23 | ns | 1.86 | 2.21 | 3.38 | 2.60 | −1.52 | 1.20 | ns |
| A/RL | 0.08 | 0.80 | −1.00 | 1.28 | 1.08 | 1.81 | ns | −1.50 | 1.80 | −0.75 | 1.07 | −0.75 | 0.99 | ns |
| A/RLp | 0.67 | 0.68 | 0.44 | 0.98 | 0.23 | 0.49 | ns | −0.29 | 0.95 | 1.00 | 1.31 | −1.29 | 2.14 | ns |
| RL | −1.31 | 1.25 | −0.50 | 1.19 | −0.81 | 1.34 | ns | −0.63 | 1.96 | −2.44 | 1.42 | 1.81 | 2.13 | ns |

[a] Positive numbers imply upward movement of Co, backward movement of Co, forward movement of Pg and A, and downward movement of Pg, whereas negative numbers imply downward movement of A, backward movement of A, and anterior rotation of OL. RL indicates occlusal line; RLp, occlusal line perpendicular; and NS, not significant.

* $P < .05$; $P < .01$; $P < .001$.

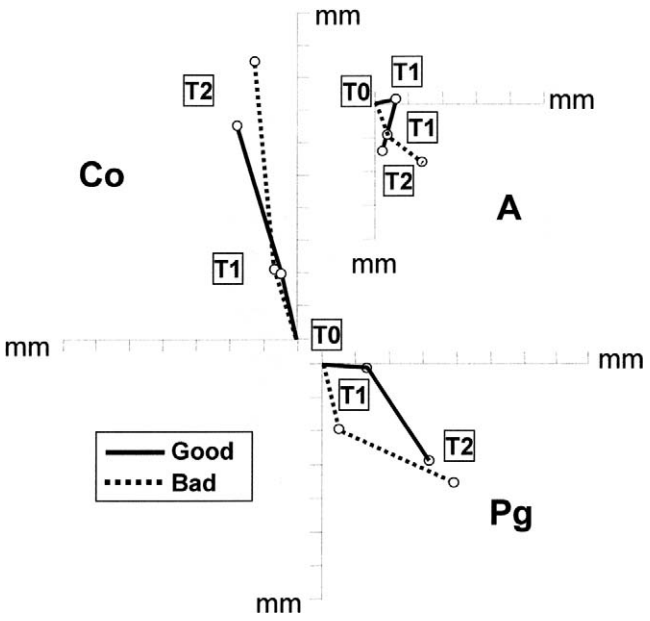


**Figure 7.** Effective temporomandibular joint changes (Co), maxilla position changes (A), and chin position changes (Pg) in 16 boys with Class II division 1 malocclusion treated with van Beek activator. Registrations at different times of examination: T0, T1, and T2. Lateral head films were missing for one patient each from the time points T0 and T1.

smaller anterior mandibular autorotation. However, previous studies analyzing the dentoskeletal effect of van Beek activator treatment demonstrated either a vertical control or an intrusion of the upper incisors.[14–16] The second possible explanation is a posterior rotation of the maxilla as described by Altenburger and Ingervall.[14] Also, in the present sample, the A-point developed more downward (A/RL = 0.75 mm, ns) in the good responder group compared with the bad responder group. The third possible explanation is a discrepancy between the anterior and posterior facial height development between the groups. According to Hultgren et al,[17] a larger development of the posterior facial height is a prerequisite for an anterior mandibular rotation. In fact, the vertical effective TMJ changes (Co/RL) during the van Beek activator period were larger in the bad responder group, thus explaining the larger amount of mandibular autorotation.

The smaller anterior mandibular autorotation and the smaller forward development of the Pg-point in the good responder group were compensated by a larger restriction of maxillary growth in comparison with the bad responder group. The smaller forward development of the Pg-point in the present good responder group is opposite the results of Ahlgren and Laurin,[2] who found a significant larger decrease in ANB angle in successful vs unsuccessful Andresen activator patients.

The main difference between successful and unsuccessful van Beek activator treatment seems to be attributed to differences in dental changes, which were larger in the good responder group than in the bad responder group. In the study by Ahlgren and Laurin,[2,] however, about the same amount of dental changes was seen when comparing successful with unsuccessful Andresen activator patients.

It remains unknown as to why the bad responders did not respond well. Besides the limited number of patients, the assessment of cooperation is, in fact, the main limitation of this study and any previous studies analyzing possible causes for treatment failure, because neither the clinical judgment nor written reports are objective measures of cooperation. However, in headgear treatment, a high degree of correlation between the number of hours of wear recorded in a calendar and the actual wearing time recorded by means of an electronic headgear timer has been demonstrated.[18] Nevertheless, the possibility of a poor cooperation in the bad responder group cannot fully be ruled out. However, the present results need to be verified in a larger and prospective patient material.

## CONCLUSIONS

- During van Beek activator treatment, the good responder group exhibited more dental changes than did the bad responder group.
- Although van Beek activator treatment affected the direction of condylar growth, as well as the direction of maxilla and chin changes, the skeletal changes did not contribute to the Class II correction.

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