

## Systematic Review Article

# Patient satisfaction after orthodontic treatment combined with orthognathic surgery: A systematic review

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### ABSTRACT

**Objective:** To synthesize available evidence about factors associated with patients' satisfaction after orthodontic treatment combined with orthognathic surgery.

**Materials and Methods:** Studies that evaluated any factor associated with patients' satisfaction after the conclusion of an orthodontic treatment combined with an orthognathic surgery were identified. Orthognathic surgical procedures should have been undertaken after completion of craniofacial growth. Any satisfaction psychometric tool was considered. No language limitation was set. A detailed individual search strategy for each of the following bibliographic databases was crafted: MEDLINE, PubMed, EBM Reviews, Web of Science, EMBASE, LILACS, and Scopus. The references cited in the identified articles were also cross-checked, and a partial gray-literature search was undertaken using Google Scholar.

**Results:** Eight articles satisfied the inclusion criteria of this systematic review and accounted for 998 patients. The included studies showed large variation in sample size (range = 44 to 505 patients), age (range = 15 to 72 years old), distinct psychological evaluation tools, and time elapsed between the assessment and the completion of surgery and postorthodontic treatment. Most of the studies (five of eight) were classified as having high risk of bias.

**Conclusion:** Factors associated with satisfaction were final esthetic outcome, perceived social benefits from the outcome, type of orthognathic surgery, sex, and changes in patient self-concept during treatment. Factors associated with dissatisfaction were treatment length; sensation of functional impairment and/or dysfunction after surgery, and perceived omitted information about surgical risks. (*Angle Orthod.* 2016;86:495–508.)

**KEY WORDS:** Patient satisfaction; Satisfaction; Orthodontic; Orthognathic; Combined orthodontics

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### INTRODUCTION

In recent years interest in patient satisfaction during health care provision has grown significantly. Therefore, patients' perceptions and expectations have become increasingly important in justifying health services delivery and ensuring overall health care quality.<sup>1</sup>

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High rates of patient satisfaction after orthognathic surgery have been reported. Patients who completed orthodontic treatment combined with orthognathic surgery reported a large variety of psychological benefits, such as improved self-confidence, self-esteem, and/or facial-attractiveness image.<sup>2-4</sup> Facial and dentoalveolar changes after orthognathic surgery are believed to contribute to better personal relationships<sup>5</sup> and/or employment prognosis.<sup>6</sup> In contrast, dissatisfaction can also occur as result of patients' unachieved expectations. In addition, temporary impairment of oral function, paresthesia, and/or unanticipated short-term facial changes have also been linked to patients' dissatisfaction after orthognathic surgery.<sup>7</sup> Thus, despite the fact that, in many cases, originally stated surgical goals were achieved and therefore success was presumed, clinicians sometimes failed to receive positive feedback from their patients.<sup>8</sup> In some cases the reasons behind this apparent lack of perceived success by these patients remains unclear.

Health providers sometimes underestimate patient-reported outcomes.<sup>9</sup> This is a potentially significant problem. Full understanding of patients' views and expectations are paramount to achieve overall success in the provision of health services. Recently, a systematic review addressed the impact of malocclusion on laypersons' quality of life. The correlation between esthetically compromised malocclusions and their impact on emotional and social dimensions was significant and accompanied by a resulting decrease in quality of life.<sup>10</sup> Another systematic review concluded that patients' quality of life improved after orthognathic surgery.<sup>11</sup> No previous attempt at synthesizing the specific factors that affected such outcomes was identified.

Therefore, the aim of the present systematic review was to synthesize available studies that have evaluated factors associated with patients' satisfaction after orthodontic treatment combined with orthognathic surgery.

## MATERIALS AND METHODS

Reporting of this systematic review was performed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis - PRISMA checklist.<sup>12</sup> This systematic review protocol was registered at the International Prospective Register of Systematic Reviews – PROSPERO (CRD42014014542). Details of the protocol can be accessed at [www.crd.york.ac.uk/PROSPERO/display\\_record.asp?ID=CRD42014014542](http://www.crd.york.ac.uk/PROSPERO/display_record.asp?ID=CRD42014014542).

