Cephalometric Facial Soft Tissue Changes with the Twin Block Appliance in Class II division 1 Malocclusion Patients

A Systematic Review

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ABSTRACT

Objective: To evaluate facial soft tissue changes after the use of the twin block appliance in Class II division 1 malocclusion patients.

Materials and Methods: Several electronic databases (PubMed, MEDLINE, MEDLINE In-Process & Other Non-Indexed Citations, Cochrane databases, EMBASE, Web of Science, and LILACS) were searched with the help of a senior health-sciences librarian. Abstracts that appeared to fulfill the initial selection criteria were selected by consensus, and the original articles were retrieved. The article references were hand-searched for possible missing articles. Clinical trials that assessed facial soft tissue changes with the use of the twin block appliance without any surgical intervention or syndromic characteristics were considered. A comparable untreated control group was required to factor out normal growth changes.

Results: Two articles fulfilled the selection criteria and quantified facial soft tissue changes. Although some statistically significant changes in the soft tissue profile were found, the magnitude of the changes may not be perceived as clinically significant. Changes produced in the upper lip seem to be controversial, although the study with sounder methodological quality did not report significant changes. No change in the anteroposterior position of the lower lip and the soft tissue menton or improvement of the facial convexity was found.

Conclusions: Three-dimensional quantification of the soft tissue changes is required to overcome current limitations in our understanding of the soft tissue changes obtained after the use of the twin block appliance in Class II division 1 malocclusion patients.

KEY WORDS: Functional appliances; Soft tissue; Profile; Facial changes; Twin block

INTRODUCTION

Different removable functional appliances have been used to treat patients with Class II division 1 malocclusions. Although one of the main reasons for lay persons to undergo orthodontic treatment is esthetic improvement,1,2 of the multitude of reports evaluating the skeletal and dental changes produced by removable functional appliances, only a relatively small proportion have analyzed the soft tissue changes.

The twin block appliance is the most popular functional appliance in the United Kingdom.3 It was first introduced by Clark in 19884 and consists of two separate, upper and lower, removable plates with acrylic blocks trimmed to an angle of 70 degrees. These separate plates make the twin block appliance different in comparison with other removable functional appliances, which are basically monoblocks. Theoretically, this plus a less bulky appearance would increase patient acceptance of the appliance. Patients would also have more freedom in their mandibular movements. All these considerations could conceptually produce different treatment results compared with the removable functional monoblocks.

Several studies have evaluated the soft tissue changes produced by the twin block.5–14 Although
TABLE 1. Search Results From Different Electronic Databases

<table>
<thead>
<tr>
<th>Database*</th>
<th>Key Words</th>
<th>Results</th>
<th>Selected</th>
<th>Total No. of Selected Abstracts (%)b</th>
</tr>
</thead>
<tbody>
<tr>
<td>PubMed</td>
<td>(1) functional appliance*; (2) twin block; (3) #1 OR #2; (4) soft tissue*; (5) facial change*; (6) profile change*; (7) #4 OR #5 OR #6; (8) #3 AND #7; (9) limit #8 to humans</td>
<td>28</td>
<td>7</td>
<td>100</td>
</tr>
<tr>
<td>MEDLINE</td>
<td>(1) functional appliance.mp; (2) twin block.mp; (3) #1 OR #2; (4) soft tissue.mp; (5) facial change.mp; (6) profile change.mp; (7) #4 OR #5 OR #6; (8) #3 AND #7; (9) limit #8 to humans</td>
<td>28</td>
<td>6</td>
<td>85.7</td>
</tr>
<tr>
<td>MEDLINE In-Process &amp; Other Non-indexed Citations</td>
<td>(1) functional appliance.mp; (2) twin block.mp; (3) #1 OR #2; (4) soft tissue.mp; (5) facial change.mp; (6) profile change.mp; (7) #4 OR #5 OR #6; (8) #3 AND #7; (9) limit #8 to humans</td>
<td>1</td>
<td>1</td>
<td>14.3</td>
</tr>
<tr>
<td>EMBASE</td>
<td>(1) functional appliance.mp; (2) twin block.mp (3) #1 OR #2; (4) soft tissue.mp; (5) facial change.mp; (6) profile change.mp; (7) #4 OR #5 OR #6; (8) #3 AND #7;</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>All EBM reviews (Cochrane Database of Systematic Reviews, ACP Journal Club, DARE, and CCTR)</td>
<td>(1) functional appliance.mp; (2) twin block.mp (3) #1 OR #2; (4) soft tissue.mp; (5) facial change.mp; (6) profile change.mp; (7) #4 OR #5 OR #6; (8) #3 AND #7;</td>
<td>10</td>
<td>2</td>
<td>28.6</td>
</tr>
<tr>
<td>Web of Science</td>
<td>(1) TS = (functional appliance* OR twin block) AND (soft tissue* OR facial change* OR profile change*); DocType = Article; Language = All languages; Database(s) = SCI-EXPANDED</td>
<td>18</td>
<td>4</td>
<td>57.1</td>
</tr>
<tr>
<td>LILACS</td>
<td>twin block AND facial</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hand search</td>
<td>Reference list from selected articles</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

