Arch-width and perimeter changes in patients with borderline Class I malocclusion treated with extractions or without extractions with air-rotor stripping

Derya Germec-Cakan,¹ Tulin Ugur Taner,² and Seden Akan³
Istanbul and Ankara, Turkey

Introduction: The aim of this study was to compare dental arch-width and perimeter changes in patients with borderline Class I occlusion, treated with extractions or without extractions with air-rotor stripping (ARS).

Methods: The study was conducted with 26 sets of pretreatment and posttreatment dental models of patients with borderline Class I occlusion. Thirteen patients (mean age, 18.1 ± 3.7 years) were treated with 4 premolar extractions, and 13 (mean age, 17.8 ± 2.4 years) were treated without extractions but with the ARS technique. Mean maxillary and mandibular crowding values were 5.7 ± 1.5 and 5.9 ± 1.4 mm in the extraction group, and 5.0 ± 1.3 and 5.9 ± 1.3 mm in the nonextraction group, respectively. A digital caliper was used to measure maxillary and mandibular intercanine and intermolar arch widths and arch perimeters. The Wilcoxon test was used to evaluate treatment changes in each group. The Mann-Whitney U test was used to compare the pretreatment and posttreatment values and the treatment changes between the 2 groups.

Results: At the start of treatment, the maxillary and mandibular intercanine and intermolar widths and the arch perimeters of both groups did not differ statistically. The maxillary intercanine widths were maintained in both groups. The maxillary and mandibular intermolar widths and arch perimeters decreased in the extraction group. In the nonextraction group, intermolar widths decreased, but arch perimeters did not change significantly. After treatment, the maxillary and mandibular intercanine widths were not different between the groups.

Conclusions: In Class I borderline patients with moderate crowding, extraction therapy with minimum anchor-age did not result in narrower dental arches, and nonextraction treatment with ARS preserved the intercanine arch widths and arch perimeters. (Am J Orthod Dentofacial Orthop 2010;137:734.e1-734.e7)

The consequences of extraction and nonextraction therapies in various malocclusions have been widely investigated. In addition to hard- and soft-tissue changes after extraction and nonextraction, arch-width changes are also discussed by orthodontists. Dimensional changes of the dental arch gained attention because of their possible influences on smile esthetics and long-term stability.

Some authors claimed that extraction treatment resulted in constricted arch forms with narrower dental arch widths and reduced the fullness of the dentition during smiling,¹² whereas others suggested that narrower dental arches and unesthetic smiles were unexpected.³,⁴

In nonextraction treatment modalities, the resolution of crowding is usually achieved by distal movement of the posterior teeth, advancement of the anterior teeth, and transversal expansion.⁵ Tooth movement in 3 planes of space naturally leads to increased arch dimensions. In most studies conducted on patients with Class I malocclusions, it was shown that mandibular intercanine width increased after nonextraction treatment.⁵⁻⁷ On the other hand, significant expansion of the dental arches can adversely affect the stability of orthodontic treatment outcomes.⁸,⁹ The mandibular intercanine width has especially been considered immutable by some authors.¹⁰⁻¹²

As an alternative to tooth extraction and various nonextraction treatment modalities in patients with moderate crowding, air-rotor stripping (ARS) was introduced by Sheridan.¹³ The space obtained by the removal of interproximal enamel is used to resolve the crowding...
MATERIAL AND METHODS

Borderline patients. However, no comparison of dental dentoskeletal structures and facial profiles in Class I of extraction and nonextraction therapy with ARS on nation. A recent prospective study evaluated the effects without significant lateral expansion and incisor procli-

was reported in the literature.

The objective of this study was to assess arch-width and perimeter changes in Class I borderline patients treated with extraction or nonextraction with ARS.

The sample consisted of 26 borderline Angle Class I patients who could have been treated either with or without extraction because of their moderate dental arch crowding, balanced facial profiles, and dentoske-

metrical relationships. The selection criteria were (1) orthognathic facial profile, moderate maxillary and mandibular dental arch crowding, and Angle Class I molar relationship; (2) no skeletal discrepancy, con-

stricted maxillary dental arch, posterior crossbite, or congenitally missing teeth; and (3) completed pubertal growth spurt.