## Eligibility Criteria

The following inclusion criteria were used:

- The study evaluated factors associated with patient satisfaction after the conclusion of an orthodontic treatment combined with an orthognathic surgery.
- Orthognathic surgical procedures were undertaken after completion of craniofacial growth.
- Any satisfaction psychometric tool was considered.
- Neither language nor publication year set as limitations.

The following exclusion criteria were applied:

- Reviews, letters, case reports, conference papers, and personal opinion publications
- Evaluation of individuals with severe craniofacial syndromes
- Orthognathic surgery related to obstructive sleep apnea therapy
- Treatment involving other major dental specialty work
- Cases that simultaneously underwent minor esthetic/cosmetic surgery (ie, genioplasty, septoplasty)
- Studies that did not assess participants' expectations after completion of the entire treatment.

## Information Sources

A computerized systematic search was conducted in MEDLINE, PubMed, EBM Reviews, Web of Science, EMBASE, LILACS, and Scopus. The references cited in the selected articles were also hand searched for additional relevant studies that could have been missed in the electronic searches. A limited gray-literature search was explored in Google Scholar by restricting the search by the first 100 most relevant hits.

## Search Strategy

Details of the key words and word truncation for each database are presented in Appendix 1. All electronic searches were conducted from their earliest records up to September 30, 2014 and updated until March 28, 2015.

## Study Selection

Eligibility of the selected articles was determined in two phases. In phase one, two reviewers independently screened titles and abstracts of studies identified in all electronic databases. In phase two, the two reviewers assessed the selected full-text articles applying the same inclusion and exclusion criteria to confirm their final eligibility. The reviewers were not blinded to the authors and the full text of the study. Disagreements between reviewers were resolved

through discussion until consensus; a third reviewer was involved when this attempt failed to make a final decision.

### Data Collection Process and Data Items

Three reviewers were involved in a standardized data extraction process based on the Cochrane Consumers and Communication Review<sup>13</sup> template. One reviewer collected the required information from the selected articles. Two reviewers cross-checked all the retrieved information. Again, disagreements were resolved by discussion and mutual agreement between the reviewers. An additional reviewer was involved, when required, to make a final decision.

The data extracted included sample size of selected studies, timing of assessment, methodology, psychological tool elected to assess patients' satisfaction, orthognathic surgery type, response rate of studies, statistical test, and findings of the included articles. If the reviewers deemed any article to be unclear after full evaluation, they contacted the authors of the study for clarification.

### Risk of Bias in Individual Studies

The Newcastle-Ottawa Scale,<sup>14,15</sup> modified for cross-sectional studies,<sup>16,17</sup> was applied. This scale addresses three domains (selection, comparability, and outcome), and the selected studies could be awarded one check for each factor in the two first categories (sum of five checks) and two checks for each factor in the comparability domain. The sum of the checks, a maximum of seven, reflects the overall quality rating of the study.

Two reviewers assessed the risk of bias of the selected studies. Disagreements were resolved by attempting to achieve consensus between reviewers. A third reviewer was involved when needed to make a final decision.

### Summary Measures and Synthesis of Results

Any quantified/qualified factor that was identified as affecting a patient's satisfaction after the completion of orthodontic treatment combined with orthognathic surgery was accepted.

### Risk of Bias Across Studies and Additional Analyses

It was decided a priori that if the data from different studies were sufficiently homogeneous and that the combination of the collected data was justifiable a meta-analysis would be carried out. Additional analysis, such as risk of bias across studies or publication bias, would be calculated only if a meta-analysis was completed.

## RESULTS

### Study Selection

Eight articles satisfied the inclusion criteria of this systematic review. A flow chart of the selection process is outlined in Figure 1. A list of articles excluded during the second selection phase and the reasons for their exclusion is presented in Appendix 2.

### Study Characteristics

The included studies showed large variation in sample size, age, distinct psychological evaluation tools, and time elapsed between the satisfaction assessment and treatment. Most samples included patients from university hospitals.<sup>4,18-22</sup> A summary of the studies' characteristics is provided in Table 1.