* EBM, Evidence-Based Medicine; ACP, American College of Physicians; DARE, Database of Abstracts of Reviews of Effects; CCTR, Cochrane Database of Trial Registration.

b Percentages do not add up to 100% because the same reference could be found in several databases.

some literature reviews and systematic reviews have focused on the effect of functional appliances on skeletal and dental structures, no systematic review has been specifically focused on the soft tissue changes produced by the twin block appliance. Such a review would permit the clinician to evaluate the quality of the available evidence and discuss the facial implications of this type of removable functional orthodontic treatment. Therefore, the objective of the present systematic review was to evaluate facial soft tissue changes by using lateral cephalograms after the use of the twin block appliance in Class II division 1 malocclusion cases.

MATERIALS AND METHODS

A computerized search was conducted of several electronic databases: MEDLINE (from 1966 to week 3 of October 2005), MEDLINE In-Process & Other Non-Indexed Citations (up to October 21, 2005), LILACS (from 1982 to October 2005), PubMed (from 1966 to week 3 of October 2005), EMBASE (from 1988 to week 43 of 2005), Web of Science (from 1945 to October 22, 2005), and all evidence-based medicine reviews (Cochrane Database of Systematic Reviews, American College of Physicians Journal Club, Database of Abstracts of Reviews of Effects, and Cochrane Database of Trial Registration; to the fourth quarter of 2005). Terms used in this literature search were “twin block,” “functional appliances,” “soft tissue,” “profile,” and “facial changes.” The selection and specific use of each term inside each database search were made with the help of a senior librarian specialized in health sciences database searches (Table 1).

The following inclusion criteria were chosen to initially select potential articles from the published abstract results:

- Human clinical trials;
- Facial soft tissue changes evaluated through lateral cephalograms;
- Use of the twin block appliance to correct Class II division 1 malocclusions;
- Nonsyndromic or medically compromised patients;
- No individual case reports or series of cases; and
- No surgical intervention.

No attempts were made at this stage to identify studies that did not use adequate control groups to factor out growth changes. It was considered improbable that the abstracts would report enough information regarding control groups. This would potentially exclude some articles. Meeting abstracts were not selected but were used to trace articles when a full article was published from the data.

All the article abstracts that appeared to meet the
initial inclusion criteria were selected, and the actual articles were collected. The selection process was independently made by the two researchers. Their results were compared and discrepancies were settled through discussion; except for the LILACS database, which was only evaluated by one of the researchers because of language limitation. When an article abstract did not provide enough information to make a decision, the actual article was obtained.

The articles ultimately selected were chosen with the following additional inclusion criteria:

- A comparable control group to factor growth changes when required; and
- Only the twin block appliance was used.

The actual articles from the selected abstracts were then independently evaluated by the two researchers. A consensus was reached regarding which articles fulfilled the final selection criteria. These articles were finally included in the systematic review. Articles that did not factor out growth changes when required (growing samples) were rejected at this stage. Craniofacial growth was considered important to factor out in order to accurately assess the true magnitude of the soft tissue changes.

