Original Article

An Analysis of the Corrective Contribution in Activator Treatment

Paola Cozza, MD, DDS, MS[a]; Laura De Toffol, DDS[b]; Lucilla Iacopini, DDS[b]

Abstract: This retrospective study (1) cephalometrically investigates the effectiveness of activator therapy, (2) evaluates the contribution of skeletal growth in the self-correction of the Class II malocclusion, and (3) analyzes separately the dental and skeletal responses to activator treatment and the differences between the incisor and molar areas. The subjects, all in the mixed dentition, were selected from a single center and were divided into a group of 40 Class II patients treated with an activator and an untreated group of 30 Class II patients. Dentoskeletal changes that occurred were compared on lateral cephalograms taken before the treatment/observation period and after 21 months (standard deviation, three months). When the activator patients were compared with the untreated control subjects, therapy promoted a combination of skeletal and dental changes that led to an improvement of the sagittal discrepancy. Other changes observed in the untreated Class II subjects did not bring about a correction of the malocclusion. An analysis of the corrective contributions in activator therapy in the posterior area showed that the orthopedic effects were greater than the dental effects in correcting the posterior occlusal relationship. In the anterior area of the arch, although both the skeletal and dental changes were favorable toward the sagittal correction, the skeletal contribution was greater than the dental contribution. In general, the skeletal contribution (140%) exceeded the dental correction (60%), and the mandibular changes (73%) exceeded the maxillary contribution (27%) both in the anterior and posterior regions. (*Angle Orthod* 2004;74:741–748.)

Key Words: Functional therapy; Activator

INTRODUCTION

Many articles demonstrate the effectiveness of the activator in the treatment of Class II malocclusion caused by mandibular retrognathism in growing patients.[1–9] Most report that the improvement of the sagittal problem depends on a combination of dental and skeletal effects on the maxilla and the mandible, including a retroclination of the upper incisor, a proclination of the lower incisor, a reduced maxillary forward growth, and an effective mandibular growth. However, very few quantify the relative weight of skeletal and dental contributions to the correction of the sagittal problem.

A working hypothesis was introduced by Pancherz[10] and later by Weiland et al,[11] Vardimon and Saduman,[12] and O'Brien et al[13] to more precisely identify the mode of action of the activator. In this work a study group (growing patients with treated Class II malocclusion) was compared with a control group (growing patients with untreated Class II malocclusion). The aims of this study were to demonstrate the effectiveness of the activator therapy, to evaluate the contribution of skeletal growth in the self-correction of the Class II malocclusion in the untreated subjects, and to analyze separately the dental and skeletal responses to activator therapy and the differences between the incisor and molar areas.

MATERIALS AND METHODS

The subjects for both the study and control groups were selected from a single center (Department of Orthodontics, University of Rome 'Tor Vergata'). The following selection criteria were used: (1) 9–11 years of age; (2) overjet greater than five mm; (3) Class II molar relationship, with at least half a cusp width distal molar relationship; (4) skeletal Class II malocclusion with the ANB angle greater than 5°; (5) retrognathic mandible, with the SNB angle <78°; and (6) no history of previous orthodontic therapy.

Patients satisfying these criteria were divided into a control group of 30 subjects (15 girls and 15 boys), who had declined activator therapy, and a treatment group of 40 subjects (20 girls and 20 boys), who underwent activator ther-

[a] Professor, Department of Orthodontics, School of Dentistry, University of Rome 'Tor Vergata', Rome, Italy.
[b] Private Practices, Rome, Italy.
Corresponding author: Paola Cozza, MD, DDS, MS, Via Veio 53, 00183 Rome, Italy
(e-mail: p.cozza@flashnet.it).

