Original Article

Early versus late intermaxillary elastics in patients with Class II malocclusion: a randomized clinical trial

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ABSTRACT

Objectives: To compare efficacy and treatment duration of early versus late Class II elastics in patients with Class II malocclusion.

Material and Methods: Forty patients were randomized into two groups based on the timing of elastics use: early and late. In the early group, light short elastics were used from the day of placement of fixed preadjusted edgewise appliances. In the late group, elastics were inserted once 0.016 × 0.022-inch stainless steel archwires were in place. Lateral cephalograms and standardized smile photographs were taken before treatment and after achieving a Class I buccal segment relationship. Treatment duration, dental, skeletal, and soft tissue measurements were then compared between the two groups.

Results: Maxillary central incisors were retroclined relative to the SN plane (95% confidence interval (CI): 3.75°–11.99° and 3.96°–9.18° in the early and late groups, respectively) with clockwise rotation of the occlusal plane (95% CI: 3.75°–11.99° and 3.96°–9.18° in the early and late groups, respectively). Treatment duration to level and align and reach Class I buccal occlusion was significantly less in the early group (95% CI: 4.74–10.8 months). Comparison between groups revealed no significant differences for all measurements except MP/SN and PP/SN angles ($P < .05$).

Conclusions: Class II elastics were equally effective and more efficient in the early group with significantly less time needed to level and align and reach Class I buccal occlusion compared to the late group. (*Angle Orthod*. 2025;95:587–594.)

KEY WORDS: Class II malocclusion; Elastics; Early treatment; Gingival display

INTRODUCTION

Class II malocclusion is among the most common developmental anomalies with a prevalence ranging from 15% to 30% in most populations.[1] Many orthodontic techniques are used for Class II correction, including use of Class II elastics. These correct the malocclusion by retraction and clockwise rotation of the maxillary arch with protraction and clockwise rotation of the mandibular arch.[2] Despite their popularity, there are no significant data to determine the most convenient protocols of using Class II elastics, including force value and timing for starting elastic wear.

According to the Alexander Discipline, premature use of elastics can have significant side effects if used with light archwires that cannot control incisor torque and arch form.[3] This can cause mandibular incisor proclination, maxillary incisor retroclination, molar extrusion, and alteration of the occlusal plane. In addition, smile esthetics might be compromised due to increased gingival exposure. Therefore, elastics should not be used until these factors are under control. Alexander recommended 1/4 inch, 6 ounce elastics from the maxillary lateral incisor hook to the mandibular first or second molar on rigid stainless steel rectangular archwires.[3]

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Recently, the active early protocol was introduced.[4] This included the use of immediate light short elastics applied from the first appointment with full-time wear and light force. It was claimed that this protocol was efficient and effective. However, these claims were based only on case reports and clinical articles, with no controlled studies.

Therefore, this study was conducted with the aim of comparing the dental effects of early vs late Class II elastic wear. It further aimed to compare the duration needed to achieve leveling, alignment, and anteroposterior correction between immediate light short vs late, Class II elastic wear.

MATERIALS AND METHODS

This study was conducted as a two-arm parallel-group, randomized clinical trial with a 1:1 allocation ratio. The study proposal was approved by the Faculty of Dentistry Ain Shams University, Research Ethics Committee (FDASU-REC) and registered in Clinicaltrials.gov (NCT06232928).

Participants were recruited from the orthodontic clinic Faculty of Dentistry, Ain Shams University. Inclusion criteria were: (1) half unit Class II buccal segment relationship and increased overjet $>$ 4 mm, (2) full permanent dentition (excluding third molars), (3) treatment plan involving the use of a pre-adjusted edgewise fixed appliance with a non-extraction approach. Exclusion criteria were: (1) gummy smile, (2) active periodontal disease, (3) systemic diseases or syndromes.

Seventy participants were assessed for eligibility. Thirty were excluded (did not meet the inclusion criteria) (Figure 1). Forty participants who agreed to participate were randomized into two groups of 20 subjects each, based on the timing of elastics use: early group, 12 females, eight males; and late group, 13 females, seven males (Figure 1). No dropouts were reported. Baseline characteristics are shown in Table 1.

