Review

Stability of open-bite treatment in adult patients: A systematic review

Raquel Bueno Medeiros, Luiz Felipe Cardoso de Araújo, José Nelson Mucha*, Alexandre Trindade Motta

Department of Orthodontics, Universidade Federal Fluminense, UFF, Niterói, RJ, Brazil

ARTICLE INFO

Article history:
Received 23 August 2012
Accepted 1 September 2012
Available online 19 October 2012

Keywords:
Adults
Anterior open bite
Orthodontics treatment
Stability
Systematic review

ABSTRACT

Background: Anterior open-bite in adults is a challenging malocclusion to be treated and many therapies have been advocated to increase the stability.

Objective: Review and compile evidence for the stability of anterior open-bite treatments in adult patients.

Methods: An electronic search was performed in PubMed, Cochrane Library, Lilacs, and SciELO, from January 1989 to April 2012. The following orthodontic treatment modalities were included: with or without extraction, combined with temporary anchorage devices, and orthognathic surgery. The overbite was assessed pretreatment, posttreatment, and at least 1-year posttreatment. Studies with growing patients or reporting less than 1 year of follow-up were excluded.

Results: Randomized control trials and systematic reviews have not been identified. Mean overbite relapse was 0.6 mm in the case series group (84% stability in orthodontic cases and 86% in surgical cases) and 0.39 mm in the case series and control groups (89% stability). Orthodontic treatment with extractions seemed to be more stable than nonextraction, as well as one-jaw surgery compared with bimaxillary surgery. The available data on orthodontics combined with temporary anchorage devices is still scarce.

Conclusions: Scientific available data on the stability of open-bite treatment reveals only weak evidence about certain treatment modalities, which is not enough to predict the success of clinical choices.

© 2012 World Federation of Orthodontists.

1. Introduction

Anterior open bite in adults is known as one of the most challenging problems in orthodontics, especially regarding stability [1,2]. Such malocclusion develops as result of the combination of many etiologic factors, and when a treatment choice is made, it should consider the patient's age and the dental and skeletal discrepancies [3–8]. Early treatment of the open-bite usually provides the best results but adult patients represent a more difficult morphological problem to be solved [9–11].

Many therapies have been advocated to increase the stability of open-bite correction according to the malocclusion severity and facial disharmony, and orthognathic surgery combined with orthodontic treatment might play an important role in providing stability [2,12].

A previous systematic review with meta-analysis [13] on the stability of the open-bite treatment in growing and nongrowing subjects concluded that higher-quality evidence controlled trials are needed to definitively answer how to best deal with these patients.

The purpose of this systematic review was to assess the available scientific literature on the stability of open-bite treatment modalities in adult patients.

2. Materials and methods

A survey of articles, published from January 1989 up to April 2012, about the stability of open-bite treatment was conducted on the following electronic databases: PubMed, Cochrane Library, Lilacs, and SciELO.

To determine the key words for electronic search, we designed a specific protocol and a question for research. Table 1 shows the patients-intervention-comparison-outcome format designed for a specific protocol and a question for the research [14]. The methods for this review were based on the guidelines of the preferred reporting items for systematic reviews and meta-analyses statement [15].

* Corresponding author: Rua Henrique Cordeiro 400/1606, CEP: 22631-450, Barra da Tijuca, Rio de Janeiro, RJ, Brazil.
E-mail address: nelsonmucha@wnetrj.com.br (J.N. Mucha).
The key words used in the electronic search were “anterior open bite,” “long face,” “vertical dentoalveolar problem,” “vertical skeletal problem,” combined with “orthodontic treatment” (MeSH Terms). The titles and abstracts of the identified studies in the electronic search were prescreened according to the relevance of the study's topic. At this point, the rejected articles were registered.

The reference list of the retrieved articles was also screened in an attempt to identify any article that might have been missed in the primary search. No language restriction was applied during the identification process of the published studies.