Failure to consider craniofacial growth changes would result in a potential overestimation of the magnitude of the changes attained. Simultaneous use of a fixed appliance was considered a confounder and a reason for exclusion. Although measurement error is needed for a correct interpretation of the clinical significance of the findings, it was not considered a reason to reject an article but was considered in the interpretation of the data.

Knowing that more methodologically sound studies may provide more reliable conclusions, a methodological scoring process was developed to identify which selected studies would be most valuable (Table 2). No attempt was made to imply that this evaluation tool has been properly validated. Previous reports29–31 have shown that there is no sound evidence about the validity of the use of quality assessment of clinical trials, and these reports recommend that researchers examine the individual influence of key components on methodological quality.

The reference lists of the retrieved articles were also hand-searched for additional relevant publications that may have been missed in the database searches. In cases where extra information was required for discussion or statistical analysis but was not specifically stated in the article, contact with the authors was sought to obtain the required information.

RESULTS

The search results and the final number of abstracts selected according to the initial selection criteria from the various databases are provided in Table 1. Comparing the database results, PubMed showed all of the finally selected articles. MEDLINE did not find one article, but the article was identified from MEDLINE-InProcess. Abstracts selected in all evidence-based medicine reviews and the Web of Science were already found in PubMed. No selected abstract was found in LILACS, which included only Latin American publications. No article was missed in the electronic database searches that appeared during the hand search of the reference lists of the selected articles.

From the seven studies5,7,9,11,13,14 that based on the abstracts seemed to be potentially useful, after reading the complete article, only two5,9 (29%) actually fulfilled the final selection criteria. The remaining five articles5,7,11,13,14 were rejected due to the lack of an adequate control group to factor out expected normal growth changes. A flow diagram of the literature search appears in Table 3.

The methodological quality checklist was applied to the selected articles (Table 4).

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**TABLE 2. Methodological Score for the Clinical Trials**

<table>
<thead>
<tr>
<th>I. Study Design (11)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Objective—objective clearly formulated (✓)</td>
</tr>
<tr>
<td>B. Population—described (✓)</td>
</tr>
<tr>
<td>C. Selection criteria—clearly described (✓); adequate (✓)</td>
</tr>
<tr>
<td>D. Sample size—considered adequate (✓); estimated before collection of data (✓)</td>
</tr>
<tr>
<td>E. Baseline characteristics—baseline characteristics (✓); similar between groups (✓)</td>
</tr>
<tr>
<td>F. Timing—prospective (✓); long-term follow-up (✓)</td>
</tr>
<tr>
<td>G. Randomization—stated (✓)</td>
</tr>
</tbody>
</table>

**II. Study Measurements (4) |

| H. Measurement method—appropriate to the objective (✓) |
| I. Blind measurement—blinding (examiner ✓; statistician ✓) |
| J. Reliability—described (✓) |

**III. Statistical Analysis (5) |

| K. Dropouts—included in data analysis (✓) |
| L. Statistical analysis—appropriate for data (✓) |
| M. Confounders—included in analysis (✓) |
| N. Statistical significance level—P level stated (✓); confidence intervals (✓) |

Maximum number of √s = 20

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**TABLE 3. Flow Diagram of the Literature Search**

<table>
<thead>
<tr>
<th>Manual search 0 title</th>
<th>Electronic search 42 abstracts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potentially appropriate to be included 0 paper</td>
<td>Potentially appropriate to be included 7 papers</td>
</tr>
<tr>
<td>→ excluded 35</td>
<td></td>
</tr>
<tr>
<td>7 papers</td>
<td></td>
</tr>
<tr>
<td>→ excluded 5</td>
<td>lack of control group</td>
</tr>
<tr>
<td>2 papers finally selected</td>
<td></td>
</tr>
</tbody>
</table>

