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AN ALTERNATIVE METHOD TO CORRECT CLASS III MALOCCLUSION: EARLY TREATMENT

Tülin ARUN*
Nejat ERVERDİ**

ABSTRACT: The aim of this study was to examine cephalometrically the dental and skeletal effects of mandibular headgear in pseudo-prognathia cases. For this purpose, pretreatment and posttreatment lateral cephalograms of 40 early mixed dentition Class III subjects were evaluated (13 girls and 7 boys used mandibular headgear and 10 girls and 10 boys formed the control group). The total observation period was one year. Results showed that the general growth and development of the mandible were inhibited, lower anterior face height was increased and the lower molars moved significantly distally.

Key Words: Mandibular headgear, pseudo-prognathism, mandibular growth.

ÖZET: KL III MALOKLUZYONLARIN TEDAVİSİNDE ALTERNATİF BİR METOD: ERKEN TEDAVİ. *Bu araştırmanın amacı, pseudo-prognati vakalarında mandibuler headgearin dental ve iskeletsel etkilerini sefalometrik olarak incelemektir. Bu amaçla, erken karışık dişlenme döneminde olan 40 Kl III deneğin tedavi öncesi ve tedavi sonrası lateral sefalogramları değerlendirilmiştir (13 kız ve 7 erkek mandibular headgear grubunu, 10 kız ve 10 erkek kontrol grubunu oluşturmuştur). Toplam gözlem süresi 1 yıldır. Sonuçlar, mandibulanın genel büyüme ve gelişiminin engellendiğini, alt anterior yüz yüksekliğinin arttığını ve alt molarların önemli ölçüde distale hareket ettiğini göstermiştir.*

Anahtar Kelimeler: *Mandibuler headgear, pseudo-prognatizm, mandibuler büyüme.*

INTRODUCTION

In orthodontic treatment, the early correction of simple anterior crossbites is a common method that may be performed with a removable appliance (16). However, skeletal problems make malocclusions difficult to cerrect, if anterior crossbite is a part of a skeletal problem such as Class III malocclusions, treatment planning may also involve an orthopaedic approach.

In the correction of Class III malocclusions, mandibular headgear applications are encountered in the literature, although not very frequently. Literature review indicates that although maxillary headgear was widely accepted in orthodontic circles, mandibular headgear was not really taken up until primate study reports (1, 2, 5, 8, 12, 14, 18). Mandibular headgear was used by some authors to facilitate lower teeth banding, distalization or distal tipping of lower molars (6, 9, 10, 13, 15, 19). Orton et al. (17), Battagel and Orton (3) and Battagel (4) reported mandibular distal movements with a decrease in the SNB and SNPog angles, a decrease in mandibular growth relative to controls, lingual movement of lower incisors, a correction of 1 degree per year in the ANB angle and an increase in lower facial height in patients treated with mandibular headgear. Battagel (4) noted that there was a correlation between the stability of treatment and overbite. Heiser and Koller (11) evaluated the influence of the appliance on the TMJ and reported significant improvements or at least no deteriorations. Therefore the purpose of this study was to describe the skeletal and dental changes due to mandibular headgear and to evaluate the usefulness of the appliance.

SUBJECTS AND METHOD

The material of this investigation consisted of pretreatment and posttreatment lateral cephalometric radiographs of 40 growing children with Class III malocclusion, who were treated in the Marmara University Dental Faculty. Individuals with mandibular prognathia having anterior crossbite and a normal or sagittal directed growth pattern, were selected for this investigation. Only those patients who could achieve an edge to edge incisor relationship when their mandibles were manipulated to a retruded position were included in the study. The subjects were randomly divided into two gruops of 20 subjects each. Group 1 was treated with mandibular headgear, group 2 was not treated. The average pretreatment age was 8.26 0.4 for group 1 and 8.24 0.4 for group 2. The details of the two groups are given in Table 1. In the mandibular headgear group (Group 1), lower molar teeth were banded and a facebow with downward facing U bends of its inner bow was adjusted into the molar tubes. The outer bow was initially positioned in the same plane as the inner bow. Since the outer bow passed above the centre of resistance of the lower molar, distal tipping of this tooth was observed (the centre of resistance being the bifurcation point of the lower molar) (Figs. 1,2). The desired force was then applied to the facebow. In order to achieve the desired orthopaedic changes, the force was maintained at a level of 480-500

* *Associate Professor, Department of Orthodontics, Faculty of Dentistry, University of Marmara, İstanbul.*
** *Professor, Department of Orthodontics, Faculty of Dentistry, University of Marmara, İstanbul.*

Fig. 1,3: The initial position of the outer bow.

gr. The patients were instructed to wear their appliance for 16 hours per day during the one year treatment period. The mandibular distal movement was freed from occlusal interferences by application of posterior bite planes. The bite planes were removed once the anterior crossbite had been eliminated. After a period of 6 months, the arms of the outer bow were bent downwards, so that the point of force application was below the centre of resistance of the lower molar with resultant mesial tipping and uprighting of this tooth (Figs. 3, 4).