The research was approved by the ethical committee of the Medical School of Hacettepe University, Ankara, Turkey.

Patients referred to the orthodontic clinic in a time period of 4 years were evaluated by experienced orthodontists according to their intraoral and extraoral photographs, and cephalometric and model analyses. Borderline patients meeting the selection criteria were informed about the 2 treatment alternatives: extraction and nonextraction with ARS. Informed consent was obtained from each patient before orthodontic treatment. Those who did not want to participate in this study were excluded. Patients who accepted treatment were randomly divided into 2 groups. In the order of referral to the orthodontic clinic, the first patient was assigned to the extraction group, and the next one to the nonextraction group. In the first group, 13 patients were treated with extraction of 4 premolars. Maxillary and mandibular first premolars were extracted in 10 patients, and maxillary and mandibular second premolars were extracted in 3 patients. In the second group, the crowding was resolved with the ARS technique. No expansion appliances were used in any group. The sex distribution, mean ages, treatment times, and dental crowding amounts of all subjects are shown in Table I.

In the extraction group, after the premolar extrac-

tions, the treatment started with sectional canine distal-

ization. No anchorage preparation was made during segmental canine distalization. After the elimination of crowding, the remaining extraction spaces were closed with increased labial crown torqued archwires. All anterior teeth were tied together to increase anterior anchorage and allow mesialization of the posterior teeth rather than retraction of the anterior teeth.

In the nonextraction group, before ARS, the enamel thickness of the teeth was evaluated on bite-wing radiographs. The ARS technique was applied to posterior and anterior teeth with a specially designed ARS bur kit (Raintree Essix, Metairie, La). A segmental approach was preferred to eliminate the excessive protrusion of the incisors. At the beginning of orthodontic treatment, the posterior teeth were leveled, and separators were placed between the first molars and second premolars. After separation, the enamel on the mesial side of the first molars and the distal side of the second premolars was reduced with 699 LC crosscut fissure tungsten carbide burs (Raintree Essix) and finished with finishing di-

amond burs and Extrathin medium and fine Sof-Lex polishing disks (3M Dental Products, St Paul, Minn). With the combination of anterior Essix plate to reinforce anterior anchorage, the second premolars were distalized by using open push coils into the space obtained by stripping. Then this procedure was continued from the posterior to the anterior teeth. When the canines were distalized, the incisors were bonded and stripped with fine diamond burs (55000, Raintree Essix). Topical fluoride gel was applied after stripping, and the subjects were advised to use fluoride mouth rinse during their orthodontic therapy.

At the end of extraction and nonextraction treat-
ment, all patients were successfully treated (ie, they had good occlusion with Class I canine and molar relationships, and well-aligned and interdigitated arches with no crowding or remaining extraction spaces).

<table>
<thead>
<tr>
<th>Group</th>
<th>Male (n)</th>
<th>Female (n)</th>
<th>Total (n)</th>
<th>Age (y) Mean ± SD</th>
<th>Treatment time (mo) Mean ± SD</th>
<th>Maxillary crowding (mm) Mean ± SD</th>
<th>Mandibular crowding (mm) Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extraction</td>
<td>2</td>
<td>11</td>
<td>13</td>
<td>18.1 ± 3.7</td>
<td>24.8 ± 6.9</td>
<td>−5.7 ± 1.5</td>
<td>−5.9 ± 1.4</td>
</tr>
<tr>
<td>Nonextraction</td>
<td>2</td>
<td>11</td>
<td>13</td>
<td>17.8 ± 2.4</td>
<td>17.0 ± 4.6</td>
<td>−5.0 ± 1.3</td>
<td>−5.9 ± 1.3</td>
</tr>
</tbody>
</table>
The intercanine and intermolar widths in the maxillary and mandibular arches were measured with a digital caliper (Opto-Rs 232 simplex/duplex, Sylvac/Fowler, Crissier, Switzerland) on study models. The cusp tips of the teeth were marked with a black 0.3-mm pencil. The distances between the mesiobuccal cusp tips of the molars (intermolar widths) and cusp tips of the canines (intercanine widths) were measured to determine the intermolar and intercanine widths on the pretreatment (T1) and posttreatment (T2) study models, as described by Kim and Gianelly4 (Fig 1). Dental arch perimeters were measured between the mesial contact points of the first molars over the contact points of the posterior teeth and the incisal edges of the anterior teeth with a flexible ruler on the maxillary and mandibular dental casts (Fig 2).15

In both groups, arch widths and perimeters at T1 and T2 were recorded, and treatment changes were calculated as the differences between the T2 and the T1 measurements.