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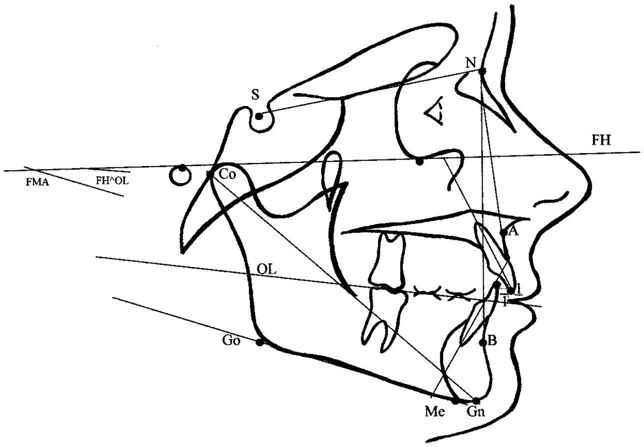

FIGURE 1. Cephalometric analysis: SNA angle, SNB angle, ANB angle, Go-Me (mm), Co-Gn (mm), FMA angle, FH-OL angle, IMPA angle, 1-FH angle, interincisal angle, overjet (mm), overbite (mm).

apy. Only cases with good cooperation and treatment responses from the patients were selected.

The appliance used was an acrylic monobloc with a central screw attached to the upper jaw by Adams clasps. The appliance was designed to avoid undesirable anterior dental movements and two mm of the labial surfaces of the maxillary and mandibular incisors were capped to prevent tipping.

The appliance was produced from a construction bite that positioned the mandible anteriorly in an edge-to-edge incisal relationship. The lower jaw was postured forward in a Class I or overcorrected Class I molar relationship to stimulate mandibular growth. During treatment, contact was maintained between the appliance and the maxillary posterior teeth. The mandibular posterior teeth were encouraged to erupt by trimming acrylic on the occlusal and lingual aspect.

The patients were instructed to wear the appliance a minimum of 14 h/d. The skeletal and dental changes that occurred were assessed on two lateral cephalometric radiographs. In the treatment group, the first cephalogram was taken before treatment (T0) and the second one at achieving a Class I occlusal relationship (after 21 + 3 months) (T1). In the control group, radiographs were obtained at the same interval.

The initial cephalometric patterns of the control and treated subjects, as well as the alterations due to growth or treatment, were assessed using the following angles and distances:

- Sagittal analysis: SNA angle, SNB angle, ANB angle, Go-Me (mm), Co-Gn (mm)
- Vertical analysis: FMA angle, FH-OL angle
- Dental analysis: IMPA angle, 1-FH angle, interincisal angle, overjet (mm), overbite (mm) (Figure 1)

Other measuring points and reference lines used were

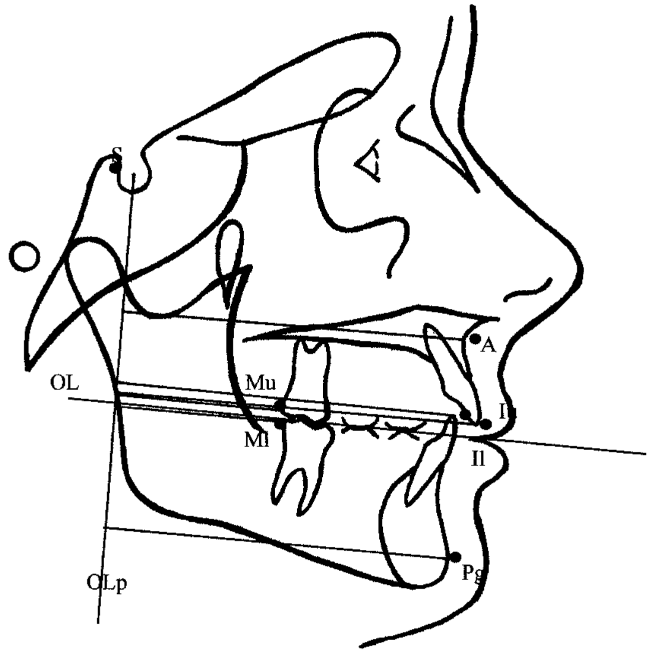

FIGURE 2. Sagittal registrations performed to the OLp and parallel to OL: A-OLp, Pg-OLp, Iu-OLp, Il-OLP, Mu-OLp, Ml-OLp.

those defined by Pancherz.[10] These linear measurements for the assessment of sagittal relationships were performed using the occlusal line (OL) and the occlusal line perpendicular (OLp) drawn through the sella. The reference grid was taken from the first head film (T0) and transferred to the T1 tracing using the sella-nasion line (SN), with sella as the registration point. All sagittal registrations were performed to the same reference line (OLp) and parallel to OL: A-OLp, Pg-OLp, Iu-OLp, Il-OLP, Mu-OLp, and Ml-OLp (Figure 2).

