# Treatment needs following activator-headgear therapy

**Olav Bondevik, DDS, Lic. Odont**

Some authors have emphasized the importance of case selection for treatment with functional appliances. There is agreement that other treatment modalities should be used for hyperdivergent cases with signs of backward growth rotation of the mandible and minimal overbite, cases in which bodily and rotational tooth movements are needed, and cases judged to have poor cooperation or minimal growth remaining.[1] Postretention occlusal[2] as well as skeletal[3] effects of activator treatment have been analyzed. However, success rates of functional appliance therapy have been poorly documented.

A recent study on the effect of combined activator-headgear therapy concluded that most patients need additional treatment with fixed appliances to attain satisfactory occlusal results.[4] However, the frequency and severity of various occlusal deviations were not reported, and no attempt was made to decide whether the results reflected inherent limitations of the appliance or poor patient cooperation.

The aim of the present study was to describe in detail the problems that remain after a period of activator-headgear treatment in patients judged to have satisfactory cooperation. Attempts were made to evaluate any association between cooperation level and frequency of the remaining problems.

## Material and methods

### Subjects

Pretreatment and posttreatment study models and charts of all 94 patients treated with a combined activator-headgear appliance in the graduate clinic of the Orthodontic Department, University of Oslo, between 1972 and 1982 were screened. The author had selected patients for

**Abstract**

The purpose of this study was to analyze the types and prevalence of malocclusions that remain to be corrected after a period of combined activator-headgear treatment. Study models of all patients who started treatment with an activator-headgear appliance in the graduate orthodontic clinic at the University of Oslo between 1972 and 1982 were screened. Patients initially judged to need a second phase of treatment and those later judged to have poor cooperation were omitted from the study. The results show that the most frequently remaining problems following activator-headgear treatment were overbite, overjet, and the presence of interdental spaces. Correction of the Class II skeletal and dental relationship was achieved in the majority of the cases. The only predictor for success was age at the time of treatment.

**Key Words**

Activator-headgear treatment

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**Table 1**
**Age at the start of treatment and treatment time in groups with satisfactory (n=14) and unsatisfactory (n=35) results**

| | Satisfactory result | | | Unsatisfactory result | | |
|---|---|---|---|---|---|---|
| | min | mean | max | min | mean | max |
| Age | 9y 6m | 11y 11m | 14y 7m | 7y 9m | 10y 11m | 14y 2m |
| Treatment time | 0y 8m | 1y 5m | 2y 4m | 0y 3m | 1y 6m | 3y 6m |

**Table 2**
**Cross tabulation of results and cooperation in 49 Norwegian subjects treated with Andresen activator and cervical headgear**

| | Cooperation | | | |
|---|---|---|---|---|
| Results | Good | Average | Uncertain | Sum |
| Satisfactory | 6 | 0 | 8 | 14 |
| Unsatisfactory | 8 | 8 | 19 | 35 |
| Sum | 14 | 8 | 27 | 49 |

**Table 3**
**Number of patients with remaining dental or skeletal problems compared with the number of patients who exhibited the problem originally in 35 Norwegian patients with unsatisfactory results following activator-headgear treatment**

| | Cooperation | | | |
|---|---|---|---|---|
| | Good (=8) | Average (n=8) | Uncertain (n=19) | Sum (n=35) |
| Overjet | 2/8 | 3/8 | 10/19 | 15/35 |
| Overbite | 4/6 | 4/8 | 10/15 | 18/29 |
| Distal occlusion | 1/6 | 2/6 | 4/17 | 7/29 |
| Spaces | 6/5 | 1/0 | 4/6 | 11/11 |
| Midline discrepancy | 1/1 | 0/3 | 7/11 | 8/15 |
| Retroclined maxillary incisors | 2/0 | 2/0 | 0/0 | 4/0 |

this particular kind of treatment and supervised the actual treatment in the clinic. The aim was to achieve a satisfactory result using the activator-headgear as the sole appliance. Sixteen patients were omitted from the material because fixed appliances were judged necessary in a later phase of treatment. An additional 29 patients judged to have poor cooperation were omitted because cooperation is the sole factor showing significant influence on the effect of activator-headgear treatment.[4] This left 49 patients for the study.

The selection criteria for activator-headgear treatment were:

- Angle Class II, Division 1, malocclusion or Angle Class I malocclusion with proclined maxillary incisors
- Overjet at least 4 mm
- Overbite at least 4 mm
- Less than 2 mm crowding of the incisors
- Minimal rotation of the incisors
- Cephalometric angle ML\NSL less than 35°

Age at start of treatment and treatment time with activator-headgear are shown in Table 1. Patients were divided into three groups according to cooperation: good, average, and uncertain (Table 2).

