

# Evaluation of Dentoskeletal changes and Facial Harmony in treated children with Skeletal Class 2

Amirfarhang Miresmaeili DDS. MSs<sup>a</sup>

Nasrin Farhadian DDS. MSs<sup>b</sup>

Marjan Tadjbakhsh DDS<sup>c</sup>

**Introduction:** There are several studies to evaluate dento-skeletal changes after treatment of skeletal class 2 malocclusion with Dr Farmand's functional appliance but in non of them facial harmony has been considered. The purpose of the present study is evaluation of facial harmony in addition to dentoskeletal changes after treatment with Dr Farmand's functional appliance.

**Materials and Methods:** Initial and final cephalograms of eighteen treated skeletal class 2 div 1 patients have been selected. All of them had been treated with Farmand's appliance before termination of growth spurt. Each cephalogram was separately traced two times. Means of before and after treatment data were compared with paired t-test.

**Results:** Skeletal class 2 relationship has been successfully corrected through decreasing ANB angle ( $-1.88 \pm 1.75$ ,  $p=0.00$ ), 66 and angle of convexity ( $-1.47 \pm 1.21$ ,  $p=0.00$ ), and Also dental changes (upper incisor retrusion and lower incisor protrusion) were occurred (decrease of U1 to SN was  $-4.77 \pm 4.71$ ,  $p=0.00$  and increase in IMPA was  $+3.93 \pm 2.87$ ,  $p=0.00$ ). Soft tissue changes involved retrusion of upper lip to E-line ( $-2.86 \pm 1.88$ ,  $p=0.00$ ) and decrease of upper sulcus dept ( $-1.55 \pm 2.04$ ,  $p=0.005$ ) and lower sulcus dept ( $-2.44 \pm 1.85$ ,  $p=0.00$ ) which played an important role in improvement of facial harmony. Lower lip was placed more anteriorly relative to H-line ( $1.37 \pm 1.48$ ,  $p=0.001$ ) which is not desirable in profile harmony.

**Conclusion:** Dr Farmand's functional appliance is effective in treating skeletal class 2 patients by producing skeletal as well as dental improvement. Soft tissue harmony also is improved but final position of lower lip must be regarded more carefully.

**Key words:** Occlusion, Orthodontics, Functional appliance, Lips, Cephalometric

(Received Feb 11, 2005; revised and accepted Sept 20, 2005)

Growth modification by functional appliances in skeletal class 2 malocclusion is an accepted and routine modality of treatment for children with mandibular deficiency. Up to now many types of these appliances were developed such as: Activator, Bionator, Bimler, Frankle functional, Herbst, Twin block ...<sup>1</sup>. In spite of many researches about these appliances there are some doubts about their certain effects specially in soft tissue<sup>2</sup>. Soft tissue profile plays an important role in social relation-

ship and orthodontic considerations. Dr. Farmand an Iranian professor and pioneer in orthodontics innovated a special type of functional appliance in 1968 which has been named FA2. In fact this appliance is a modification of Balter's bionator.

Generally the effects of these appliances are: acceleration in mandibular growth, headgear effect in maxilla, lingual tipping of upper incisors, proclination of lower incisors, redirection of mandibular growth, adaptive changes in glenoid fossa, ...<sup>3,4</sup>.

The aim of present study was to evaluate facial harmony as well as dentoskeletal changes after treatment of patients with skeletal class 2 malocclusion by Dr. Farmand's functional appliance.

<sup>a,b</sup>Assistant professor of orthodontic department, Hamedan University of Medical Sciences

<sup>c</sup> Dentist

Corresponding Author: Dr. Amirfarhang Miresmaeili  
e-mail: Amir.farhang@aaomembers.org

## Method & Materials

Initial and final cephalograms of 18 skeletal class 2 children (9 boys and 9 girls) were selected from Hamedan dental school and 2 other private offices. The inclusion criteria were: skeletal class 2 div 1 with mandibular deficiency before treatment, increased overjet (more than 5 mm before treatment), without missing of permanent tooth in pretreat-

ment panoramic x-ray, full eruption of permanent 1st molar and all incisors before treatment, treated by Dr. Farmand's FA2 (fig. 1) before termination of growth spurt, reduction of overjet after treatment, accepted occlusion after treatment without any tooth extraction.