Method error

Each cephalogram was traced and measured by Dr Cozza. All measurements were repeated after a period of seven days, and the mean value of the two measurements was used. All measurement error coefficients were found to be close to 1.00 and within acceptable limits (Table 1).

Statistical method

Descriptive statistics included mean and standard deviation. The mean intragroup differences in cephalometric measurements at T0 and T1 were examined with Wilcoxon rank sum test and differences at T0 and T1 between the control and treated groups with the Mann-Whitney test. The level of significance used was $P < .05$. Nonparametric tests used as the variables studied were not normally distributed.

Percent evaluation of the corrective contribution

Skeletal and dental effects in activator therapy were analyzed excluding the physiological correction due to

TABLE 1. Method Error Coefficient

	Variables	*R*
1	SNA (°)	.99
2	SNB (°)	.98
3	ANB (°)	.98
4	Go-Me (mm)	.99
5	Co-Gn (mm)	.98
6	FMA (°)	.98
7	FH^OL (°)	.98
8	IMPA (°)	.97
9	1^FH (°)	.98
10	Interincisal angle (°)	.97
11	Overjet (mm)	.98
12	Overbite (mm)	.99
13	A-OLp (mm)	.99
14	Pg-OLp (mm)	.98
15	Iu-OLp (mm)	.98
16	Il-OLp (mm)	.99
17	Mu-OLp (mm)	.99
18	Ml-OLp (mm)	.97

growth. Therefore, the values considered (defined δ—delta) were derived from the difference between the average (T1 − T0) of the treatment group and the control group. Two skeletal and two dental parameters were chosen both for the incisor and molar areas.

The dental parameter considered the movement of the teeth inside a skeletal base, which itself undergoes a displacement during treatment. For example, the upper incisor has been expressed as (Iu-OLp)-(A-OLp) or considering the net dental movement from which the maxillary skeletal base displacement was subtracted.

Molar correction

For the intermolar relationship correction, the following parameters were considered:

- A-OLp expresses the influence of therapy on the maxillary skeletal base growth
- Pg-OLp expresses the influence of therapy on the mandibular skeletal base growth
- (Mu-OLp)-(A-OLp) expresses the influence of therapy on the first upper molar movement
- (Ml-OLp)-(Pg-OLp) expresses the influence of therapy on the first lower molar movement

Overjet correction

For the interincisor relationship correction, the following parameters were considered:

- A-OLp expresses the influence of therapy on the maxillary skeletal base growth
- Pg-OLp expresses the influence of therapy on the mandibular skeletal base growth
- (Iu-OLp)-(A-OLp) expresses the influence of therapy on the upper incisor movement
- (Il-OLp)-(Pg-OLp) expresses the influence of therapy on the lower incisor movement

The sum of the absolute values (without plus or minus sign) of these parameters corresponds to the molar or overjet correction. Each of these values was put into a proportion with the sum, giving the corrective contribution (in percentage) of every maxillary and mandibular dental and skeletal component. The following proportion has been used:

x:partial contribution = 100:total contribution;
x = partial contribution × 100/total contribution.

RESULTS

Before treatment all patients had a dental and skeletal Class II malocclusion and an increased overjet. Table 2 shows the differences between the study and control groups at baseline (T0). The changes observed in the measured variables are shown in Tables 3 and 4, which present the averages and standard deviations of each cephalometric measurement considered before (T0) and after the treatment/observation period (T1). The comparison between the study and control group changes is shown in Table 5. To evaluate skeletal and dental corrections during activator treatment, the anterior and posterior areas were considered separately (Table 6).

Molar area

The amount of molar correction results from the sum of dental ((Mu-OLp)-(A-OLp) = 0.37 mm, (Ml-OLp)-(Pg-OLp) = 1.17 mm) and skeletal (A-OLp = −1.26, Pg-OLp = 3.14 mm) values and is 5.94 mm (Figures 3 and 4).

Using the proportion, the results show that the maxillary contribution (27%) comprised 21% skeletal movement and 6% upper molar drift. Although A-OLp value has a minus sign (−1.26 mm), which expresses a skeletal growth constraint, (Mu-OLp)-(A-OLp) has a plus sign (0.37 mm), which indicates a mesial movement of the upper molar.