Pre-adjusted edgewise appliances (0.018-inch slot Roth prescription) were placed. Elastic size and force level was selected, using a force gauge, to be in the range of 4–5 ounces for the late group. For the early group, the force level was in the range of 2–3.5 ounces initially. This was maintained while alignment archwires (nickel-titanium or NiTi) were in place. Once 0.016 $\times$ 0.022-inch stainless steel archwires were inserted, the force level was increased to 4–5 oz. Light short elastics were inserted from the maxillary canine hook to the mandibular second premolar hook immediately after appliance placement in the early group (Figure 2). In the late group, elastics were inserted from the maxillary canine hook to the mandibular first molar hook after reaching 0.016 $\times$ 0.022-inch stainless steel archwires (Figure 3). Glass ionomer cement was used for disarticulation of occlusion in both groups. The archwire sequence was 0.016-inch NiTi, 0.016 $\times$ 0.022-inch NiTi, then 0.016 $\times$ 0.022-inch stainless steel. Leveling and alignment was judged to be complete when 0.016 $\times$ 0.022-inch stainless steel archwires were reached and kept in place for 1 month.

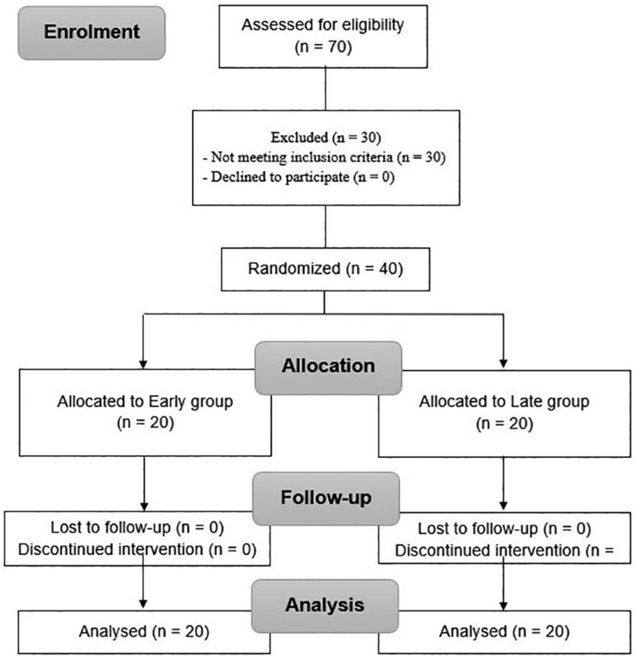

Figure 1. CONSORT flowchart.

Patients were instructed to wear the elastics full-time and change them every 12 hours. Follow-up was done at 6-week intervals and WhatsApp messages were sent for “home follow-up” to enhance patient compliance. Cephalometric radiographs and standardized smile photos were taken before treatment (T0) and after alignment and leveling was achieved along with a Class I buccal segment relationship (T1).

Cephalometric analysis was done using Dolphin version 11.5 software (Chatsworth, Calif, USA). Landmarks were identified on the digital images, and dental, skeletal, and soft tissue measurements were then performed (Table 2). The smile line was assessed on the frontal smile photo by measuring the vertical distance from the incisal edge of the upper maxillary incisors to the lower border of the upper lip using Adobe Photoshop CC software (Adobe Inc, California) (Figure 4).

Sample Size Calculation

Sample size calculation was performed using GPower 3.1 software. To detect a clinically significant difference of 5° in the inclination of the upper incisors to

Table 1. Baseline Characteristics of Participants at T0[a]