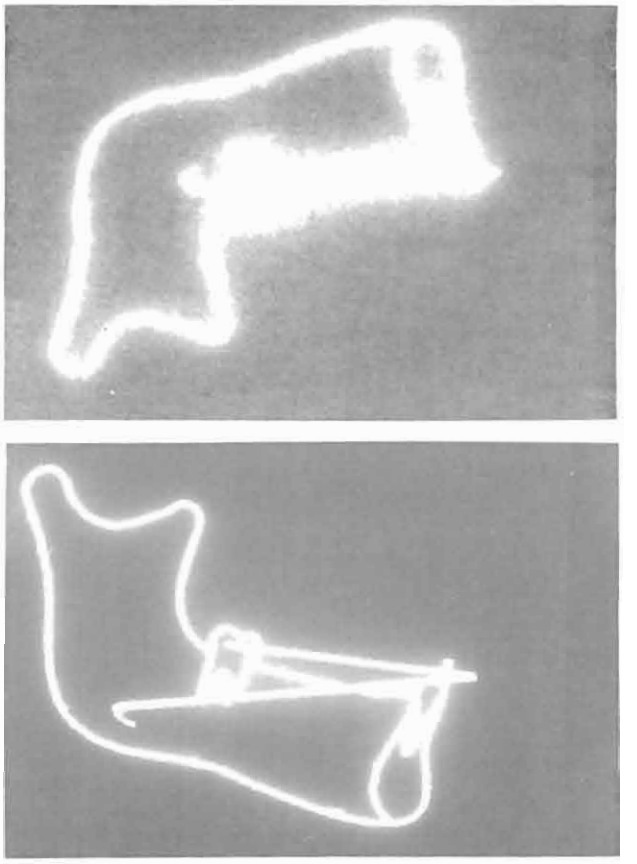

Fig. 2, 4: At the end of the 6 months the outer bow was bent downwards.

Cephalometric method

Open and closed mouth lateral cephalograms obtained from the treatment and control subjects at the beginning and at the end of the observation period were evaluated. The reason for obtaining an open-mouth lateral cehalogram was to avoid superimposition of the glenoid fossa over the condyle and thus to facilitate the accurate tracing of the condylion point. Condylion was first traced on the open-mouth lateral cephalogram then, it was superimposed on the closed-mouth lateral cephalogram. Eighteen cephalometric points were selected for analysis. A total of 30 measurements were made of which 15 were angular (Fig. 5) and 15 linear (Fig. 6). The reference plane was the vertical plane passing through point S and intersecting the SN plane at a right angle. This plane was transferred from the first cephalogram to the second via superimposition onto the SN plane.

Statistical method

Following the completion of the tracing and measurements of the 80 lateral cephalograms obtained from the 40 subjects, non-parametric tests were used in the sta-