Each lateral cephalogram was separately traced and 12 skeletal parameters, 8 dental parameters and 10 soft tissue

Table-1. Skeletal changes during treatment with FA2

Skeletal variables	Before treatment		After treatment		P value
	Mean	SD	Mean	SD	
SNA	78.16	4.2	77.43	7.49	0.472
SNB	71.83	3.36	72.83	6.24	0.443
ANB	6.34	2.14	4.45	2.8	0.000*
Saddle angle	124.56	4.77	124.22	4.65	0.491
Articular angle	144.25	5.52	143.8	5.35	0.757
Gonial angle	127.26	7.72	127.2	4.93	0.971
SUM	396.3	4	395.22	4.29	0.008*
FMA	29.9	5.94	28.83	4.29	0.225
Y - Axis	64.02	4.36	62.47	2.85	0.05*
Angle of Convexity	5.23	2.69	3.75	2.79	0.000*
Body length	65.06	5.33	68.84	5.16	0.000*
Ramus height	39.58	5.41	44.26	4.39	0.000*
Jarabac index	61.58	3.3	62.88	3.8	0.002*

\* significant difference

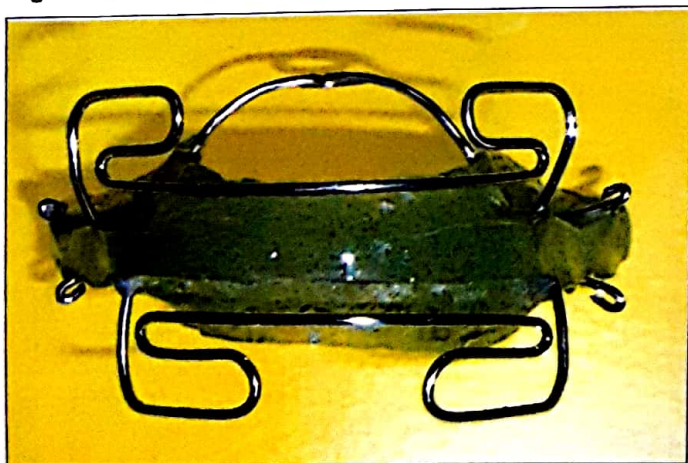
Table-2. Dental changes during treatment with FA2

Dental variables	Before treatment		After treatment		P value
	Mean	SD	Mean	SD	
IMPA	95.47	7.08	99.4	5.75	0.000*
FMIA	54.08	9.3	51.37	6.84	0.022*
U1 to SN	107.13	6.36	102.36	6.32	0.000*
U1 to FH	114.08	7.67	109.65	5.85	0.007*
U1 to NA	4.76	2.72	3.8	2.66	0.212
L1 to NB	4.52	3.09	7.02	3.01	0.000*
Interincisal angle	120.4	8.81	121.98	8.49	0.190
Overjet	6.36	2.4	1.63	0.83	0.000*



**Table-3.** Soft tissue changes

	Before treatment		After treatment		P value
	Mean	SD	Mean	SD	
Soft tissue variables					
Upper lip to E line	0.58	2.12	2.33	7.49	0.000*
Lower lip to E line	0.81	2.89	0.14	2.85	0.117
Upper sulcus depth	6.91	2.25	5.36	1.87	0.005*
Lower sulcus depth	6.37	1.83	3.93	2.25	0.000*
Upper lip thickness	13.33	3.74	12.22	5.75	0.45
Upper lip strain	11.8	2.55	12.76	2.73	0.096
Lower lip to H line	0.26	1.79	1.63	1.80	0.001*
Nose tip to H line	-1.74	4.34	3.3	4.06	0.000*
H line angle	20.54	5.81	17.25	5.64	0.000*
Soft-tissue chin thickness	5.23	1.6	3.75	1.70	0.000*

**Fig 1.** Dr. Farmand 's functional appliance FA2

parameters were measured two times by one orthodontist then the mean of 2 measurements was used for analysis. Dentoskeletal changes and facial harmony were analyzed according to a combination analysis and Holdaway analysis. Mean of each data, before and after treatment, were compared by paired t test.