Variable	Early Group (n = 20) Mean ± SD	Late Group (n = 20) Mean ± SD	*P* Value
Age (y)	19 ± 3.5	18.5 ± 4.1	.77
Overbite (mm)	2.71 ± 1.0 mm	3.52 ± 1.34	.14
Overjet (mm)	5.53 ± 1.57 mm	5.14 ± 1.86	.64
Amount of maxillary arch crowding (mm)	2.37 ± 1.76	3.02 ± 2.50	.51
Amount mandibular arch crowding (mm)	3.01 ± 0.56	2.80 ± 0.67	.29
Key cephalometric indicators			
SNA (°)	82.82 ± 2.98	85.68 ± 3.92	.08
SNB (°)	77.97 ± 4.01	78.73 ± 3.43	.65
ANB (°)	4.58 ± 1.98	5.15 ± 2.65	.59
MP/SN (°)	33.44 ± 8.14	29.11 ± 4.68	.14
UI/SN (°)	114.33 ± 5.3	112.5 ± 8.2	.56
LI/mandibular plane (°)	91.49 ± 4.74	92 ± 5.98	.94

[a] Independent *t*-test; SD indicates standard deviation.
* Significant at P ≤ .05; T0, before treatment.

the SN plane between the early and late Class II elastic groups, with a standard deviation of 5°, the effect size was 1.0.[5] At a power of 80%, and a significance level of 0.05, 16 participants per group were needed. Accordingly, 20 participants per group were included to account for possible dropouts.

Randomization

Patients who met the inclusion criteria and approved to participate in the study were allocated randomly to either the early or late group. A colleague not involved in the clinical trial generated random number sequences in blocks of 10. Each subject was given a number in the order in which he/she showed up for diagnosis. Allocation of the subjects into either the early group or late group was performed by matching that number with the generated sequence. The allocation sequence was concealed from the study investigators. Blinding of the operator was not possible. However, the outcome assessor was blinded from the treatment allocation.

Statistical Analysis

Statistical analysis was performed with SPSS 20 (IBM, USA). Quantitative data were explored for normality by using the Shapiro-Wilk and Kolmogorov Normality test and presented as mean and standard deviation (SD) values. Paired *t*- and independent *t*-tests were used to compare changes within and between the two groups.

RESULTS

Interobserver and intra-observer reliability was evaluated using the intraclass correlation coefficient (ICC). Ten subjects were randomly selected, and measurements were repeated by the same operator two weeks after the first measurement. For interobserver error, another trained operator made the measurements on the same 10 subjects. Excellent agreement ($\alpha = >0.9$) was obtained for all measurements.

The mean duration of alignment and leveling with achievement of Class I buccal segment relationships was 6.47 ± 2.51 months in the early group, and

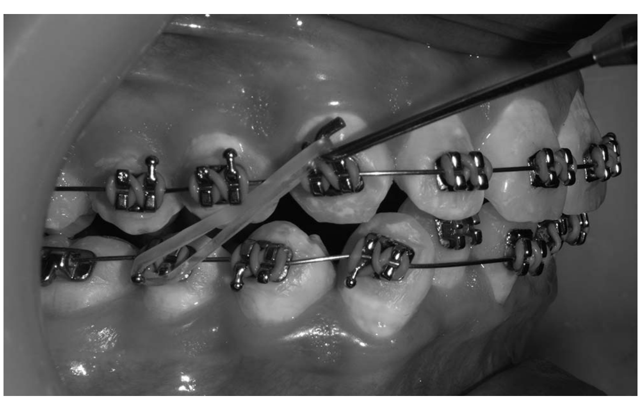

Figure 2. Early short Class II elastics (with force being measured using a gauge).

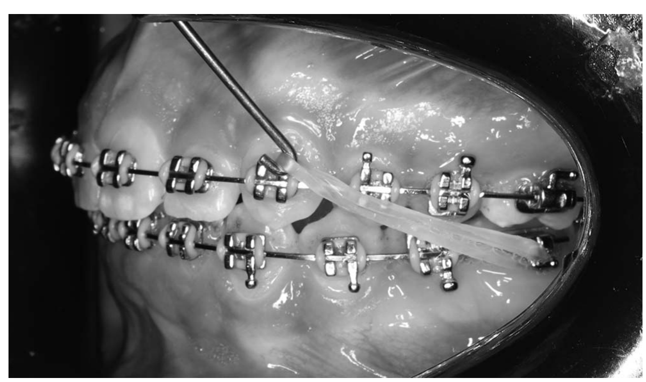

Figure 3. Class II elastics in the late group (with force being measured using a gauge). 0.016 × 0.022-inch stainless steel archwires in place.