The mandibular contribution (73%) comprised 53% skeletal movement and 20% lower molar drift. As in the maxilla, the skeletal parameter (Pg-OLp = 3.14) has a plus sign, which indicates a mandibular advancement. On the contrary, the dental value has a minus sign ((Ml-OLp)-(Pg-OLp) = −1.17 mm), which indicates a distal movement of the lower molars.

Incisor area

The amount of interincisor relationship correction results from the sum of dental ((Iu-OLp)-(A-OLp) = 0.55 mm, (Il-OLp)-(Pg-OLp) = 1.72 mm) and skeletal (A-OLp = −1.26, Pg-OLp = 3.14 mm) values and is 6.67 mm (Figures 5 and 6).

Using the proportion, the results show that the maxillary

TABLE 2. Comparison Between Study and Control Groups at T0: Mean Values, Standard Deviations, and Significance

	Variables	T1 − T0 Study Group (n = 40)	SD	T1 − T0 Control Group (n = 30)	SD	*P*
1	SNA (°)	81.83	3.03	83	1.64	*
2	SNB (°)	74.75	2.81	77.33	2.25	**
3	ANB (°)	7.08	1.81	5.70	1.03	**
4	Go-Me (mm)	65.61	4.88	69.83	4.50	NS
5	Co-Gn (mm)	101.69	6.32	108.73	3.65	**
6	FMA (°)	23.28	4.01	20.67	1.48	**
7	FH^OL (°)	10.02	2.14	8.80	1.77	NS
8	IMPA (°)	95.67	5.57	96.40	7.75	NS
9	1^FH (°)	115.25	4.60	113.07	7.49	NS
10	Interincisal angle (°)	125.44	6.1	128	12.47	NS
11	Overjet (mm)	8.72	1.83	6	1.84	***
12	Overbite (mm)	4.53	2.00	3.33	2.25	NS
13	A-OLp (mm)	75.53	3.71	76.83	3.99	NS
14	Pg-OLp (mm)	73.83	4.29	77.67	5.55	*
15	Iu-OLp (mm)	82.67	4.60	84	4.53	NS
16	Il-OLp (mm)	73.05	4.02	77.67	4.4	**
17	Mu-OLp (mm)	47.50	3.39	50.17	4.21	NS
18	Ml-OLp (mm)	44.47	3.32	48	4.76	*

* $P < .05$; ** $P < .01$; *** $P < .001$. NS, not significant.

contribution (27%) comprised 19% skeletal movement and 8% upper incisors movement. Both parameters considered have minus sign values and respectively express a skeletal growth constraint and an upper incisors retraction.

The mandibular contribution (73%) comprised 47% skeletal movement and 26% lower incisors movement. As in the maxilla, both parameters considered have positive values and respectively express a skeletal mandibular advancement and a lower incisors proclination.

DISCUSSION

The first aim of this work was to evaluate the effectiveness of the activator in the treatment of the Class II malocclusion in growing subjects. When the patients of the activator group were compared with untreated control subjects, a relative maxillomandibular displacement was observed (ANB, −2.14°), which was mainly due to advancement of the mandibular structures (SNB, 1.64°; Co-Gn, 5.67 mm; Pg-OLp, 5.14 mm) and a less important maxillary growth inhibition (SNA, −0.5°).

Dentoalveolar effects (proclination of the lower incisors [IMPA, 1.55°] and retroclination of the upper incisors [1-FH, −5.64°]) played an important role in this correction. The molar drifts had a favorable direction toward the correction of the Class II molar relationship, even if the comparison with the control group changes was not statistically significant.[14]

The second aim was to evaluate the contribution of skeletal growth to the self-correction of the Class II malocclusion in the untreated subjects. The changes in the untreated control subjects can be summed up as an increase of the mandibular length and an advancement of the mandibular structures (SNB, 0.17°; Co-Gn, three mm; Pg-OLp, two mm), an advancement of the maxillary base (SNA, 0.33°; A-OLp, 2.23 mm), a mesial drift of the lower molars (Ml-OLp, 2.67 mm), a mesial drift of the upper molars (Mu-OLp, 2.83 mm), a retroclination of the lower incisors (IMPA, −1.67°), and a slight retroclination of the upper incisors (1-FH, −0.73 mm).

