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LONG-TERM FOLLOW-UP OF PATIENTS WITH A SKELETAL ANGLE CLASS III RELATIONSHIP TREATED WITH CHIN CAPS

Aim: *To evaluate the long-term result of chin-cap treatment in patients with a skeletal Angle Class III relationship due to mandibular prognathism.* ***Material and Methods:*** *Records of nine patients (five girls and four boys) with a mean age of 10.8 ± 1.6 years at the start of treatment were retrieved from the archives. The records comprised lateral cephalograms, intra- and extraoral photographs, and dental casts. The subjects were recalled at 6.1 ± 1.5 years after the completion of active orthodontic treatment. Cephalometric measurements from the treatment's beginning (T1), end (T2), and follow-up (T3) were calculated by using PorDios software. Subjects with a positive overjet at T3 were grouped as stable, and those with a negative overjet were grouped as relapse. Differences between the two groups were analyzed by repeated measures analysis of variance (ANOVA) and the Duncan test.* ***Results:*** *Five individuals maintained a positive overjet at T3, while four relapsed as indicated by a negative overjet. SNA increased in the stable group between T2 and T3 but not in the relapse group.* ***Conclusion:*** *About half of the young individuals with a mandibular prognathism treated with a chin cap relapsed over time. The relapse seemed to originate from skeletal rather than dentoalveolar changes.* World J Orthod 2009;10:317–322.

Key words: *chin cap, follow-up, long-term observation, skeletal Angle Class III relationship*

For many years after its introduction by Amos Westcott in the 1840s,[1–11] chin-cap therapy was one treatment alternative in patients with mandibular prognathism. Age and related skeletal growth are important factors for successful treatment with a chin cap. Another influencing factor is patient cooperation, as are the direction and amount of the applied force.

Mitani and Sakamoto[5] showed that if used properly, chin-cap therapy can be effective within certain limits. Decisive are the long-term results from an orthopedic correction of skeletal Class IIIs, about which reports are still fairly sparse.[2,3,6,8-12] Uner at al[13] found that even after 4 years of chin-cap therapy, relapse is still a possibility.

Consequently, the aim of this study was to evaluate the long-term results of treatment with chin caps in patients with a skeletal Angle Class III relationship due to mandibular prognathism.

MATERIALS AND METHODS

Fifty-five individuals with a skeletal Angle Class III were randomly selected from the archives of the orthodontic department of the Ankara University and invited for a follow-up visit. Only nine persons (five girls, four boys) responded and agreed to be involved in this study. The mean age of these subjects was 10.8 ± 1.6 years at the beginning of treatment. They all were treated with

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Fig 1 Patient from the stable group; **(left)** pretreatment, **(center)** posttreatment, and **(right)** long-term follow-up extra- and intraoral photographs.

chin caps and comprehensive fixed appliances. The mean treatment duration was 3.3 ± 1.1 years. The applied chin caps exerted a force of 500 cN and were to be used at least 16 hours per day. For retention, Hawley-type retainers were worn full-time in both arches with a chin cap at night for at least 1 year.

From all participating individuals of this follow-up, lateral cephalograms, intra- and extraoral photographs, and dental casts were obtained. This occurred on average 6.1 ± 1.5 years after orthodontic treatment. The respective records were taken according to the principles outlined in the Declaration of Helsinki, and an informed consent form was signed by each person.

Cephalometric parameters from the beginning (T1) and end (T2) of treatment, as well as the follow-up (T3), were calculated using PorDios software (Purpose on Request Digitizer Input Output System). The study casts were inspected for present overjet. Patients who had a positive overjet were classified as stable and those with a negative overjet as relapse. Changes between the groups were analyzed by repeated measures analysis of variance (ANOVA) and the Duncan test.

RESULTS

Five individuals maintained a positive overjet (Fig 1), while four showed relapse (Fig 2). Changes of their cephalometric variables are shown in Fig 3 and Table 1.