Studies applied different tools to assess satisfaction: questionnaires filled out during a follow-up consultation,<sup>22-24</sup> questionnaires mailed after treatment,<sup>4</sup> structured interview after the follow-up consultation,<sup>21</sup> or both questionnaires (interview and questionnaires)<sup>19,20</sup> and structured interview by phone.<sup>18</sup> Two studies reported that patients were first interviewed by telephone and the satisfaction evaluation was conducted later.<sup>4,23</sup>

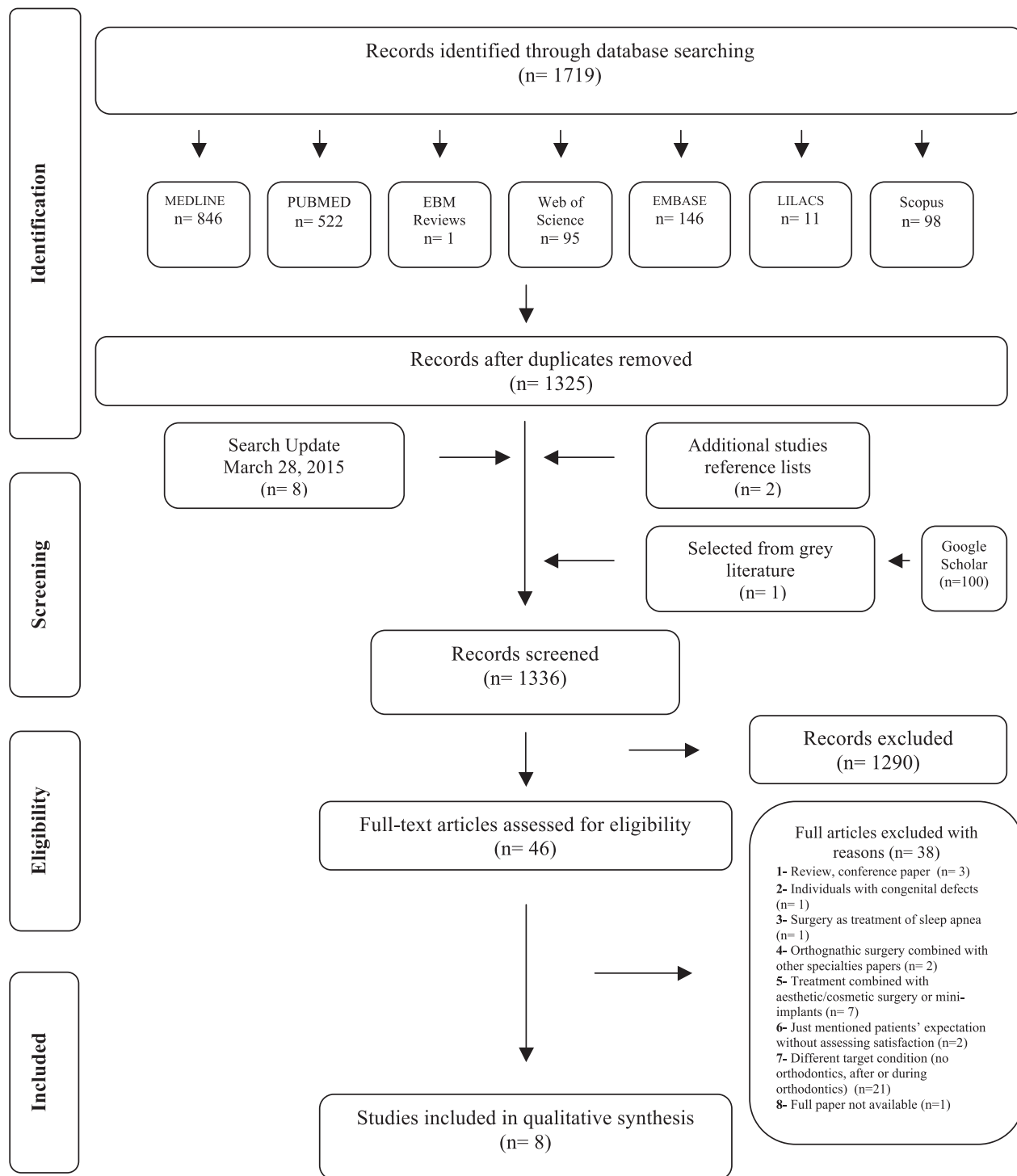
The author of one initially selected study was contacted to clarify missing information by e-mail.<sup>25</sup> Because of the provided information, the study was later excluded from the review.