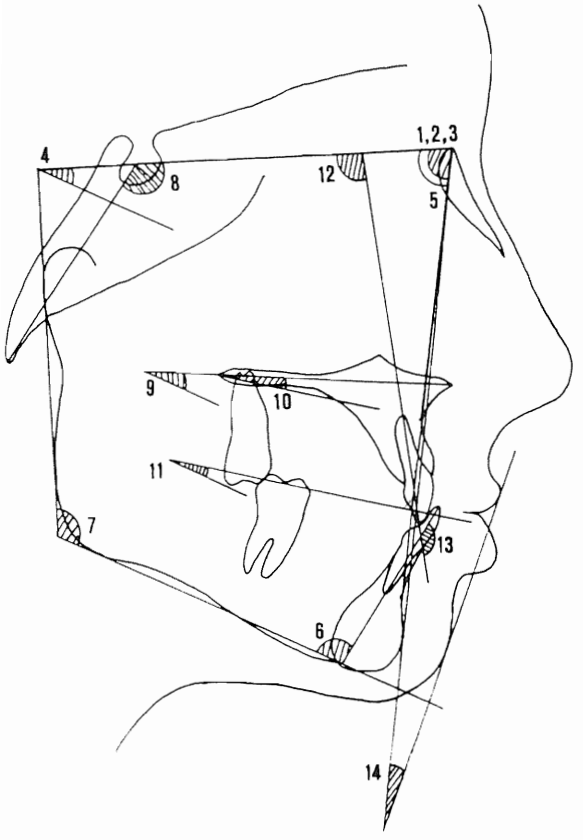

Fig. 5: Angular measurements: 1.SNA, 2.SNB, 3.ANB, 4.GoMeSN (mandibular plane angle), 5.SNPg, 6. IMPA (incisor mandibular plane angle), 7. ArGoMe (Gonial angle), 8.NSBa, 9.PP-MP (palatal plane/mandibular plane), 10.OP-PP (occlusal plane/palatal plane), 11.OP-MP (occlusal plane/mandibular plane, 12. U1-SN, 13.U1-L1 (interincisal angle), 14.H angle (N-Pg/labium superior-soft tissue gnathion), 15. H-ANB (calculated by using variables nos 14 and 3).

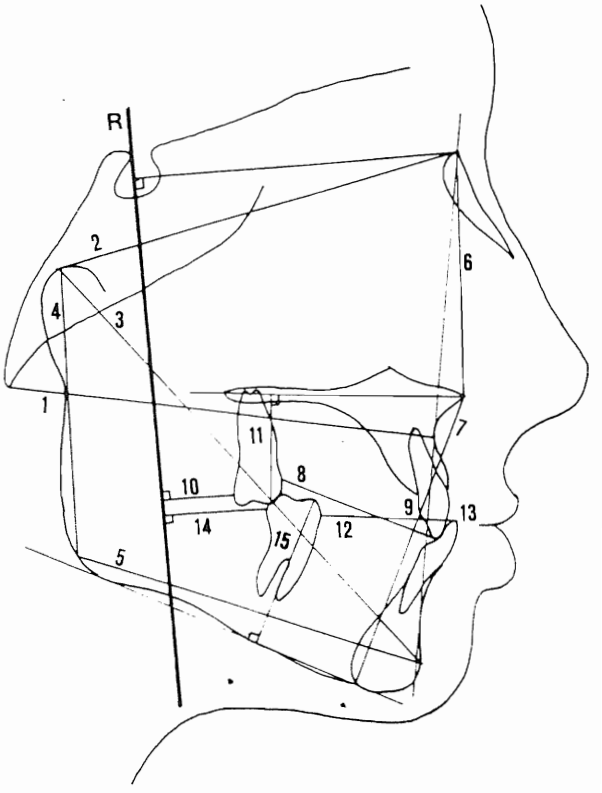

Fig. 6. Linear measurements: 1.Ba-A, 2. Co-N, 3.Co-Pog, 4.Co-Go, 5.Go-Pog, 6. N-ANS, 7.ANS-Me, 8.U1-U6, 9.U1-NA, 10.U6-RP, 11.U6-PP, 12.L1-L6, 13.L1-NB, 14.L6-RP, 15.L6--MP.

tistical evaluation. Intragroup comparisons were performed by using Wilcoxon test and intergroup comparison by using Mann-Whitney U test.

RESULTS

Table 2, 3 and 4 show the results of treatment. In the study 13 of 30 parameters showed statistically significant changes. According to the statistical evaluation the differences between the two groups were significant in the following measurements:

Changes in the sagittal relationship: SNB ($p<0.01$), ANB ($p<0.001$), SNPg ($p<0.01$), H-ANB ($p<0.001$), Co-Pg ($p<0.05$). Sagittal mandibular growth was inhibited and mandibular distal movement was achieved. Changes in the vertical relationship: GoMeSN ($p<0.01$), ArGoMe ($p<0.001$), PP-MP ($p<0.001$), Co-Go ($p<0.001$), ANS-Me ($p<0.001$). Vertical dimension increased due to posterior rotation of the mandible. Changes in the dental relationship: L1-L6 ($p<0.01$), L6-RP ($p<0.001$), L6-MP ($p<0.05$). Lower molars were intruded and significantly distalized.