Cooperation was judged from chart entries and scored as good if appliance-wear was consistent, average if the chart entries indicated a change in cooperation over time, and uncertain if no information was listed.[4]

**Appliance**

The activator used in this study resembled the original Andresen activator, prescribing 4-5 mm anterior displacement of the mandible from centric occlusion and 4-6 mm vertical displacement. Andresen[5] limited bite opening to 4 mm. Any midline discrepancy that was not due to tooth migration was corrected in the construction bite. Lowpull headgear was fitted to bands on the maxillary first molars. Asymmetric headgear was used in cases with an asymmetric molar relationship. Highpull headgear was not indicated due to case selection. Patients were instructed to wear the appliances for 12 to 14 hours per day. When the following criteria were met, the result could be classified as satisfactory:

- Angle Class I molar relationship, ±1 mm
- Overjet less than 4 mm
- Overbite less than 4 mm
- No rotation of maxillary incisors
- Occlusal contact on all teeth
- Less than 1 mm crowding of mandibular incisors

- Less than 15° tooth rotation, limited to one premolar or canine

Angle classification was determined from a buccal view. Overjet and overbite were determined as shown in Figure 1 and measured with a sliding caliper. The degree of crowding was determined by subtracting the perimeter of the anterior segment measured by a resilient ruler (Figure 2) from the sum of the mesiodistal width of each of the anterior teeth, measured by a divider.

**Statistical analysis**

A stepwise logistic regression with log ratios of maximized likelihood functions[6] was used to test for dependency between treatment success and cooperation level, sex, age, treatment time, amount of asymmetry in the molar relationship, midline discrepancy, overjet and overbite, and treatment outcome. (Program LR in the BMDP statistics package.)

## Results

**Remaining malocclusion**

Only 14 of the 49 subjects fulfilled the criteria for a satisfactory result at the end of the activator-headgear treatment period (Table 2); the remaining 35 needed a second phase of treatment with fixed appliances. All the satisfactory cases were in the subgroups with either good or uncertain cooperation.

Excessive overjet and overbite were the problems that most commonly remained after treatment. The overbite was corrected in less than half of the patients, and the success rate for overjet correction was only slightly better (Table 3). Even the subgroups with good cooperation had success rates as low as 33% and 75%, respectively. The Class II molar relationship remained in 7 of 29 patients (Table 3). Most of these patients had presented with an asymmetrical molar relationship combined with midline discrepancy.

The number of patients with interdental spaces was the same before activator-headgear treatment as after (Table 3), although the distribution changed: fewer of the uncertain cooperators had spaces following treatment, while more of the good and average cooperators had them. Spaces closed in some patients but opened in others, particularly in the maxillary premolar region.

Midline deviations were corrected in about half the patients (Table 3) and the majority of the remaining patients showed some improvement.

Subjective evaluation indicated that four patients had retroclined maxillary incisors after treatment and needed palatal root torque (Table 3). All patients with at least one remaining problem, such as rotation of maxillary incisors, crowding of the mandibular incisors, rotation or axial inclination of canines/premolars and lack of occlusal contact—all of which necessitated further correction—were gathered into one group, "Others" (Table 3). The number of subjects with each of these deviations was very small, and although some of the original problems were corrected, some patients developed new problems during the activator-headgear treatment.

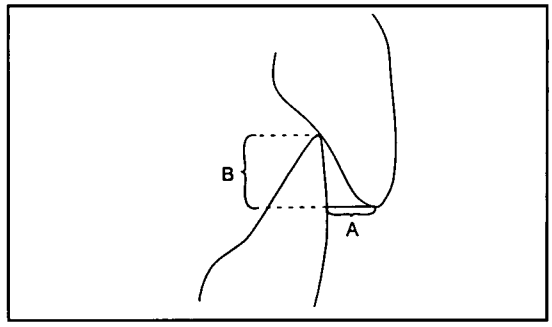


**Figure 1**

**Figure 1**
**Measurement of overjet (a) and overbite (b).**

**Figure 2**
**A ruler (continuous line) was placed on the anterior segment to measure the perimeter. The teeth were measured with a divider (dotted lines).**

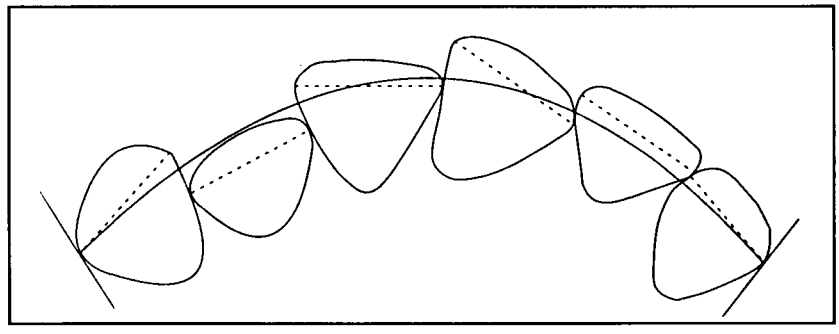

**Figure 2**

**Predictors**

The only significant predictor was age (P = 0.015), indicating higher success rates with increasing age. The mean age in the group with a satisfactory treatment result was 11.95 years, while the mean age in the unsatisfactory group was 10.87 years.