To be included in this study, each article had to fulfill the following requirements: (1) systematic review and meta-analysis, randomized clinical trials, case series and control or, case series; (2) nongrowing patients, at least 14 years old for females and 16 years old for males at the beginning of treatment; and (3) a minimum of a 1-year follow-up period. The exclusion criteria included the following: (1) patients presenting craniofacial pathologies, syndromes, cleft lip and/or palate, or (2) case reports with less than eight patients.

The preferred reporting items for systematic reviews and meta-analyses flow diagram of the included and excluded studies is illustrated in Figure 1. The selection was done by two independent reviewers (LFA and RBM), who had access to the full text of each potentially relevant study. In a consensus meeting, an agreement was settled on which studies to include with the support of a third reviewer (LFA and RBM). When necessary, the authors were contacted for further information.

From the selected articles, the following study characteristics were recorded: author and year, sample size, gender, treatment modality, age and overbite in mm in T1 (pretreatment), T2 (post-treatment) and T3 (at least 1-year of follow-up).

A methodological quality scoring process was used to identify which selected studies would be most valuable and was based on the data from Nguyen et al [16] and Baratieri et al [17].

The articles selected for eligibility were assessed on the basis of study design, study measurements, and conclusion (Tables 2 and 3). The methodological quality assessment scores ranged from 0 to 16 points. Studies were qualified as having high (≥ 13), moderate (≥ 8 and < 13), or low (> 8) methodological quality.

### 3. Results and discussion

The primary search strategy returned 1909 potential articles. After evaluating titles, 1377 studies were discarded, and after reading the abstract 430 were also excluded. Figure 1 outlines the search results, the number of selected studies, and the reasons for exclusion. The main reasons for excluding an article included a short follow-up period (less than 1 year), the patients’ age, and lack of overbite information.

According to the inclusion and exclusion criteria, 14 studies were selected, comprising 8 case series and 6 case series with control. No randomized control trials or systematic reviews were identified concerning the stability of the open-bite treatment in adults until April 2012.

### Table 1

<table>
<thead>
<tr>
<th>Question</th>
<th>P - Patients/problem</th>
<th>I - Intervention</th>
<th>C - Comparison</th>
<th>O - Outcome</th>
<th>Study design (10)</th>
<th>Study measurements (5)</th>
<th>Conclusion (1)</th>
<th>Total score</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is the kind of treatment performed in adult patients with anterior open bite that provides greater stability after treatment?</td>
<td>Adult patients with anterior open bite</td>
<td>Undergoing orthodontic or orthodontic-surgical treatment</td>
<td>Among different types of treatments performed</td>
<td>Treatment with greater stability posttreatment</td>
<td>A- Description of objective</td>
<td>B- Population adequately described (age, sex,)</td>
<td>D- Sample size: &lt; 30/group (1) or ≥ 30/group (2)</td>
<td>M- Reasonable conclusion for study power</td>
</tr>
</tbody>
</table>
patients who are still growing, and lack of data. Eight case series studies and six case series with control were selected.

No randomized control trials or systematic reviews were identified on the stability of the open-bite treatment in adults until April 2012.

The main difficulty challenging this study was data obtained at different time points in surgical studies. The follow-up at T3 should be at least 1 year after the removal of orthodontic appliances, but surgery studies commonly used the surgical procedure as a reference. Even though it is possible to assess surgical stability within 1 year after surgery, postsurgical orthodontic movement with dental compensation and lack of follow-up without braces might have also influenced the results. In some cases there is an overbite increase from T2 (the end of treatment) to T3 (posttreatment period), and this unusual increase in millimeters in the overbite can be seen in Tables 4 and 5.

Table 5 presents the following information from the six case series with control studies [24–29]: total sample, 396 patients; mean overbite of –3.02 mm in T1, +1.16 mm in T2, and +1.01 mm in T3; and mean follow-up of 4.3 years and relapse of 0.39 mm. These six articles were on orthognathic treatment modality, but different criteria were used to compare the variable features according to each study's objectives.