## Results

9 boys and 9 girls were included in this study. Mean age of patients after treatment was  $13y,7mo \pm 2y,1mo$  and mean of treatment duration was  $15.6mo \pm 7.4mo$ .

Overjet has been reduced from  $6.36 \pm 2.4$  to  $1.63 \pm 0.83$  mm and it is the result of significant skeletal as well as dental changes (protrusion of lower incisors and retrusion of upper incisor teeth) that have been occurred during treatment and shown in tables 1, 2 with different colors.

These findings indicates that the skeletal class 2 patients has been treated principally by reduction of ANB angle, angle of convexity and increase of body length and ramus height.

In table 3 according to Holdaway(5), soft tissue changes are shown. The most obvious results are: retraction of upper lip, protrusion of lower lip, decrease of lower and upper sulcus depth, increase of H line angle and nasolabial angle.

## Discussion

A lot of functional appliances have been invented which are distributed between two extremes: completely tooth borne ie herbst appliance and completely tissue borne ie Frankle appliance (3). Dr.Farmand's functional appliance which is a modified bionator appliance has both tooth born and tissue born component. In our skeletal class 2 treated cases, both dental and skeletal changes could be noticed. Although the skeletal changes are more stable and are the main target of functional therapy, all of these appliance (even the Frankle) has some dental effects. Significant improvement in ramus height, body length and ANB angle

without harmful effect on vertical dimension may be due to perfect case selection, design of appliance and control of tooth eruption by acrylic bite.

One of the main advantages of Dr Farmand functional appliance in comparison to Frankle is its reduced size which may be more easily accepted by the patients. The other one is its ability to control the eruption of posterior teeth by acrylic reduction which is not possible in Frankle appliance. Although Herbst appliance is more suitable for less cooperative patients, it may have more dental effects than skeletal one.

Dental changes including proclination of lower incisors and retroinclination of upper incisors were predictable even in Frankle's. Mc Namara et al. in 1985 reported about 1mm proclination in lower incisors after treatment with Frankle appliance<sup>6</sup>.

Results in table 3 show a general improvement of harmony in soft tissue profile that is in contrast with O'Neil's et al. they found no improvement in attractiveness of patients treated with Frankle & with Harvold activator and without treatment<sup>7</sup>. With close examination of these data one could see that the lower lip prone to become more conspicuous

than the upper lip and the chin. This could be as a result of backward movement of the upper lip through its tip but

forward movement of lower lip with its tip and base together. Therefore the final position of the lower lip may be more anterior than the upper lip and the chin and this can cause unfavorable result on profile in spite of favorable changes in skeleton.

## Conclusion

Dr Farmand functional appliance is effective in treating skeletal class 2 patients by producing skeletal as well as dental improvement. Soft tissue harmony also is improved but final position of lower lip must be regarded more carefully.

## References

- 1- Graber T.M., Rakosi T., Petrovic A.G. Dentofacial orthopedics with functional appliances. 2nd ed. Mosby, St. Louis, 1997: 85-86
- 2- Battagel J.M. Profile changes in class 2 division 1 malocclusions: a comparison of the effect of edgewise and Frankle appliance therapy. Eur J Orthod 1989; 11:243-253.
- 3- Proffit W.R. Contemporary orthodontics. Mosby, St. Louis, 2000: 368-9, 478-484.
- 4- Woodside D.G. Do functional appliances have an orthopedic effects? Am J Orthod Dentofac Orthop. 1999; 115(4): 373-381.
- 5- Holdaway R.A. "A soft tissue cephalometric analysis and its use in orthodontic treatment planning. Part 1" Am J Orthod Dentofac Orthop. 1983 Jul; 84(1):1-28
- 6- Mc Namara J.A., Bookstein F.L. Skeletal and dental changes following functional regulator therapy on class 2 patients. Am J Orthod Dentofac Orthop. 1985; 88(2):90-110.
- 7- O'Neil K., Harkness M., Knight R. "Rating of Profile Attractiveness After Functional Appliance Treatment." Am J Orthod Dentofac Orthop. 2000 Oct; 118(4):371-381