However, these changes do not bring about a correction of the malocclusion. The differential growth of the skeletal bases is not enough for the correction of the sagittal discrepancy, and the teeth are not able to follow the movement of the bony bases. The reason for this has been identified as the intercuspation of the upper and lower dentition, which maintains the same dental relationship, independently from the skeletal growth.[15] Unlocking the intercuspation of the upper and lower dentition could negate the adaptive mechanism and allow the mandible to carry the overlying lower dentition forward with it during normal growth.

The third aim of this study was to analyze separately the dental and skeletal responses to activator therapy on the dental arches and the differences between incisor and molar areas.

Molar area

The molar relationship was corrected one-fourth dentally (26%) and three-fourths skeletally (74%). The molar drifts were unfavorable toward the improvement of the Class II relationship but are subsumed into the favorable skeletal changes. Thus, the orthopedic effects are greater than the dental effect in correcting the posterior occlusal relationship.

Probably the dentoalveolar adaptation mechanism is the

TABLE 3. Study Group (n = 40): Averages and Standard Deviations Before and After Treatment; Means and Standard Deviations; and Significance

	Variables	T0	SD	T1	SD	Mean	SD	*P*
1	SNA (°)	81.83	3.03	81.33	2.81	−0.5	1	NS
2	SNB (°)	74.75	2.81	76.39	2.95	1.64	1.3	***
3	ANB (°)	7.08	1.81	4.94	1.40	−2.14	1	***
4	Go-Me (mm)	65.61	4.88	67.97	5.39	2.36	1.76	***
5	Co-Gn (mm)	101.69	6.32	107.36	7.44	5.67	4.85	***
6	FMA (°)	23.28	4.01	23.75	4.42	0.47	1.83	NS
7	FH^OL (°)	10.02	2.14	11.28	2.69	1.25	2.24	*
8	IMPA (°)	95.67	5.57	97.22	4.76	1.55	3.09	NS
9	$\underline{1}$^FH (°)	115.25	4.60	109.61	4.51	−5.64	4.12	***
10	Interincisal angle (°)	125.44	6.1	128.86	5.52	3.42	6.4	*
11	Overjet (mm)	8.72	1.83	3.69	1.46	−5.03	1.45	***
12	Overbite (mm)	4.53	2.00	3.36	1.61	−1.17	2	*
13	A-OLp (mm)	75.53	3.71	76.50	3.92	0.97	1.55	*
14	Pg-OLp (mm)	73.83	4.29	78.97	5.17	5.14	3.25	***
15	Iu-OLp (mm)	82.67	4.60	82.86	4.29	0.19	3.10	NS
16	Il-OLp (mm)	73.05	4.02	78.64	6.35	5.59	4.83	***
17	Mu-OLp (mm)	47.50	3.39	49.44	4.14	1.94	2.34	**
18	Ml-OLp (mm)	44.47	3.32	49.11	4.33	4.64	2.57	***

* $P < .05$; ** $P < .01$; *** $P < .001$. NS, not significant.

reason why the forward growth of the mandible did not carry the dentition with it. The intercuspation of the upper and lower dentition was unlocked only when the appliance was worn (14/24 h), which prevents the dentoalveolar processes from following the movement of the bony bases.[15]

Jakobsson[16] and Wieslander and Lagerstrom[17] were the first to introduce a reference grid system to evaluate dental and skeletal changes during activator treatment using a perpendicular to SN line[16] or to Frankfort plane.[17] Moreover, these studies used a control group of untreated Class II subjects. Jakobsson[16] found no statistical differences in the changes observed in treated and control subjects at the upper molars.

Wieslander and Lagerstrom[17] obtained similar results and reported no significant differences in the position of upper and lower molars between the activator and control groups.

Later, two other studies were reported using a cephalometric reference grid system (OLp) to determine the dental and skeletal effects of an activator. However, the findings are not entirely comparable with those reported in our work because values reported by Pancherz[10] and Weiland et al[11] referred to the changes obtained with the appliance, without excluding the effect of physiological growth.

Pancherz[10] found that the molar correction (5.1 mm) was the result of the mandibular growth (4.7 mm) and the mesial drift of the lower molars (2.3 mm). The skeletal maxillary changes (−2.3 mm) were unfavorable, and the upper incisor movement (0.4 mm) was not significant.