McCance et al [24] compared 21 patients treated with bimaxillary orthognathic surgery according to the angle’s Class II or III classification. Hoppenreijis et al [25] divided a sample of 234 patients according to the following purposes: (1) type of surgery (maxilla only vs. two jaw); (2) segmentation of the maxilla (one piece vs. multiple segments); and (3) type of fixation (semi-rigid vs. rigid). Lo et al [26] compared 40 patients treated with LeFort I surgery according to the segmentation of the maxilla (one piece vs. multiple segments). Proffit et al [27] divided the sample studied into 28 patients with a one-jaw procedure versus 26 patients with a two-jaw surgical procedure. Moldez et al [28] compared 13 patients with Class II impaction versus 10 patients with clockwise rotation of the maxilla during the surgical procedure. Teitinen et al [29] compared 12 patients with rigid fixation maxillary surgery versus 12 patients with two-jaw surgical procedures.

This systematic review displays an overview and the level of evidence of the available studies on different treatment modalities regarding stability for the open bite in adults.

The overbite was used to assess the stability of the open-bite treatment because it reflects a skeletal and/or dental relapse, and is commonly described in different studies. Cephalometric measurements may vary in different analysis and fail to detect dental changes.

The reviewers evaluated the full text of the 67 studies. The main reasons for exclusion were a short follow-up period (< 1 year), Table 4 provides information from four studies that treated patients with orthodontic approaches only, and 4 studies that treated patients with orthognathic surgery. The average stability can be considered very similar in both groups (84% vs. 86%).

In the orthodontic treatment group [4,18–20], a relapse ranging from –0.25 to –1.25 mm on average was observed, which means a 78% to 96% stability in the period evaluated.

The stability was higher (96%) in patients who had extractions performed as needed [18] compared with 78% in the patients treated without extraction [4], but it should be noted that the sample size and the observation time are small.

When studies that used orthodontics combined with temporary anchorage devices (TADs) [19,23] were compared, relapse ranged from –0.90 to –1.20 or from 82% to 78% in stability. It should be noted that the time monitoring the two studies were 1 and 3 years, respectively.

Table 4
<table>
<thead>
<tr>
<th>Author, year</th>
<th>N</th>
<th>Gender</th>
<th>Age</th>
<th>Treatment</th>
<th>Overbite (mm)</th>
<th>T3–T2</th>
<th>Stability</th>
<th>Mean Stability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fischer et al, 2000 [20]</td>
<td>28</td>
<td>22</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>–2.72</td>
<td>–1.92</td>
<td>3.3</td>
</tr>
<tr>
<td>Sugawara et al, 2002 [19]</td>
<td>58</td>
<td>40</td>
<td>18</td>
<td>23</td>
<td>X</td>
<td>–0.80</td>
<td>+2.2</td>
<td>+0.80</td>
</tr>
<tr>
<td>Hoppenreijis et al, 2000 [21]</td>
<td>19</td>
<td>8</td>
<td>1</td>
<td>23</td>
<td>X</td>
<td>–3.91</td>
<td>+1.65</td>
<td>+0.45</td>
</tr>
<tr>
<td>Baek et al, 2010 [22]</td>
<td>29</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>X</td>
<td>–2.23</td>
<td>+3.63</td>
<td>+3.38</td>
</tr>
<tr>
<td>Sugawara et al, 2002 [19]</td>
<td>39</td>
<td>7</td>
<td>2</td>
<td>19.3</td>
<td>X</td>
<td>–2.80</td>
<td>+2.10</td>
<td>+1.20</td>
</tr>
<tr>
<td>Fischer et al, 2000 [20]</td>
<td>58</td>
<td>40</td>
<td>18</td>
<td>23</td>
<td>X</td>
<td>–0.80</td>
<td>+2.2</td>
<td>+0.80</td>
</tr>
<tr>
<td>Moldez et al, 2000 [28]</td>
<td>13</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>X</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Kim et al, 2000 [18]</td>
<td>10</td>
<td>—</td>
<td>—</td>
<td>19</td>
<td>X</td>
<td>–4.05</td>
<td>+1.75</td>
<td>+0.50</td>
</tr>
<tr>
<td>Total/average</td>
<td>174</td>
<td>—</td>
<td>—</td>
<td>23.8</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>–2.72</td>
</tr>
</tbody>
</table>

N, number of patients; Ort, nonextraction and extraction orthodontics; TAD, orthodontics combined with temporary anchorage devices; Sur, orthognathic surgery; y, years.