DISCUSSION

Class III malocclusion usually becomes manifested at a very early age by the appearance of an edge to edge incisor relationship or an anterior crossbite (7, 16). It is generally accepted that orthopaedic problems have to be elimanated in early years of life. Elimination of any ten-

Table 1. Treatment and control groups.

Group	Treatment	N	Average pretreatment age SD (yr)	Observation period (yr)
1	Mandibular headgear	F 13+ M 7=20	8.26 ±0.4	1
2	None (control)	F10+M10=20	8.24 ±0.4	1

F= Female, M= Male, yr= year.

Table 2. Sagittal Skeletal Changes.

	Mandibular headgear (Group 1)							Control (Group 2)							
	Pretreatment		Posttreatment		Difference		Test	Pretreatment		Posttreatment		Difference		Test	Test
	mean	SD	mean	SD	mean	SD	Wilcoxon	mean	SD	mean	SD	mean	SD	Wilcoxon	Mann Whitney U
SNA	78.4	3.4	78.5	3.4	0.1	0.2		79.2	3.1	79.1	3.1	-0.1	0.1		
SNB	77.2	3.8	76.4	3.3	-0.8	1.1	*	80	3.3	80.4	3.6	0.4	0.8		**
ANB	1.2	1.1	2.2	1.3	1	1.3	**	-0.8	1.3	-1.3	1.3	-0.5	1	*	***
SNPg	77.4	3.6	76.5	3.2	-0.9	1.3	**	80.7	3.6	81	3.6	0.3	1		**
H-ANB	6.1	3.3	8	3.5	1.9	3.5	*	6.3	4.1	3.9	3.7	-2.4	1.3	***	***
Ba-A	83.9	4.4	84.6	4.6	0.7	1.9		84.7	3.6	85.5	3.7	0.8	0.6	***	
Co-N	79.7	3.9	79.7	4.2	0	1.6		83.5	3.8	84.5	3.9	1	0.4	***	
Co-Pg	103.7	4.1	104.2	4.1	0.5	1.7		103.7	3.6	110.3	3.6	6.6	1.8	***	*
Go-Pg	68.5	4.7	69	4.5	0.5	1.9		71	3.7	72.9	3.4	1.9	1	***	

$p < 0,05$ *
$p < 0,01$ **
$p < 0,001$ ***

Table 3. Vertical Skeletal Changes.

	Mandibular headgear (Group 1)							Control (Group 2)							
	Pretreatment		Posttreatment		Difference		Test	Pretreatment		Posttreatment		Difference		Test	Test
	mean	SD	mean	SD	mean	SD	Wilcoxon	mean	SD	mean	SD	mean	SD	Wilcoxon	Mann Whitney U
GoMeSN	37	4.4	38.6	4.7	1.6	1.8	***	33.9	6.1	33.9	6.5	0	1		**
NSBa	127.9	5.6	126.8	5	-1.1	3.5		125.4	5.1	126	5.3	0.6	1.8		
ArGoMe	123.5	3.7	125.7	4.7	2.2	3.6	*	125.2	8.1	123.4	8	-1.8	1.9	***	***
PP-MP	26.3	3.9	28.8	4.9	2.5	2.4	***	27.4	4.3	27.1	5.1	-0.3	1.7		***
OP-PP	9.4	2.9	10.6	3.4	1.2	3.4		16.5	4.4	15.9	3.8	-0.6	2.2		
OP-MP	16.3	3.3	17.2	4.9	0.9	4		10.7	3.3	10.9	2.8	0.2	2.8		
Co-Go	52.1	2.8	51.4	2.7	-0.7	1.1	*	53.1	3.5	55	3.4	1.9	0.6	***	***
N-ANS	49	3.3	49.9	3.1	0.9	0.5	***	48.4	2.7	49.4	2.9	1	0.9	***	
ANS-Me	59.6	3.6	63.5	4.3	3.9	2.1	***	60.4	2.4	62.1	3	1.7	1.6	***	***

$p < 0,05$ *
$p < 0,01$ **
$p < 0,001$ ***

dency toward a pseudo Class III malocclusion in early stage of dentition will avoid the need for more aggressive types of therapy in this patients in the future. This investigation was carried on a sufficient number of cases for statistical evaluation. The ages of the patients were close to each other, a factor providing accuracy in the comparison of the results. To standardise the cases from the point of severity of malocclusion, only those cases

Table 4.Dental Changes.