Table 2. Cephalometric Measurements Performed in Both Groups Before and After Treatment

Measurement	Definition
Dentoalveolar measurements	
U1/SN	Angle formed between the long axis of the upper central incisor and the sella-nasion plane.
U1/PP	Angle formed between the long axis of the upper central incisor and the palatal plane.
U1/NA	The angle formed between the long axis of the upper central incisor and nasion–Point A.
U1/L1	Angle formed between the long axis of upper and lower central incisors.
L1/MP	Angle formed between the long axis of the lower central incisor and mandibular plane.
L6/MP	Angle formed between the long axis of the lower first molar and mandibular plane.
U6/PP	Angle formed between the long axis of the upper first molar and palatal plane.
U1/NA	Distance from upper incisal tip to and nasion–Point A.
L1/NB	Distance from lower incisors tip and nasion–Point B.
U1/PP	Distance from the incisal tip of the upper incisor to the palatal plane.
U6/PP	Distance from mesiobuccal cusp tip of upper molar to the palatal plane.
L1/MP	Distance from the incisal tip of the lower incisor to the mandibular plane.
L6/MP	Distance from mesiobuccal cusp tip of lower molar to mandibular plane
Skeletal measurements	
SNA	Angle formed between Sella-nasion line and nasion–point A line.
SNB	Angle formed between Sella-nasion line and nasion–point B line.
ANB	Angle formed between point A–nasion line and nasion–point B line.
MP/SN	Angle formed between the Sella-nasion plane (SN) and mandibular plane (Me- Go).
PP/SN	Angle formed between the Sella-nasion plane and the palatal plane (ANS- PNS).
PP/MP	Angle formed between the mandibular plane and palatal plane.
OP/SN	Angle formed between occlusal plane and Sella-nasion plane.
Gonial angle	Angle formed between articulare (Ar), gonion (Go), and menton (Me) points.
PFH / AFH Ratio	The ratio between posterior facial heights (S-Go) and total anterior facial height (N-Me).
LAFH/ AFH Ratio	The ratio of lower anterior facial height (ANS-Me) to total anterior facial height (N-Me).
Soft tissue measurements	
Nasolabial angle	Angle is formed by pronasale (Pn), soft tissue subnasale (Sn'), and upper lip (Ls) points.
Angle of facial convexity	Angle is formed by glabella (G), soft tissue subnasale, (Sn), and soft tissue pogonion (Pog') points.
Ls- E line	Distance from the upper lip point (Ls) to E-line.
Li- E line	Distance from the lower lip (Li) point to E-line.
Upper lip thickness	Distance from point A to the outer border of the upper lip.
Upper lip strain	Distance from the labial surface of maxillary incisors to the outer border of the upper lip at the vermillion border.

14.24 $\pm$ 3.8 months in the late group. Treatment duration was significantly less in the early group by 7.77 $\pm$ 1.44 months (95% CI: 4.7–10.8; $P < .05$) (Table 3).

The maxillary incisors were retroclined in both groups, with a decrease in values of the SN/UI and PP/UI angles in the early group (-7.87 ± 5.76 and $-7.21 \pm 5.77°$, respectively), and reduction of the SN/UI angle in the late group ($-6.57 \pm 3.65°$), Table 4. The mandibular incisors were proclined in both groups. In addition, mandibular first molar extrusion was found in the late group by 2.39 $\pm$ 1.86 mm. Comparing both groups, there were no statistically significant differences for all dental measurements (Table 4).

Skeletal cephalometric measurements showed no significant changes within the early group for all measurements except for the OP/SN angle. which showed a clockwise rotation of 2.8 $\pm$ 2.89° (95% CI: -4.87 to -0.73). On the other hand, the late group showed significant change in SNA, MP/SN, PP/SN, and OP/SN angles and the LAFH/AFH ratio. Comparison between the two groups revealed no significant differences for any measurements except the MP/SN and PP/SN angles (Table 4). Regarding soft tissue measurements, no statistically significant differences were noted between the groups (Table 4). Figure 5 shows cephalometric superimpositions for both groups. Measurement of the smile line from the incisal edge to the lower border of the upper lip increased at the maxillary incisors in both groups. Comparison between the groups revealed no statistically significant differences (Table 5).