Weiland et al[11] found that, with the Herren activator therapy, the molar correction (2.73 mm), the dental (1.49 mm) and the skeletal (1.24 mm) components contributed equally. These results were compared with those obtained in a Jasper Jumper group and a headgear-activator group. In the Herren activator group the correction of the molar relationship was smallest, but it was mainly due to skeletal adaptation. This confirms the opinion that rapid dentoalveolar compensation prevents a more marked correction of the skeletal discrepancy in Class II malocclusion.

Two other studies in the literature analyzed the skeletal and dental effects in the treatment of Class II malocclusion, using other kinds of functional appliances. Moreover, these articles expressed the results obtained as a percentage. Interestingly, these works used a control group and, therefore, changes observed were due to the net effect of therapy, excluding the effect of physiological growth.

Vardimon and Saduman[12] used a removable functional magnetic system (FMS) for the treatment of skeletal Class II malocclusion and reported different findings. The molar correction was achieved by distal movement of the upper molar (32.5%), retraction of the maxillary base (28%), mesial drift of the lower molar (21.5%), and mandibular skeletal advancement (18%). The molar relationship was corrected half skeletally and half dentally.

O'Brien et al[13] used a modified Twin-Block and found that in the molar correction, the dental component (59%) exceeded the skeletal one (41%) as well. The major cause of molar relationship improvement was the mesial drift of the lower molar (33%), followed by the distal movement of the upper molar (26%), mandibular skeletal advancement (22%), and maxillary retraction (19%).

Incisor area

An analysis of our findings shows that the incisor relationship was corrected one-third dentally (34%) and two-thirds skeletally (66%). In the anterior area of the arch, both

TABLE 4. Control Group (n = 30): Averages and Standard Deviations Before and After Treatment; Means and Standard Deviations; and Significance

	Variables	T0	SD	T1	SD	Mean	SD	*P*
1	SNA (°)	83	1.64	83.33	1.48	0.33	0.49	NS
2	SNB (°)	77.33	2.25	77.50	2.28	0.17	0.41	NS
3	ANB (°)	5.70	1.03	5.83	1.57	0.13	0.61	NS
4	Go-Me (mm)	69.83	4.50	72	3.75	2.17	1.71	**
5	Co-Gn (mm)	108.73	3.65	111.73	6.83	3	3.68	**
6	FMA (°)	20.67	1.48	19.33	5.23	−1.33	5.22	NS
7	FH^OL (°)	8.80	1.77	8.67	1.48	−0.13	1.90	NS
8	IMPA (°)	96.4	7.75	94.73	6.49	−1.67	1.29	**
9	1^FH (°)	113.07	7.49	112.33	5.21	−0.73	4.08	NS
10	Interincisal angle (°)	128	12.47	133.33	8.91	5.33	4.17	***
11	Overjet (mm)	6	1.84	5.87	2.5	−0.13	0.88	NS
12	Overbite (mm)	3.33	2.25	6.67	2.12	3.33	1.18	***
13	A-OLp (mm)	76.83	3.99	79.07	3.88	2.23	1.37	***
14	Pg-OLp (mm)	77.67	5.55	79.67	3.97	2	3.05	NS
15	Iu-OLp (mm)	84	4.53	86	3.46	2	1.69	**
16	Il-OLp (mm)	77.67	4.4	78.4	3.6	0.73	2.05	NS
17	Mu-OLp (mm)	50.17	4.21	53	2.35	2.83	2	***
18	Ml-OLp (mm)	48	4.76	50.67	3.92	2.67	2.55	**

* $P < .05$; ** $P < .01$; *** $P < .001$. NS, not significant.