1 Four studies that treated patients only with orthodontic approaches.

2 Four studies that treated patients with orthognathic surgery.

Mean score 10.8 Moderate
Table 5
Case series and control — surgical treatment

<table>
<thead>
<tr>
<th>Author, year</th>
<th>N</th>
<th>Malocclusion</th>
<th>Fixation</th>
<th>Intervention</th>
<th>Overbite (mm)</th>
<th>T3–T2</th>
<th>Time (y)</th>
<th>Relapse (mm)</th>
<th>Stability</th>
</tr>
</thead>
<tbody>
<tr>
<td>McCance et al, 1992 [24]</td>
<td>10</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>−6.4</td>
<td>−1.6</td>
<td>−1.6</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Hoppenreijis et al, 1997 [25]</td>
<td>122</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>−6</td>
<td>3.1</td>
<td>2.4</td>
<td>1</td>
<td>0.7</td>
</tr>
<tr>
<td>Teittinen et al, 2012 [29]</td>
<td>12</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>−1.66</td>
<td>+1.86</td>
<td>+2.12</td>
<td>1.45</td>
<td>0.25</td>
</tr>
<tr>
<td>Lo et al, 1998 [26]</td>
<td>19</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>−2.02</td>
<td>1.90</td>
<td>1.88</td>
<td>3</td>
<td>0.02</td>
</tr>
<tr>
<td>Moldez, 2000 [28]</td>
<td>13</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>−2.2</td>
<td>+2.0</td>
<td>1.1</td>
<td>5</td>
<td>0.9</td>
</tr>
<tr>
<td>Profit et al, 2000 [27]</td>
<td>28</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>−2.00</td>
<td>2.00</td>
<td>1.45</td>
<td>3</td>
<td>0.55</td>
</tr>
<tr>
<td>Total/average</td>
<td>396</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>−3.02</td>
<td>+1.16</td>
<td>1.78</td>
<td>4.3</td>
<td>−0.39</td>
</tr>
</tbody>
</table>

N. number of patients; WIF, wire internal fixation; RIF, rigid internal fixation; 1p, one piece LeFort I; MS, multi-segment LeFort I; IM, maxillary impaction; Ro, maxillary rotation; Mx only, maxilla only; BiM, bimaxillary; y, years.

* Difference between correction and relapse.

The stability reported in the recent available data may be considered optimistic, but it must be considered that all the osteotomies included in this systematic review are retrospective. Actually, a greater relapse rate could be expected if the orthodontic treatment alone was considered. The stability reported in the recent available data may be considered optimistic, but it must be considered that all the osteotomies included in this systematic review are retrospective. Actually, a greater relapse rate could be expected if the orthodontic treatment alone was considered. The stability reported in the recent available data may be considered optimistic, but it must be considered that all the osteotomies included in this systematic review are retrospective. Actually, a greater relapse rate could be expected if the orthodontic treatment alone was considered.
4. Conclusions

Scientific available data on the stability of open-bite treatment provides only weak evidence about certain treatment modalities, which is not enough to predict the success of clinical choices. Orthodontic treatment with extractions seemed to be more stable than nonextraction, as well as one-jaw surgery compared with bimaxillary surgery. The available data on TADS is still scarce. Nevertheless, the decision to treat with orthognathic surgery is not limited to the malocclusion, because it also addresses correction of dentofacial deformities that will improve facial aesthetics.

References