DISCUSSION

Only case reports and clinical articles have discussed treatment outcomes from early vs late Class II elastic use. Despite many claims regarding efficacy and efficiency of using immediate, light, short Class II elastics, no prospective controlled studies have been reported. The current study was the first randomized clinical trial comparing the effects of early vs late Class II elastic use in nonextraction treatment of Class II malocclusion cases.

A striking finding in the current trial was that there was a significant difference in treatment duration of

Figure 4. Measurement of the smile line using Adobe Photoshop software.

alignment and leveling with Class II correction between the two groups. Treatment duration was significantly less in the early group by 7.77 ± 1.44 months. This can be considered as a big advantage of the early protocol as all patients seek more rapid treatment. In addition, less treatment time could be accompanied with fewer side effects, such as white spot lesions, root resorption, and others.[6] Additionally, early use of Class II elastics allows orthodontists to take advantage of the potentially enhanced level of patient cooperation that could be expected at the beginning of treatment.

Class II elastics caused maxillary incisor retroclination in both groups with a decrease in values of SN/UI and PP/UI in the early group (−7.87 ± 5.76 and −7.21 ± 5.77°, respectively), and a reduction of the SN/UI angle in the late group (−6.57 ± 3.65°). This was in agreement with the findings of previous studies.[7,8] It seemed that, in the late group, the maxillary incisors tipped lingually until binding of the rectangular archwire within the bracket slot occurred, and the higher force was then transmitted to the maxillary arch, causing significant clockwise rotation of the palatal plane.[9] The net result of maxillary incisor retroclination in relation to the SN plane was the sum of both significant clockwise rotation of the palatal plane and minimal incisor retroclination relative to the basal bone. On the other hand, in the early group, the maxillary incisors significantly retroclined relative to the palatal plane, which may have been caused by the early use of elastics on round, undersized archwires, resulting in uncontrolled tipping of the incisors with significant retroclination. This may explain why the net change in incisor inclination to the SN plane did not show significant differences between the two groups. The clinical significance of this finding is that early elastics could preferably be used in cases with proclined incisors relative to the palatal plane. In contrast, for patients with normal incisor inclination, it would be recommended to wait until reaching rigid rectangular stainless steel archwires, using other mechanisms such as adding a compensating curve to the wire to enhance torque control, to avoid significant lingual tipping of the incisors. This should be considered during the treatment planning stage.

Table 3. Time Analysis in Both Groups[a]

Time (mo)	Mean	SD	*P* Value
Early group (T0–T1)	6.47[a]	2.51	$<.0001$*
Late group			
Leveling and alignment	9.35[a]	4.16	
Anteroposterior correction	4.89[a]	1.93	
Total duration (T0–T1)	14.24[b]	3.8	

[a] One-way analysis of variance test; Tukey's post hoc test.

* Significant at $P < .05$. Different letters (a, b) are statistically significantly different; SD indicates standard deviation; T0, before treatment; T1, after Class II correction and achieving Class I buccal segment relationship.

Mandibular incisors were proclined by 5.85 ± 4.91° and 4.71 + 5.26° in the early and late groups, respectively, with no significant differences between them. This was similar to the findings of previous studies.[8,10] Therefore, it could be recommended clinically to consider using long-term or indefinite retention for cases treated with Class II elastics when there is an intentional or non-intentional change of more than 2 mm in

Table 4. Cephalometric Measurements in Both Groups (T1–T0) and Comparison Between Them[a]