**Statistical analysis**

All statistical analyses were performed with the SPSS software package (SPSS for Windows 98, version 10.0, SPSS, Chicago, Ill). For each variable, the arithmetic mean and the standard deviation were calculated. The Wilcoxon test was used to evaluate treatment changes in each group. The Mann-Whitney U test was used to compare the T1 and T2 values and treatment changes between the groups. Statistical significance was established at $P<0.05$.

Two weeks after the first measurements, all variables were remeasured by the same examiner (S.A.). Random errors were calculated with Dahlberg’s formula.16 Method errors ranged from 0.15 to 0.62 mm.

**RESULTS**

At T1, the maxillary and mandibular intercanine and intermolar widths and arch perimeters of the groups did not differ statistically (Table II).

At T2, the mean maxillary intercanine widths were maintained in both groups (Table III). The mean maxillary intermolar widths were significantly decreased in both groups (extraction, $–2.23 \pm 1.27$ mm, $P<0.01$; nonextraction, $–1.07 \pm 1.19$ mm, $P<0.05$) (Table III). The maxillary arch perimeter was significantly decreased in the extraction group, with a mean value of $8.23 \pm 2.01$ mm ($P<0.01$), and it was maintained in the nonextraction group (Table III).

The mandibular intercanine width was significantly increased in the extraction group with a mean value of
1.01 ± 1.59 mm (P < 0.05), whereas no significant change was found in the nonextraction group (Table III). The mandibular intermolar width was significantly decreased in the extraction and nonextraction groups, with mean values of 3.16 ± 1.13 mm (P < 0.01) and 1.26 ± 1.9 mm (P < 0.05), respectively (Table III). The mean mandibular arch perimeter decreased significantly in the extraction group (–8.55 ± 2.7 mm, P < 0.01), but no significant changes were found in the nonextraction group (Table III).

The comparison of the maxillary and mandibular intercanine and intermolar arch widths and perimeters at T2 showed no significant differences (P > 0.05) between the groups. But mandibular intermolar width (P < 0.05) and maxillary and mandibular arch perimeters (P < 0.001) indicated significantly greater values in the nonextraction group than those in the extraction group at T2 (Table IV).

**DISCUSSION**

It is well documented that both extraction and nonextraction treatments lead to dimensional changes in the dental arches. In general, these studies evaluated the treatment changes in clear-cut extraction or nonextraction patients. Furthermore, in some studies comparing the effects of extraction vs nonextraction therapy, the study groups were not homogenous in the distribution of the various malocclusions. The aims of this study were to assess and compare archwidth and perimeter changes in Class I borderline patients treated with extraction or nonextraction with ARS.

At T1, no significant differences were observed between the 2 groups in maxillary and mandibular crowding, arch widths, and perimeters, providing evidence that subjects with similar dental characteristics were selected for comparable groups (Table II). Also, all patients were treated according to a strict extraction or nonextraction protocol. Therefore, one might consider that these findings come from a carefully selected and conservatively treated sample of Class I borderline patients rather than from a random sample of subjects with various malocclusions and different degrees of severity.

In the extraction group, the maxillary intercanine width was maintained. This finding shows that extraction therapy does not result in constriction in the maxillary canine area. In some studies, maxillary intercanine width increased after extraction treatment. The extent of arch-width changes during orthodontic treatment might depend on treatment mechanics and type of malocclusion. For example, Boley et al studied Class I patients treated according to the Tweed philosophy, and the premolar extraction decision was based on resolving a severe tooth size-arch length discrepancy (TSALD) or protrusive incisors. To obtain their treatment objectives, they used orthodontic mechanics including headgear and intermaxillary elastics; these might cause more pronounced canine distalization. On the contrary, we used minimum anchorage principles in the extraction group to preserve lip positions; this might explain the smaller amount of maxillary canine distalization into the wider sections of the dental arches. Furthermore, Bishara et al, who evaluated arch changes in Class II Division 1 extraction patients, found approximately 3 mm of intercanine-width increase. In Class II Division I patients, the maxillary dental arch is usually narrow, and, to fit with the mandibular arch, it must be expanded with active expansion appliances or archwires. This might explain the greater increase in intercanine width of Class II subjects after treatment.