TABLE 5. Changes in Study and Control Groups from T0 to T1: Mean Values, Standard Deviations, and Significance

	Variables	T1 − T0 Study Group (n = 40)	SD	T1 − T0 Control Group (n = 30)	SD	*P*
1	SNA (°)	−0.5	1	0.33	0.49	*
2	SNB (°)	1.64	1.3	0.17	0.41	***
3	ANB (°)	−2.14	1	0.13	0.61	***
4	Go-Me (mm)	2.36	1.76	2.17	1.71	NS
5	Co-Gn (mm)	5.67	4.85	3	3.68	NS
6	FMA (°)	0.47	1.83	−1.33	5.22	NS
7	FH^OL (°)	1.25	2.24	−0.13	1.90	NS
8	IMPA (°)	1.55	3.09	−1.67	1.29	***
9	1^FH (°)	−5.64	4.12	−0.73	4.08	**
10	Interincisal angle (°)	3.42	6.4	5.33	4.17	NS
11	Overjet (mm)	−5.03	1.45	−0.13	0.88	***
12	Overbite (mm)	−1.17	2	3.33	1.18	***
13	A-OLp (mm)	0.97	1.55	2.23	1.37	*
14	Pg-OLp (mm)	5.14	3.25	2	3.05	*
15	Iu-OLp (mm)	0.19	3.10	2	1.69	*
16	Il-OLp (mm)	5.59	4.83	0.73	2.05	***
17	Mu-OLp (mm)	1.94	2.34	2.83	2	NS
18	Ml-OLp (mm)	4.64	2.57	2.67	2.55	NS

* $P < .05$; ** $P < .01$; *** $P < .001$. NS, not significant.

the skeletal and dental changes were favorable toward the sagittal correction. The skeletal contribution was greater than the dental effect, as can be seen in the molar region of the dental arch.

Jakobsson[16] found an improvement in overjet (−3.3 mm), a retroclination of the maxillary incisors (−2.0 mm), and a proclination of the lower incisors (1.2 mm).

Wieslander and Lagerstrom[17] obtained similar results and reported a significant retroclination of the upper incisors (−3.33 mm) but no significant differences in the position of lower incisors between the activator and control groups.

Pancherz[10] found that the dental and skeletal effects of the activator appliance are equivalent in both the molar and incisor areas. The overjet correction (5 mm) was mainly due to a retroclination of the upper incisor (2.5 mm) and to the mandibular skeletal advancement (4.7 mm), whereas the forward growth of the maxillary base (−2.3 mm) was considered unfavorable toward the correction. The lower incisor did not change its position significantly (0.1 mm).

Weiland et al[11] found that with Herren activator therapy, the overjet correction (3.58 mm) was due mostly to the dental component (2.09 mm) that was greater than the skeletal component (1.49 mm). The retraction of the upper incisor (1.10 mm), together with the skeletal mandibular ad-

TABLE 6. Mean Changes (T1 − T0) in Study and Control Groups, and Differences Between the Means (Delta)

Variables (mm)	Mean, Study Group	Mean, Control Group	Delta
A-OLp	0.97	2.23	−1.26
Pg-OLp	5.14	2	3.14
Iu-OLp	0.19	2	−1.81
Il-OLp	5.59	0.73	4.86
Mu-OLp	1.94	2.83	−0.89
Ml-OLp	4.64	2.67	−1.97
(Iu-OLp)-(A-OLp)	−0.78	−0.23	−0.55
(Il-OLp)-(Pg-OLp)	0.45	−1.27	1.72
(Mu-OLp)-(A-OLp)	0.97	0.6	0.37
(Ml-OLp)-(Pg-OLp)	−0.5	0.67	−1.17

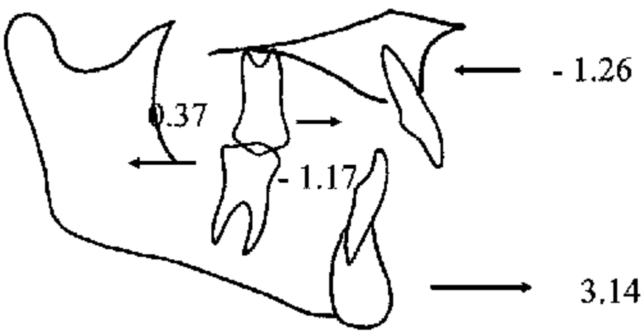

FIGURE 3. Skeletal and dental changes in the molar area.