Measurement	Early Group MD	Early Group SD	Early Group 95% CI Lower	Early Group 95% CI Upper	Late Group MD	Late Group SD	Late Group 95% CI Lower	Late Group 95% CI Upper	Difference Between the Two Groups MD	Difference 95% CI Lower	Difference 95% CI Upper	*P* Value
Dental Measurements												
Sagittal												
U1/SN (°)	−7.87	5.76	3.75	11.99	−6.57	3.65	3.96	−2.36	1.3	−3.23	5. 83	.55
U1/NA (°)	−7.76	6.54	3.08	12.44	−5.07	4.25	2.03	−2.36	2.69	−2.49	7.87	.29
U1/PP (°)	−7.21	5.77	3.08	11.34	−3.02	5.18	−0.68	−2.36	4.19	−0.96	9.34	.10
L1/MP (°)	5.85	4.91	−9.36	−2.34	4.71	5.26	−8.48	−2.36	−1.14	−5.92	3.64	.62
U1/L1 (°)	2.09	7.34	−7.34	3.16	−0.64	7.7	−4.87	−2.36	−2.73	−9.8	4.34	.43
U1/NA (mm)	−2.85	2.63	0.97	4.73	−2.09	2.14	0.56	−2.36	0	−2.75	2.75	1.00
L1/NB (mm)	1.49	1.24	−2.38	−0.6	1.46	2.07	−2.94	−2.36	−0.03	−1.63	1.57	.97
Vertical												
U1/PP (mm)	1	3.09	−3.21	1.21	0.01	2.86	−2.06	−2.36	−0.99	−3.79	1.81	.47
U6/PP (mm)	0.43	1.54	−1.53	0.67	0.75	1.33	−1.7	−2.36	0.32	−1.03	1.67	.62
L1/MP (mm)	−0.7	3.36	−1.7	3.1	0.32	3.8	−3.04	−2.36	1.02	−2.35	4.39	.53
L6/MP (mm)	0.94	2.35	−2.62	0.74	2.39	1.86	−3.72	−2.36	1.45	−0.54	3.44	.14
Skeletal measurements												
Sagittal												
SNA (°)	−0.27	1.46	−0.77	1.31	−2.1	2.9	0.02	4.18	−1.83	−3.99	0.33	.09
SNB (°)	0.36	0.98	−0.34	1.06	1.78	3.07	−0.42	3.98	−1.42	−3.56	0.72	.18
ANB (°)	−0.04	1.89	−1.39	1.31	−0.31	1.18	−0.53	1.15	−0.35	−1.83	1.13	.63
Vertical												
MP/SN (°)	0.6	1.36	−1.58	0.38	3.26	2.55	−5.08	−1.44	2.66	0.74	4.58	.01*
PP/SN (°)	0.7	1.8	−1.98	0.58	3.12	1.95	−4.52	−1.72	2.42	0.66	4.18	.01*
PP/MP (°)	−0.38	1.97	−1.03	1.79	−0.92	2.48	−0.86	2.7	−0.54	−2.65	1.57	.60
OP/SN (°)	2.8	2.89	−4.87	−0.73	4.11	1.88	−5.46	−2.76	1.31	−0.98	3.6	.25
Gonial angle (°)	3.7	11.47	−11.91	4.51	1.07	4.2	−4.08	1.94	−2.63	−10.75	5.49	.50
PFH / AFH	−0.42	1.26	−1.32	0.48	−0.92	2.95	−1.19	3.03	−1.34	−3.47	.79	.20
LAFH/ AFH	−0.05	1.21	−0.82	0.92	1.55	2.03	0.1	3	−1.5	−3.07	.07	.06
Soft tissue measurements												
Nasolabial angle (°)	−3.33	7.95	−2.36	9.02	3.47	10.58	−11.04	4.1	−6.8	−15.59	1.99	.12
Facial convexity (°)	−0.65	3.03	−1.52	2.82	−0.42	2.94	−1.69	2.53	−0.23	−3.04	2.58	.87
Ls− E line (mm)	−0.11	0.96	−0.58	0.8	−0.2	0.94	−0.47	0.87	0.09	−0.81	0.99	.84
Li− E line (mm)	0.45	1.32	−1.39	0.49	0.41	1.37	−1.39	0.57	0.04	−1.22	1.3	.95
Upper lip thickness (mm)	−0.5	1.64	−0.67	1.67	−0.48	1.48	−1.39	1.54	−0.02	−1.49	1.45	.98
Upper lip strain (mm)	1.24	1.79	−2.52	0.04	0.66	2.7	−2.59	1.27	0.58	−1.57	2.73	.58