### Risk of Bias Within Studies

Most of the studies (five of eight) had high risk of bias. The main risk of bias limitations were related to sample-size calculation and sample power calculation, which were not presented in any of the selected studies. However, some retrospective studies<sup>22-24</sup> defined timing and selected consecutive patients, thereby improving the selection methodology. None of the studies indicated use of blinded interviewers or questionnaire/interview evaluators. Finally, half of the studies did not apply previously validated questionnaires or interviews to assess satisfaction after treatment. Specific description and items of the Newcastle-Ottawa Scale quality assessment is presented in Table 2.

### Summary Description of the Individual Studies

*Sociodemographic factors.* Age was not related directly to satisfaction in four of the papers.<sup>18-20,22</sup> Sex<sup>22</sup> and socioeconomic status,<sup>23</sup> the latter measured as income, were associated with satisfaction. Male patients and patients with a lower socioeconomic status reported higher levels of satisfaction. Schooling



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<sup>1</sup> Adapted from PRISMA Statement (Preferred Reporting Items for Systematic Reviews and Meta-Analysis)

**Figure 1.** Flow diagram depicting the literature search and selection criteria.

was found to be related to the acceptance of undergoing treatment combined with surgery<sup>23</sup> but studies did not report whether it influenced satisfaction outcomes.

**Treatment outcome.** When pretreatment motives to undergo the surgery were addressed, satisfaction levels were better.<sup>19</sup> Treatment length was highly negatively correlated with outcome satisfaction.<sup>21</sup> Final dentofacial esthetics was strongly positively associated with satisfaction.<sup>20,24</sup> Patients dissatisfied with outcomes reported higher levels of temporomandibular joint pain and pain on mandibular movement compared to those who were satisfied with treatment outcomes.<sup>24</sup> Patients without a long-term neurosensory deficit after treatment were more satisfied.<sup>18</sup> Improvements in temporomandibular joint, facial pain, and anatomical occlusion were significantly associated with patient satisfaction.<sup>18</sup> Numbness of lips and jaw and chewing ability after treatment also had a negative effect in overall satisfaction.<sup>18,20</sup>

**Surgery type.** Patients who underwent bimaxillary surgery were more satisfied than those who underwent a maxillary or a mandibular procedure only.<sup>19,20</sup> Patients with skeletal Class II malocclusion reported dissatisfaction after treatment more frequently than those with skeletal Class I and skeletal Class III malocclusion.<sup>22</sup> Patients who underwent mandibular setback as the only procedure<sup>18,22</sup> or in combination with maxillary surgery<sup>22</sup> had a higher level of satisfaction than those who underwent mandibular advancement as the only procedure<sup>18,22</sup> or in combination with maxillary surgery.<sup>19,22</sup>

**Psychological factors.** Pretreatment motivation was correlated with posttreatment psychological status and satisfaction. Social interaction increased more after treatment as it was correlated to satisfaction (work and family environments).<sup>19,22</sup> In addition, patients indicated that the benefits of combined orthodontic-surgical treatment would have a major influence in their psychological well-being and self-concept.<sup>18–20</sup>

**Quality of care.** Patients who were more informed about surgical risks reported a higher level of satisfaction.<sup>23</sup> Overall satisfaction was linked to the quantity of information that was given to patients and to their family and direct friends.<sup>23</sup> Satisfaction was also linked to quality of care and attention immediately after surgery.<sup>4</sup> Lack of information after surgery was suggestive of dissatisfaction.<sup>4</sup>

### Synthesis of Results

Because of the limitations of the identified available evidence, only a list of the factors associated with or without patient's satisfaction can be presented.

The following factors were associated with satisfaction.