In our study, mandibular intercanine width increased approximately 1 mm in the extraction group. This might be due to the slight canine distalization to resolve moderate mandibular crowding. Gianelly stated that the arches were 1 mm wider in the mandibular canine area after extraction. Intercanine width can be increased if the canines are moved distally on the
alveolus into an extraction space. Strang referred to this movement as buccal movement of the canines to distinguish it from arch expansion. As the canines move in the alveolar bone and are not expanded out of it, it might cause better stability. However, Sondhi et al claimed that, even in such patients, intercanine width tends to decrease after treatment.

In our extraction group, maxillary and mandibular intermolar widths decreased by 2 and 3 mm, respectively. Closure of extraction sites often results in mesial movement of the molars to a narrower part of the arch, as reported in many studies. For the Class I borderline patients with moderate crowding and orthognathic profiles in this study, after resolution of the anterior crowding, the objective was to lose posterior anchorage. The cephalometric evaluations showed that the maxillary and mandibular molars moved mesially approximately 3 mm relative to the pterygoid vertical plane.

After the elimination of 6 mm of maxillary and mandibular crowding with maxillary and mandibular premolar extractions and closure of the extraction spaces, both arch perimeters decreased by approximately 8 to 8.5 mm.

Interproximal enamel reduction (stripping) removes controlled amounts of proximal enamel without damaging the teeth. This procedure, extensively investigated by many researchers, has undergone various technological developments and become a widely used clinical technique. Although stripping was introduced as an adjunctive treatment to resolve anterior crowding, Sheridan proposed its use in both the posterior and anterior segments to resolve crowding up to 10 mm. Thus, ARS might be an alternative treatment approach for space-gaining procedures such as arch expansion, distalization of the molars, protrusion of the incisors, and extraction in some borderline patients with moderate crowding and balanced profiles. However, the limitations

Table III. Treatment changes in maxillary and mandibular intercanine and intermolar arch widths and perimeters

<table>
<thead>
<tr>
<th>Measurement (mm)</th>
<th>Time</th>
<th>Extraction (n = 13)</th>
<th>Mean ± SD</th>
<th>P</th>
<th>Nonextraction (n = 13)</th>
<th>Mean ± SD</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maxillary intercanine width</td>
<td>T1</td>
<td>35.01 ± 3.66</td>
<td>0.65</td>
<td></td>
<td>34.02 ± 2.98</td>
<td>0.78</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T2</td>
<td>35.16 ± 2.10</td>
<td></td>
<td></td>
<td>33.78 ± 2.04</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>T2-T1</td>
<td>0.15 ± 2.59</td>
<td></td>
<td></td>
<td>0.24 ± 1.92</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maxillary intermolar width</td>
<td>T1</td>
<td>50.48 ± 2.49</td>
<td>0.002</td>
<td></td>
<td>50.49 ± 2.79</td>
<td>0.011</td>
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<tr>
<td></td>
<td>T2</td>
<td>48.25 ± 2.05</td>
<td></td>
<td></td>
<td>49.42 ± 2.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>T2-T1</td>
<td>−2.23 ± 1.27</td>
<td></td>
<td></td>
<td>−1.07 ± 1.19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maxillary arch perimeter</td>
<td>T1</td>
<td>73.38 ± 2.69</td>
<td>0.001</td>
<td></td>
<td>75.46 ± 4.91</td>
<td>0.469</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T2</td>
<td>65.15 ± 3.51</td>
<td></td>
<td></td>
<td>75.15 ± 3.36</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>T2-T1</td>
<td>−8.23 ± 2.01</td>
<td></td>
<td></td>
<td>−0.31 ± 2.29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mandibular intercanine width</td>
<td>T1</td>
<td>25.16 ± 1.65</td>
<td>0.019</td>
<td></td>
<td>24.60 ± 2.25</td>
<td>0.173</td>
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<tr>
<td></td>
<td>T2</td>
<td>26.17 ± 1.55</td>
<td></td>
<td></td>
<td>25.52 ± 1.45</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>T2-T1</td>
<td>1.01 ± 1.59</td>
<td></td>
<td></td>
<td>0.92 ± 2.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mandibular intermolar width</td>
<td>T1</td>
<td>43.54 ± 1.98</td>
<td>0.001</td>
<td></td>
<td>43.07 ± 3.29</td>
<td>0.046</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T2</td>
<td>40.38 ± 1.61</td>
<td></td>
<td></td>
<td>41.81 ± 2.34</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>T2-T1</td>
<td>−3.16 ± 1.13</td>
<td></td>
<td></td>
<td>−1.26 ± 1.90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mandibular arch perimeter</td>
<td>T1</td>
<td>63.31 ± 2.81</td>
<td>0.001</td>
<td></td>
<td>63.46 ± 3.91</td>
<td>0.214</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T2</td>
<td>54.76 ± 4.27</td>
<td></td>
<td></td>
<td>64.15 ± 3.05</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>T2-T1</td>
<td>−8.55 ± 2.70</td>
<td></td>
<td></td>
<td>0.69 ± 2.21</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*P < 0.05; †P < 0.01.