[a] Independent *t*-test; * Significant at $P \leq .05$; SD indicates standard deviation; MD, mean difference; CI, confidence interval.

lower incisor position, according to clinical guidelines of the British orthodontic society.[11]

The maxillary incisors showed minimal vertical changes with no significant differences between the early and late groups. It was expected that, in the early group, relative extrusion would happen due to lingual tipping of the maxillary incisors relative to the palatal plane, but the results showed minimal vertical changes. On the other hand, mandibular first molars were extruded in the late group by 2.39 ± 1.86 mm. These findings were in agreement with Jones et al and Uzel et al.[12,13] Jones et al. reported that the vertical change in the maxillary incisors to the palatal plane was 1.2 ± 2.1 mm.[12] It seemed that, in the early group, the light force range selected had a small, extrusive effect on both the maxillary incisors and mandibular first molars. However, in the late group, molar extrusion was more likely, considering the point of elastic application as well as the higher force range. In addition, the mechanics of preadjusted appliances are known to have an extrusive effect on the posterior teeth. In a growing patient, molar extrusion may be compensated by vertical growth at the ramus.[14] However, molar extrusion in adults was previously reported to be associated with significant relapse tendency.[15]

Conflicting results were reported in the literature regarding the effect of intermaxillary Class II elastics on the anteroposterior position of point A. The current study findings showed posterior movement of point A in the late group, with a mean reduction of the SNA angle (−2.1 ± 2.9°). In the systematic review by Janson et al., some studies reported posterior movement of point A whereas others found that point A has moved forward.[8] Regarding the mandible, there was no significant anteroposterior change in point B in either group, and no significant difference between the two groups.

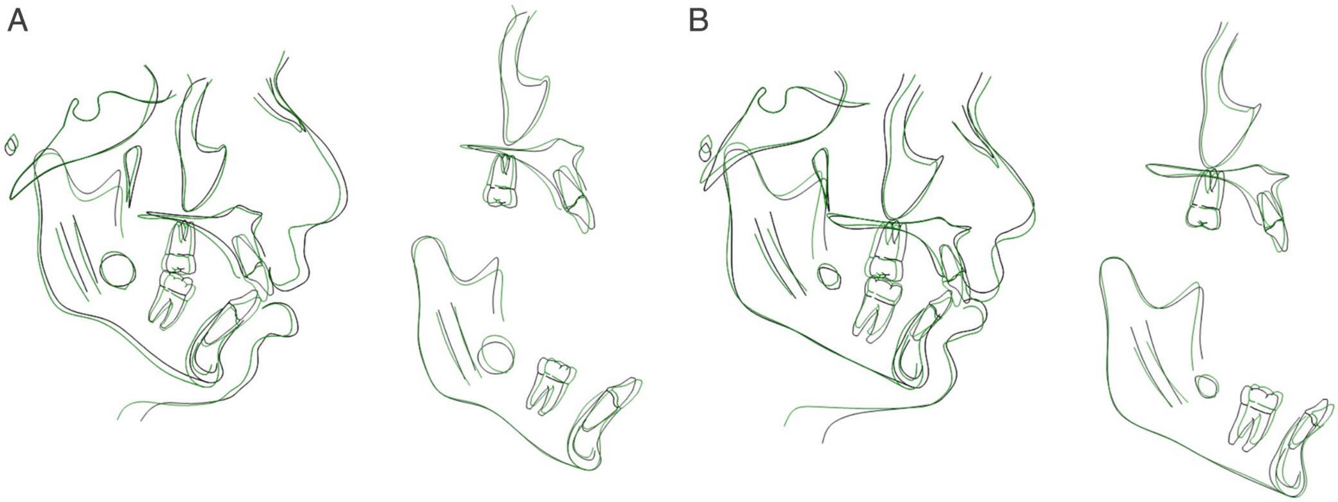

Figure 5. Cephalometric superimposition of cephalometric radiographs obtained before treatment and after achieving a Class I buccal segment relationship. (A) Early group, (B) Late group.