## Discussion

The vertical distance between molars in the construction bite could be increased from 2-4 mm, as Andresen[7] recommended, to 4-6 mm. The activator would still work according to Andresen's theories[8] because the freeway space may be larger during sleep than while awake.[9]

Patients in the group with satisfactory results were closer in age to the time of the maximum pubertal growth spurt at start of treatment than subjects in other groups. This may explain why age showed up as a significant predictor for success.

Several authors believe that patients with Angle Class II, Division 1, malocclusion are suitable

candidates for activator treatment.[9-11] It is therefore remarkable that so few patients in this study had a satisfactory treatment result. Overbite correction was particularly difficult to achieve. Wide individual variation was found, in keeping with Slagsvold,[9] and Bishara and Ziaja.[1] Wieslander and Lagerström[11] did report bite opening in their study, but their material was limited to subjects who used the appliance 10 to 12 hours per day and with good results but no criteria for satisfactory result. One reason for unsatisfactory bite opening may be insufficient eruption of premolars and molars during treatment. Anterior growth rotation of the mandible may cause a deepening of the bite that can be difficult to correct through dentoalveolar changes.[12] Luder's results,[13,14] which showed better skeletal bite opening with a low construction bite and more forward growth of the mandible by increasing the height of the construction bite, are more difficult to explain.

Several mechanisms may contribute to overjet correction, such as forward translation of the mandible with growth, restriction of maxillary growth, and changes in incisor inclination, especially the maxillary incisors. This study supports the belief that overjet is more easily corrected than overbite with activators, particularly if the mandibular incisors do not prevent retroclination of the maxillary incisors. Most of the subjects in which Class II correction was not achieved had an asymmetric molar relationship before treatment. No attempts were made to analyze the causes of the asymmetries, but likely explanations include different positions of the temporomandibular joints, differences in development of the two sides of the maxilla or the mandible, and mesial migration of the molars prior to the start of treatment. This asymmetry may explain any unilateral Class II correction. Other explanations include different degrees of growth on each side during treatment, and the appliance's inability to produce dentoalveolar compensations. This study indicates that activator-headgear treatment is more effective for the correction of Class II molar relationships than for correction of overjet and overbite. The reason may be that the headgear affects the position of the maxillary first molars without having an equal effect on the incisors.

The number of cases with spaces increased in the groups with good and average cooperation. A common effect of activator treatment is retroclination of the maxillary incisors due to activation of the labial bow, which reduces interincisal spaces. However, headgear often moves the maxillary molars distally, creating spaces in the posterior segments and preventing closure of the leeway space.

Because midline discrepancies were corrected in patients with average cooperation but remained in patients with good cooperation, this

factor may not explain the success or failure of treating such malocclusions. Perhaps the midline deviation is due to asymmetry, as discussed earlier, or local migration of the incisors. Equal growth on both sides during treatment would maintain the midline discrepancy. Because appropriate records were not available, no attempts were made to analyze why the deviation was corrected in some cases and not in others.

A critical point for success with functional appliances is cooperation. If the appliance is not used, treatment progress cannot be expected. For that reason, 29 subjects with poor cooperation according to the chart entries were omitted from the study. The students who treated the patients were instructed to question the patients regularly about frequency and duration of the appliance wear. This may not be considered a reliable way of judging cooperation. Unfortunately, a system of having the patients record appliance use each day failed.

Girls are generally considered more cooperative than boys during orthodontic treatment, but this study did not reveal any differences between the sexes. However, the fact that the mean age of the boys was about one year higher than that of the girls and that age was a significant predictor for success, may have masked a possible sex difference.

## Conclusions

The failure of functional appliances to correct malocclusions may not always be due to lack of cooperation. This study shows that despite appropriate case selection and treatment supervision by an experienced orthodontist, most activator-headgear cases need therapy with fixed appliances to achieve satisfactory results.

Overjet and overbite frequently remain uncorrected despite the fact that such occlusal deviations are regarded suitable for treatment with functional appliances. Treatment with activator-headgear sometimes produces excess spacing and retroclination of maxillary incisors. However, functional appliances frequently correct Class II disharmonies and may reduce overall treatment time. In spite of these successes, the majority of the cases need finishing with fixed appliances.

**Author Address**

Olav Bondevik
Department of Orthodontics
Geitmyrsvn. 71
0455 Oslo, Norway

*O. Bondevik is an associate professor in the Department of Orthodontics, School of Dentistry, University of Oslo, Norway.*

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