SNA showed an increase in both groups from T1 to T3 ($P < .05$). It increased further in the stable group from T2 to T3 but not in the group with relapse. SNB showed a slight increase in both groups from T2 to T3. However, it was larger in the relapse (76.8 degrees to 79.3 degrees) than in the stable group (79.8 degrees to 80.4 degrees). From T2 to T3, ANB showed a decrease in the relapse group (1.5 degrees to −1.3 degrees), in contrast to the stable group (1.6 degrees to 2.3 degrees). SND showed a significant difference ($P < .001$)

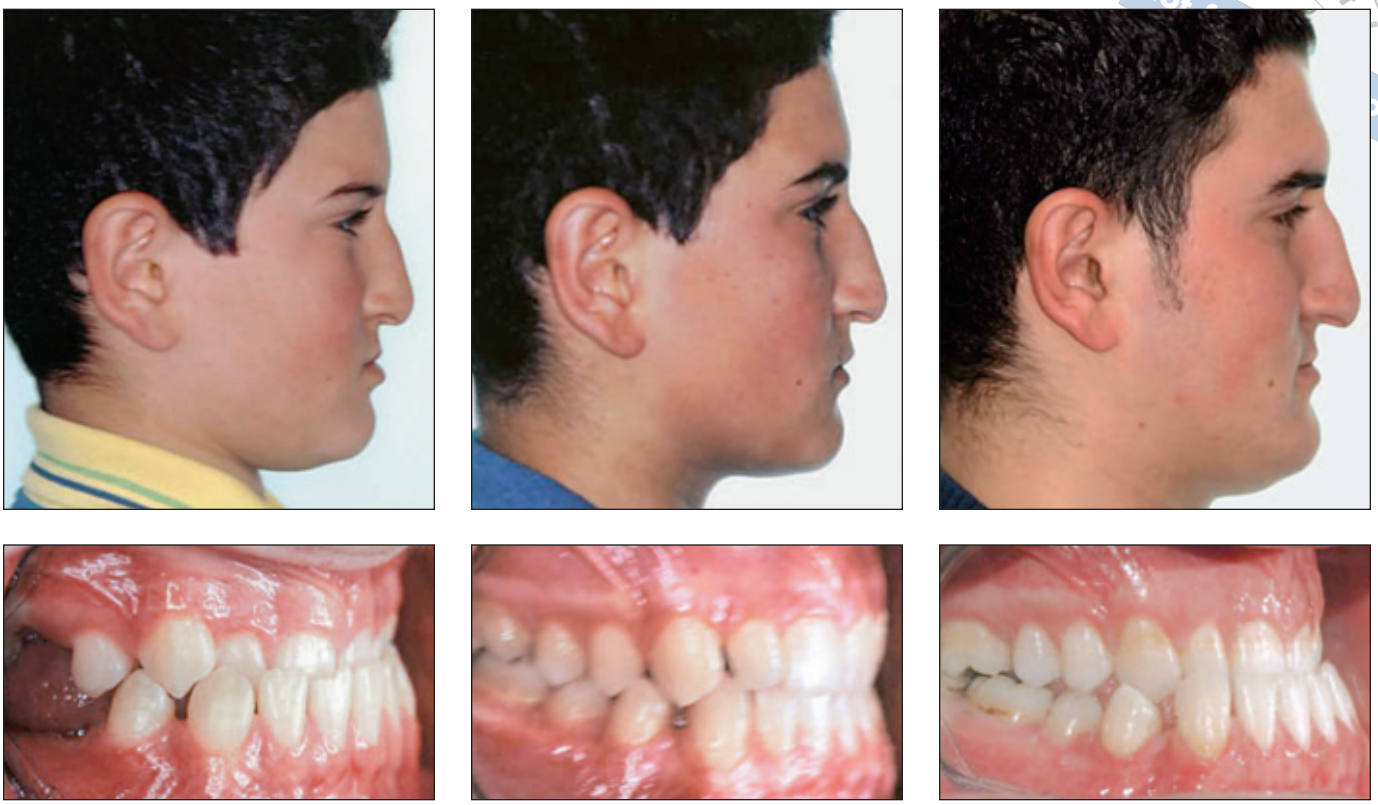

Fig 2 Patient from the relapse group; **(left)** pretreatment, **(center)** posttreatment, and **(right)** long-term follow-up extra- and intraoral photographs.

from T1 to T3 with a larger increase in the relapse than in the stable group.

From T2 to T3, SN-GoGn decreased in the stable group, but it did not change in the relapse group. SN-OcP decreased in both groups from T2 to T3 ($P < .01$).

UI-NA increased significantly ($P < .01$) in both groups from T1 to T2. LI-NB was similar between T1 and T2 in the stable group, whereas it increased significantly ($P < .05$) from 3.0 mm to 4.9 mm in the group with relapse.

Lower lip-soft tissue line measurement decreased from T1 to T3 in both groups and in the total study sample ($P < .05$).