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*Angle Orthodontist, Vol 76, No 5, 2006*
Morris et al<sup>a</sup> compared 16 adolescents (6 males/10
females with a mean age of 11 years 8 months) with
20 adolescents (13 males/7 females with a mean age
of 11 years 2 months) during a 9-month evaluation
period. All the patients had a Class II skeletal rela-
tionship with a mandibular retrognathia, Class II molar
relationships, and an overjet greater than 7 mm.
Luo and Fang<sup>a</sup> compared 12 adolescents (7 males/
5 females with an age range of 10 to 12 years) against
11 adolescents (6 males/5 females with an age range
of 10 to 12 years) in a 12-month evaluation period.
Patients included in this study had a mandibular ret-
gognathia, Class II molar relationships, and an overjet
greater than 7 mm.
No significant changes in the facial angles, nose,
lower lip, and soft tissue menton were found.<sup>a</sup><sup>,5</sup> For the
upper lip, no significant changes were reported<sup>a</sup> ex-
cept for the position of labrale superius relative to
the esthetic line, which was in a more retruded position
(1.9 mm).<sup>a</sup> Specific information about the measure-
ments used and the magnitude of the changes are
provided in Table 5. Landmarks used in the soft tissue
profile analysis are provided in Figure 1.

**DISCUSSION**

The present review was performed to systematically
analyze the soft tissue profile changes that were pro-
duced by the twin block appliance in patients with
Class II division 1 malocclusions. Despite the exten-
sive number of published studies regarding the skel-
etal and dental effects produced by the twin block ap-
ppliance, only a few studies evaluated the soft tissue
profile changes.<sup>5</sup>–<sup>14</sup> Only two of these studies<sup>5</sup>,<sup>a</sup> com-
pared the changes produced by the twin block appli-
cance with a comparable untreated control group. One<sup>a</sup>
of these two studies was more methodologically sound
and did not report any significant soft tissue profile
changes.
Lack of consensus exists regarding the impact of
functional appliances on the soft tissue profile. From a lay person’s perspective changes in the anterior visible occlusion teeth-lip relationship are probably more important than changes in the posterior occlusion. The level of evidence in the selected reports was low. Art students, dental students, and parents of orthodontic patients did not perceive any significant soft tissue changes in subjects treated with two types of removable functional appliances (Frankel’s regulator or Harvold’s activator). The present results support those findings. Even in the case of the retruded upper lip position reported by one of the studies, the second more methodologically sound study did not find any significant change. Even though several studies have reported significant dentoalveolar changes and some skeletal changes with the twin block appliance, it seems that those changes do not produce significant soft tissue profile changes.

A detailed esthetic judgment of the face should evaluate the patient’s frontal face view during conversation, facial expressions, and smiling. Current conventional orthodontic frontal and lateral cephalometric analysis are not capable of producing a real 3-dimensional image of the subject’s face. Use of facial photos helps to complement conventional radiographic analysis, but the subjectivity in their analysis is still a limitation. Therefore, stereo photogrammetry or laser surface scanning seem to be the best available tools to overcome these limitations.

A very limited number of studies evaluating 3-dimensional soft tissue changes after functional treatment have been published. Only one clinical trial evaluated soft tissue facial height changes. No significant vertical changes were reported.

Several different measurements have been used to evaluate the soft tissue changes after twin block treatment. Some of them have to be considered carefully because they used reference structures that could potentially change as a result of the treatment. For example, the esthetic plane is not a good reference plane to quantify changes in the lips because simultaneous changes in the soft tissue pogonion or pronasale could create the impression of lip changes that are really nonexistent.

CONCLUSIONS

• Evidence supporting the claim for an improvement of the facial convexity with twin block treatment of Class II division I malocclusion was not found.
• Changes produced by the twin block appliance in the upper lip seem to be controversial, although the study with sounder methodological quality did not report significant changes.
• No change in the anteroposterior position of the lower lip and soft tissue menton was found.

ACKNOWLEDGMENTS

Special thanks to Linda Seale for her professional assistance in the database searches and to Dr. Guoping Xiong for his help translating the Chinese article.

REFERENCES

3. Gill D, Sharma A, Naini F, Jones S. The twin block appli-