Table IV. Comparison of posttreatment maxillary and mandibular intercanine and intermolar arch widths and perimeters between groups

<table>
<thead>
<tr>
<th>Measurement (mm)</th>
<th>Extraction (n = 13)</th>
<th>Mean ± SD</th>
<th>Nonextraction (n = 13)</th>
<th>Mean ± SD</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maxillary intercanine width</td>
<td>35.16 ± 2.10</td>
<td></td>
<td>33.78 ± 2.04</td>
<td>0.144</td>
<td></td>
</tr>
<tr>
<td>Maxillary intermolar width</td>
<td>48.25 ± 2.05</td>
<td></td>
<td>49.42 ± 2.13</td>
<td>0.209</td>
<td></td>
</tr>
<tr>
<td>Maxillary arch perimeter</td>
<td>65.15 ± 3.51</td>
<td></td>
<td>75.15 ± 3.36</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Mandibular intercanine width</td>
<td>26.17 ± 1.55</td>
<td></td>
<td>25.52 ± 1.45</td>
<td>0.397</td>
<td></td>
</tr>
<tr>
<td>Mandibular intermolar width</td>
<td>40.38 ± 1.61</td>
<td></td>
<td>41.81 ± 2.34</td>
<td>0.048</td>
<td></td>
</tr>
<tr>
<td>Mandibular arch perimeter</td>
<td>54.76 ± 4.27</td>
<td></td>
<td>64.15 ± 3.05</td>
<td>0.000</td>
<td></td>
</tr>
</tbody>
</table>

*P < 0.05; †P < 0.001.
(thin enamel and reduced proximal convexity) and complications (risk of tooth sensitivity) of ARS should also be considered, because this is an irreversible procedure.\textsuperscript{31} Therefore, ARS should be used carefully with respect to the anatomy and physiology of the teeth. To preserve tooth morphology, Tuverson\textsuperscript{12} proposed the use of separators before mesiodistal enamel reduction of the anterior teeth with disks. Another concern about stripping is the long-term health of the teeth. A follow-up study showed that interdental enamel reduction in the mandibular anterior region did not lead to dental caries, gingival recession, or alveolar bone loss over 10 years.\textsuperscript{33}

The maxillary and mandibular intercanine widths of the nonextraction group were maintained. In most studies of patients with Class I malocclusion, it was shown that mandibular intercanine width increased after nonextraction therapy.\textsuperscript{5,7} These findings, which contrast with ours, are due to the expansion of the buccal segments of the mandibular arch to resolve crowding; in our study, moderate crowding was mainly eliminated by ARS in both dental arches.

In our nonextraction group, another contrasting result with the orthodontic literature were the decreases of maxillary and mandibular intermolar widths (approximately 1 mm). Generally, in patients, even with less crowding and treated without extractions, significant expansion or at least maintenance of the posterior dental arch dimensions was observed.\textsuperscript{4-7,19,21} On the other hand, in our study sample, as a result of stripping, no lateral expansion was needed.