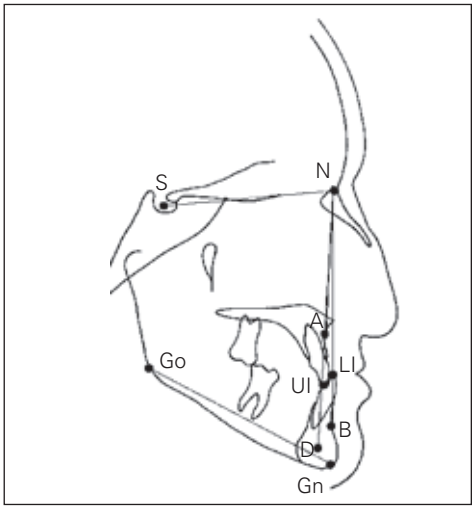

Fig 3 Cephalometric landmarks used in this study: S = sella, N = nasion, A = A point, UI = upper incisor tip, LI = lower incisor tip, B = B point, D = geometrical midpoint of symphysis, Go = gonion, Gn = gnathion.

DISCUSSION

The major variable that determines long-term success with chin-cap therapy is the amount and direction of mandibular growth during and after adolescence. According to many authors,[14–18] the length of the mandible is fundamental for long-term success or failure.

Table 1 Cephalometric measurements (means and standard deviations), ANOVA, and Duncan test for the three time points

	T1	T2	T3	P
SNA (degrees)				
Stable	80.2 ± 3.4	81.4 ± 3.8	82.7 ±3.3	**
Relapse	76.6 ± 2.1	78.3 ± 1.5	78.0 ± 3.2	
Total	[b] 78.6 ± 3.3	[a] 79.8 ± 3.2	[a] 80.6 ± 3.9	
SNB (degrees)				
Stable	79.3 ± 4.6	79.8 ± 4.3	80.4 ± 3.5	NS
Relapse	77.8 ± 3.5	76.8 ± 2.8	79.3 ± 3.6	
Total	78.6 ± 4.0	78.4 ± 3.8	79.9 ± 3.4	
ANB (degrees)				
Stable	0.9 ± 1.9	1.6 ± 2.5	2.3 ± 2.0	NS
Relapse	−1.1 ± 2.6	1.5 ± 2.1	−1.3 ± 2.6	
Total	−0.1 ± 2.4	1.6 ± 2.2	0.7 ± 2.8	
SND (degrees)				
Stable	75.3 ± 4.0	76.2 ± 3.3	77.4 ± 3.8	***
Relapse	74.3 ± 4.1	75.5 ± 3.1	77.5 ± 3.4	
Total	[c] 74.8 ± 3.8	[b] 75.8 ± 3.0	[a] 77.4 ± 3.4	
SN-OcP (degrees)				
Stable	21.4 ± 7.2	18.0 ± 6.8	15.8 ± 3.3	*
Relapse	19.0 ± 4.0	17.5 ± 1.7	16.5 ± 2.4	
Total	[a] 20.3 ± 5.8	[b] 17.8 ± 4.9	[b] 16.1 ± 2.8	
SN-GoGn (degrees)				
Stable	37.2 ± 5.3	35.8 ± 8.0	34.4 ± 8.6	NS
Relapse	38.0 ± 7.0	39.2 ± 7.0	39.2 ± 6.9	
Total	37.5 ± 5.7	37.3 ± 7.3	36.6 ± 7.8	
UI-NA (mm)				
Stable	2.3 ± 1.9	5.0 ± 2.0	4.1 ± 1.6	**
Relapse	3.0 ± 1.2	6.3 ± 1.7	6.1 ± 2.9	
Total	[b] 2.7 ± 1.5	[a] 5.6 ± 1.9	[a] 5.1 ± 2.3	
UI-NA (degrees)				
Stable	24.0 ± 6.4	23.0 ± 3.9	24.8 ± 5.5	NS
Relapse	23.5 ± 5.7	28.5 ± 2.9	26.5 ± 5.2	
Total	23.8 ± 5.7	25.4 ± 4.3	25.5 ± 5.1	
LI-NB (mm)				
Stable	[a] 4.9 ± 1.9	[a] 4.1 ± 2.6	[a] 4.4 ± 3.2	**
Relapse	[b] 3.0 ± 2.4	[a] 4.9 ± 3.1	[ab] 3.9 ± 3.6	
Total	4.0 ± 2.2	4.4 ± 2.7	4.2 ± 3.1	
LI-NB (degrees)				
Stable	25.2 ± 5.8	25.0 ± 6.3	22.8 ± 8.0	NS
Relapse	18.7 ± 4.6	22.2 ± 2.9	18.0 ± 5.8	
Total	22.3 ± 6.0	23.8 ± 5.0	20.7 ± 7.1	
Pg-NB (mm)				
Stable	0.3 ± 0.7	1.2 ± 1.0	0.4 ± 1.8	NS
Relapse	1.4 ± 2.3	2.4 ± 2.1	2.9 ± 2.9	
Total	0.8 ± 1.6	1.7 ± 1.6	1.5 ± 2.5	
UI-LI (degrees)				
Stable	126.3 ± 10.1	128.8 ± 7.7	130.0 ± 10.3	NS
Relapse	137.5 ± 8.9	129.2 ± 9.8	137.0 ± 11.4	
Total	131.3 ± 10.8	129.0 ± 8.0	133.1 ± 10.8	
Holdaway difference (mm)				
Stable	4.6 ± 2.1	2.9 ± 3.5	4.0 ± 4.7	NS
Relapse	1.6 ± 4.5	2.5 ± 4.9	1.0 ± 6.4	
Total	3.3 ± 3.5	2.7 ± 3.9	2.7 ± 5.4	
Upper lip-soft tissue line (mm)				
Stable	−1.4 ± 1.3	−0.5 ± 1.6	−0,8 ± 1.3	NS
Relapse	−2.9 ± 3.5	−1.8 ± 2.5	−3.0 ± 2.4	
Total	−2.1 ± 2.5	−1.1 ± 2.0	−1.8 ± 2.1	
Lower lip-soft tissue line (mm)				
Stable	1.2 ± 0.8	0.7 ± 1.1	−0.4 ± 1.1	**
Relapse	0.1 ± 2.3	1.5 ± 3.0	−0.5 ± 2.9	
Total	[a] 0.7 ± 1.6	[a] 1.1 ± 2.0	[b] −0.4 ± 1.9	