In both groups, the mandibular, palatal and occlusal planes showed clockwise rotation in relation to the cranial base. This rotation was probably caused by the line of action of Class II elastics away from the center of resistance of the arches. This was in agreement with the findings of Li et al.[16] In the current study, the late group showed an increase in anterior facial height which was accompanied by clockwise mandibular rotation and extrusion of the lower first molar in comparison to the early group. A study by Nelson et al showed similar results.[17] Schudy clearly showed that clockwise rotation of the mandibular plane could position the chin relatively posteriorly, to the detriment of an already deficient mandible.[18] Thus, adequate control of the vertical dimension is important for the clinical success of Class II treatment. In addition, steepening of the occlusal plane has been reported to be a cause of relapse, especially in adults.[19]

Measurement of the smile line increased at the maxillary incisors in both groups, with no differences between the groups. This might have been due to uprighting of the maxillary incisors and steepening of the palatal and occlusal planes. It was mentioned previously that Class II elastics caused an increase in gingival display on smiling.[8] Due to a lack of similar studies, the current results regarding smile analysis could not be compared to the findings of any other studies.

In summary, the early and late groups achieved compensatory correction of Class II malocclusion through a combination of upper incisor retroclination and retrusion, lower incisor proclination and protrusion, and clockwise rotation of the occlusal plane. Therefore, the treatment in both groups was equally effective. However, early Class II elastics were much more efficient, with a significantly reduced treatment duration, by 7.77 ± 1.44 months, for alignment and leveling with Class II correction.

Limitations

The limitations of this study should be taken into consideration when interpreting the results. First, the aim of the study was to compare the two different "protocols" of using early versus late elastics in the same way this is done in clinical practice, rather than merely comparing the time of insertion of the elastics. However, the growth patterns of the patients were not considered. Davidovitch et al. showed that Class II

Table 5. Measurement of Smile Line (T1–T0) and Comparison Between the Two Groups[a]

	Early Group				Late Group				Difference Between the Two Groups			
			95% CI				95% CI			95% CI		
Tooth	MD (mm)	SD	Lower	Upper	MD (mm)	SD	Lower	Upper	MD (mm)	Lower	Upper	*P* Value
Right lateral incisor	2.26	2.20	−3.83	1.23	1.23	1.03	−1.97	−0.49	−1.03	−2.65	0.59	.20
Right central incisor	1.33	2.10	−2.83	0.87	0.87	1.04	−1.62	−0.12	−0.46	−2.02	1.10	.54
Left central incisor	1.37	2.01	−2.81	1.16	1.16	1.51	−2.24	−0.08	−0.21	−1.88	1.46	.79
Left lateral incisor	1.83	2.16	−3.37	1.72	1.72	1.64	−2.89	−0.55	−0.11	−1.91	1.69	.90

[a] Independent *t*-test; SD indicates standard deviation; MD, mean difference; CI, confidence interval; * Significant at $P \leq .05$; T0, before treatment; T1, after Class II correction and achieving Class I buccal segment relationship.

elastics produced similar effects on the functional occlusal plane within each type of skeletal pattern.[20] This warrants further study. In addition, patients were included in the study when they had a half-unit Class II buccal segment relationship. More severe Class II relationships, including three-quarter and full-unit Class II relationships were not included since these cases often require longer times for Class II elastic use, with more pronounced side effects. Alternative modalities (including extraction) are usually considered for these, more severe cases. Lateral cephalometric radiographs were used to assess and compare the dental and soft tissue variables between the two groups. However, limitations inherent in lateral cephalometry always need be considered. Lastly, patient compliance is well-known to influence treatment results and is an important variable, influencing treatment progress and outcome with inter-maxillary elastics.

CONCLUSIONS

- Treatment duration for alignment and leveling with Class II correction was significantly less in the early group by 7.77 $\pm$ 1.44 months, compared to the late group.
- Class II elastics were equally effective and more efficient in the early group (immediate light short), compared to the late group.
- Retroclination of the maxillary incisors as a compensatory effect of Class II elastics occurred in both groups (protocol independent).
- Class II elastics negatively affected the amount of gingival display on smiling.

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