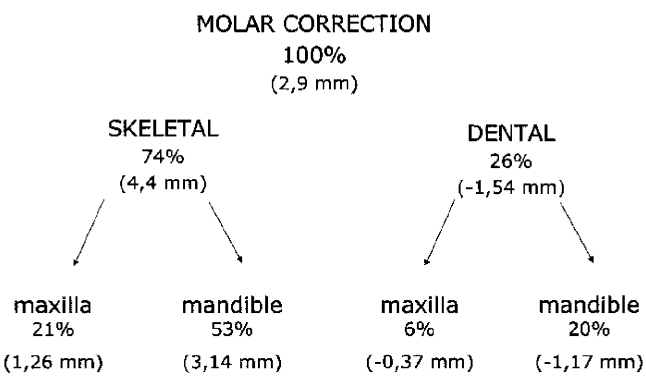

FIGURE 4. Contribution of skeletal and dental changes to molar correction. (Positive values indicate a favorable change toward the correction; negative values indicate an unfavorable change toward the correction.)

vancement (2.02 mm), was the main change responsible for the anterior correction. According to Pancherz, the lower incisor proclination is slight (0.92 mm) and the maxillary growth does not favor the sagittal correction (−0.53 mm).

Vardimon et al[12] found that, with a removable FMS, the overjet correction was achieved by retroclination of the upper incisor (43.5%), lower incisor proclination (22%), maxillary skeletal growth constraint (21%), and mandibular skeletal advancement (13.5%). The incisor relationship was corrected one-third skeletally and two-thirds dentally.

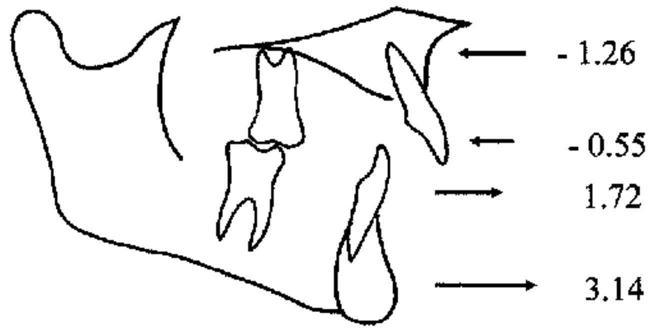

FIGURE 5. Skeletal and dental changes in the incisor area.

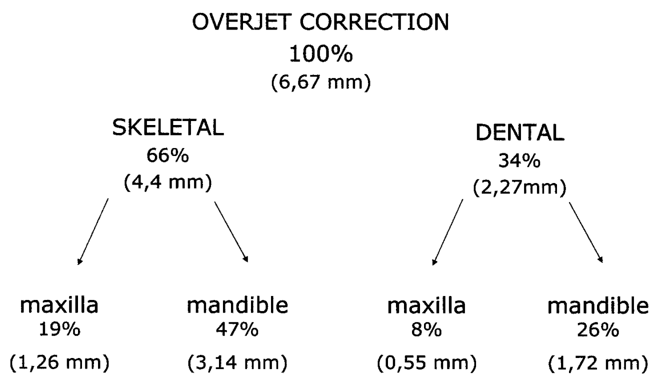

FIGURE 6. Contribution of skeletal and dental changes to overjet correction. (Positive values indicate a favorable change toward the correction; negative values indicate an unfavorable change toward the correction.)

O'Brien et al[13] used a modified Twin-Block and found that the overjet correction was due mostly to the dental changes (73%), which included retroclination of the upper incisors (44%) and proclination of the lower incisors (29%). Skeletal changes (27%) consisted of a slight maxillary retraction (13%) and mandibular advancement (14%).

CONCLUSIONS

When the activator patients were compared with untreated control subjects, therapy promoted a combination of skeletal and dental changes that led to an improvement of the sagittal discrepancy. The changes that occurred in the untreated control subjects did not bring about a correction of the malocclusion.

During activator treatment, the molar drifts are unfavorable toward the improvement of the Class II relationship but are subsumed into the favorable skeletal changes. Thus, the orthopedic effects are greater than the dental effects in correcting the posterior occlusal relationship.

In the anterior area of the arch, both the skeletal and dental changes are favorable toward the sagittal correction, but the skeletal contribution is greater than the dental contribution.

In general, the skeletal contribution (140%) exceeded the dental correction (60%) and the mandibular changes (73%)

exceeded the maxillary contribution (27%) both in the anterior and posterior regions.

In functional therapy a slight dental response allows the skeletal changes to achieve a more marked correction of Class II sagittal discrepancy, with a net improvement of the facial profile.

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