NS = not significant; *$P < .01$; **$P < .05$; ***$P < .001$. Groups (T1-T2-T3) with different letters are significantly different from one another.

In their study, Uner et al[13] saw the return of the original skeletal pattern after chin-cap removal. Somewhat in contrast to this, Ferro et al[12] observed that on average, 9 years after treatment, only six of 52 patients had a clinical relapse (overjet ≤ 0). This is a significantly lower rate than in the current study. Ferro et al noted that Wits appraisal, ANB, SNB, and overbite were the best predictors of relapse. They suggested that long-term stability can be enhanced by a deep overbite and an optimal skeletal correction. Other authors also feel that the degree of overbite is an important factor when predicting relapse.[3,9–10]

According to Baccetti et al, the cranial base angle is central.[15] An acute angle could project the mandible forward and thus favor treatment failure. Other parameters of the discriminant function of Baccetti et al are mandibular length and ramus height. Their equation successfully identified 83% of the sample from which it was derived. The discriminant function derived by Ghiz et al[18] identified the sagittal position of the mandible relative to the cranial base, mandibular length, ramus height, and gonial angle as key indicators.

Patient age has also to be considered because significant skeletal corrections can only be achieved in young patients. That is why some suggest[19] starting chin cap therapy before the age of 9 years. Age could explain the relatively high relapse rate in the current study in which the mean patient age at the start of treatment was 10.8 years. However, others[20] observed no significant difference in the skeletal profiles after chin-cap application at the age of 7 and 11 years.

Wells et al[14] investigated the long-term result of reverse-pull headgear in prognathic children (early mixed dentition stage) with an anterior crossbite. They reported 25% to 30% relapse in overjet after at least 5 years posttreatment. Late horizontal mandibular growth was suggested as a reason for relapse. They further concluded that up to an age of 10 years, the time at which reverse-pull headgear treatment begins is not a major factor in maintaining a positive overjet in the long term. Still, treatment should start quite early relative to most other skeletal problems. Baccetti et al[16] reported that maxillary skeletal changes are most likely in children younger than 8 years of age.

In the current study, SNA, ie, maxillary protrusion, increased in only the stable group. Therefore, it can be speculated that the stimulation of forward maxillary development could be meffective in preventing long-term relapse.

The results of this study should be interpreted with caution because of the relatively small sample. However, all follow-up investigations are difficult, especially as the time after orthodontic treatment increases.

CONCLUSION

Half of the individuals with mandibular prognathism treated with a chin cap showed relapse at a follow-up investigation. This relapse seems to originate from skeletal rather than from dentoalveolar changes. It can be hypothesized that stimulation of maxillary forward growth is important to prevent relapse in skeletal Class III patients.

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