	Mandibular headgear (Group 1)							Control (Group 2)							
	Pretreatment		Posttreatment		Difference		Test	Pretreatment		Posttreatment		Difference		Test	Test
	mean	SD	mean	SD	mean	SD	Wilcoxon	mean	SD	mean	SD	mean	SD	Wilcoxon	Mann Whytney U
U1-SN	97.3	6	98.9	6.1	1.6	5.2		102.7	7.7	103.6	7.9	0.9	2.7		
IMPA	89.7	5.7	87.9	6.1	-1.8	3.5	*	89	8.2	89.2	7.2	0.2	2		
U1-L1	135	8.3	134.4	8.7	-0.6	4.7		135.6	10.2	136	10.4	0.4	3.7		
U1-NA	1.8	1.5	2.9	1.5	1.1	1.5	**	2.4	1.9	3.5	1.8	1.1	1.4	***	
U1-U6	27.3	2.9	29.5	2.9	2.2	2.5	**	28.4	3.3	29.4	3.1	1	0.4	***	
U6-RP	17.1	4.4	16.5	3.4	-0.6	1.8		18.1	3.2	18.4	3.3	0.3	1		
U6-PP	18.2	1.9	18.8	1.8	0.6	0.9	*	18.8	2	19.2	1.8	0.4	1.3		
L1-NB	4.5	1.7	4.3	1.9	-0.2	1		3.8	1.9	3.9	1.9	0.1	0.9		
L1-L6	25.9	2.9	28.1	3	2.2	2.5	**	26.3	2.8	26.5	2.5	0.2	0.6		**
L6-RP	17.6	4.7	13.9	4.2	-3.7	2.6	***	19.2	4.3	20.2	4.5	1	2	*	***
L6-MP	27.8	1.9	27.3	2.2	-0.5	0.8	*	27.5	1.9	27.9	1.9	0.4	1		*

$p < 0,05$ * $p < 0,01$ ** $p < 0,001$ ***

which were able to obtain an edge to edge incisor relationship were included in the study.

Sagittal skeletal changes

The changes in the sagittal relationship showed an inhibition of mandibular sagittal growth and a relative reduction of the total mandibular length compared with the control group due to the change of the growth pattern. These results were consistent with the findings of Battagel and Orton (3). By using mandibular headgear they found orthodontic and orthopaedic changes, mandibular distal movement and a reduction of mandibular sagittal dimension according to the control group.

Vertical skeletal changes

The increase of the GoMeSN angle in the mandibular headgear group indicates posterior rotation of the mandible. The increase in the Gonial angle (ArGoMe) is entirely related to the direction of the force vector. In contrast to our findings Janzen and Bluher (12) reported a decrease in the Gonial angle due to direct forces acting on the mandible. Joho (14) also pointed out a similar effect due to the influence of mandibular headgear. Although the inclination of the palatal plane did not change in the treatment group, the increase in the inclination of the mandibular plane, due to the rotation of the mandible, led to an increase in PP-MP angle.

The decrease of the Co-Go length in the treatment group, compared to the control grup, is related to the change of the growth pattern and posterior rotation of the mandible. This is in agreement with the findings of Joho (14). The increase in the ANS-Me distance was significant in the treatment group due to the posterior rotation of the mandible. This is also in agreement with Battagel and Orton (3) who reported a significant increase in lower anterior face height in mandibular headgear group.

Dental changes

The increase in the L1-L6 distance and the decrease in the L6-RP distance in the treatment group are due to significant lower molar distalization. The decrease in the L6-MP distance in the treatment group is due to the vertical component of the vector which produced intrusion.

In the present study mandibular headgear produced significant molar distalization without molar extrusion. In addition to dental movements, downward and posterior rotation of the mandible was enhanced and its general growth and development was retarded. Nevertheless, no significant backward translation of the mandible was observed. Even though the increase in vertical dimension produced by the appliance may be considered as a disadvantage, which could be eliminated by minor forces, the mandibular headgear is recommended for clinical practice.

Consequently, for orthopaedic purposes mandibular headgear is most effective in the treatment of Class III malocclusions with low angle growth pattern. In such cases, if no dental movement is required, anchoring the roots of the molar teeth in the cortical bone by expanding the inner bow of the facebow, may be useful.

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ADDRESS FOR CORRESPONDENCE:
Dr. Tülin ARUN
Marmara Üniversitesi
Diş Hekimliği Fakültesi
Ortodonti ABD
Büyükçiftlik sokak No:6
80200 Nişantaşı, İstanbul