Another expected result of nonextraction therapy with stripping was also observed after treatment. The maxillary and mandibular arch perimeters did not change significantly. In the maxillary arch, 5 mm of TSALD was eliminated without lateral and anteroposterior expansion; this is also supported by cephalometric data indicating preservation of the maxillary incisor positions.\textsuperscript{14} On the other hand, resolution of 6 mm of mandibular dental irregularity was achieved mainly by ARS and slight incisor proclination.\textsuperscript{14} However, this did not lead to a significant change in arch perimeter. Weinberg and Sadowsky\textsuperscript{5} reported that half of the mandibular arch crowding was resolved by the increase in arch perimeter associated with incisor proclination, and the other half by generalized expansion of the buccal segments in nonextraction Class I patients with less initial crowding than that in our sample. They also emphasized that these changes might not be consistent with the original objectives and might be undesirable.\textsuperscript{5}

In addition to the treatment objectives, stability is an important point of discussion in orthodontics. Satisfactory stability might depend on minimal expansion of the mandibular canines and molars, and minimal movement of the mandibular incisors.\textsuperscript{6,20} A nonexpansion or minimal expansion approach to treatment could be a significant factor in achieving long-term postretention stability of appreciable TSALD problems.\textsuperscript{20} Glenn et al\textsuperscript{35} found that most patients whose intercanine and intermolar widths were expanded during nonextraction treatment had relapse. For stability concerns, flaring the mandibular incisors is not a successful treatment strategy. The mandibular incisors tend to rebound, especially in patients whose axial inclination was increased.\textsuperscript{11,20,22,34} When overall changes in our nonextraction group were considered, we can say that nonextraction treatment with ARS might meet the treatment objectives in carefully selected borderline patients. However, long-term follow-up of the patients is required to clarify the relapse potential of this treatment alternative.

Comparison of posttreatment arch widths and perimeters between both groups with similar arch dimensions at T1 showed that the maxillary and mandibular intercanine arch widths were not different. Furthermore, even though it was statistically insignificant, intercanine widths were greater in the extraction group than in the nonextraction group. This finding, in accordance with the findings of most studies, indicates that extraction therapy does not result in narrower dental arches than nonextraction treatment.\textsuperscript{3,4,7,17,18} Because arch width is thought to be a determinant of smile esthetics, in a study assessing the relationship between arch-width changes and smile esthetics in patients treated with extraction and nonextraction, it was shown that arch depth did not decrease after extraction, and smile esthetics were the same in both groups.\textsuperscript{4} Therefore, esthetic concerns about the negative impact of extraction therapy on the smile might not be realistic, as shown by several authors.\textsuperscript{3,35} Furthermore, smile esthetics do not depend only on arch width but also on appropriate torque of the teeth on the buccal segments of the arches.\textsuperscript{36}

When intermolar widths were compared, those of the extraction group were slightly narrower than in the nonextraction group because of the mesialization into the extraction spaces. However, this difference was significant only for the mandibular arch. Significant differences in arch perimeter between groups are an expected result.

A limitation of our prospective study was the small sample size. The attempt to compose a homogenous sample of Class I borderline patients who could have been treated either with or without extraction in terms of balanced facial profile and moderate crowding limited the number of subjects. Therefore, the results should be evaluated carefully and need to be proved in studies with larger samples.
CONCLUSIONS

1. In the extraction group, maxillary intercanine widths were maintained, whereas mandibular intercanine widths slightly increased.

2. Maxillary and mandibular intermolar widths decreased because of the mesial movement of the molars into the extraction spaces in borderline patients treated with 4 premolar extractions and minimum anchorage. Consequently, both arch perimeters diminished.

3. In Class I borderline patients with moderate crowding, nonextraction treatment with ARS preserved the maxillary and mandibular intercanine widths and arch perimeters. Therefore, ARS might be a useful nonextraction treatment alternative when anteroposterior and lateral expansion of the dental arches needs to be avoided.

4. There was no difference between intercanine widths after treatment with extraction or nonextraction with ARS.

REFERENCES