- Final esthetic outcome<sup>22,24</sup>
- Perceived social benefits from the outcome<sup>22</sup>
- Type of orthognathic surgery<sup>20,22</sup>
- Sex (female patients were more likely to link dental appearance and satisfaction with treatment outcome)<sup>18,22</sup>
- Changes in patient self-concept after treatment<sup>19,20</sup>

The following factors were associated with dissatisfaction:

- Treatment length<sup>21</sup>
- Sensation of functional impairment and dysfunction after surgery<sup>18,22,23</sup>
- Information about the risks of surgery was not provided<sup>4</sup>

### Risk of Bias Across Studies and Additional Analysis

Included data were not homogeneous enough to justify a meta-analysis.

### DISCUSSION

This systematic review investigated factors associated with satisfaction after orthodontic treatment combined with orthognathic surgery. In general terms, it is clear that the vast majority of the patients who underwent this combined treatment were satisfied (more than 85%). Patient satisfaction is a multifaceted dimension; however, people may have a complex set of important and relevant beliefs.<sup>26</sup> Interest in patient satisfaction with various aspects of their health care has grown significantly for surgeons and orthodontists. The benefits provided by a combined orthodontic-surgical treatment,<sup>27</sup> as well as the potential risks and negative side effects regarding this therapy modality,<sup>28</sup> can contribute to patients' satisfaction with the final outcome.

Orthodontists and oral maxillofacial surgeons should improve the informed consent process and properly temper patients' expectations by limiting false impressions of a "new face" after such complex treatment.<sup>8</sup> It has been observed that patients tend to expect their new profile to fit more closely to socially accepted patterns than what should really be expected.<sup>29</sup>

Another major factor to be considered is that the perceived care and attention the orthodontist, surgeon, and staff provided to the patient increased the patient's confidence in the orthodontic/surgical treatment outcomes. However, perception of care is a broad category that was sometimes only assessed as quality of care in the studies examined. These distinct

**Table 1.** Summary of Descriptive Characteristics of the Included Articles<sup>a</sup>

Author(s), Date, and Country	Sample (Size, Sex, and Age)	Timing of Assessment	Patient Recruitment	Method of Administering Survey and Response Rate
AlKharafi et al. <sup>23</sup> 2014, Kuwait	n = 74 52 female and 22 male patients Mean age = 21.1 y	6 mo and 10 y after appliance removal	Four surgical centers in Kuwait (66 patients)	Data collected from patient records: age and sex Telephone interview (15–20 min) using structured questionnaire (Arabic and English versions) Response rate: 50% 74/147
Boch et al. <sup>24</sup> 2007, Germany	n = 102 Mean age at intervention = 24.3 y Long-term follow-up assessed satisfaction (T3) Mean 47 months after surgery 24.9	11–141 mo after orthognathic surgery (mean = 47 mo)	Medical files of patients Place not declared	Patients who had undergone an orthognathic intervention between January 1988 and December 1999 Response rate: 100%
Cunningham et al. <sup>4</sup> 1996, United Kingdom	n = 100 postoperative patients	Completed orthodontic treatment at least 9 mo after surgery	Patients from Orthodontic Department of Eastman Dental Hospital in London	Selected patients contacted by phone and questionnaire sent 1 wk later Response rate: 81%
Espeland et al. <sup>22</sup> 2008, Norway	n = 516 consecutive patients 281 female and 231 male patients Mean age = 27.2 y	At the final follow-up session, 3 y after surgery	Patients who underwent surgery at the Ullevål University Hospital between January 1994 and January 2003	Invalidated questionnaire with seven fixed alternative answers questions and patients invited to give free comments Response rate: 90.2% 516/572

**Table 1.** Extended

Psychometric Tool Used to Assess Satisfaction	Variables Assessed for Association to Satisfaction	Factors Significantly Associated With Satisfaction	Authors' Conclusion and Factor Related to Satisfaction
Nonvalidated questionnaire pilot-tested with three patients	Socioeconomic status Presurgical information type	Patients with a higher socioeconomic status reported lower levels of satisfaction with outcomes ( $P = .008$ ). Patients who were informed about surgical risks reported a higher level of satisfaction ( $P < .04$ ). Patients who were informed about the different phases of the orthodontic and surgical procedures reported a higher level of satisfaction with the orthodontist ( $P < .028$ ). Patients who were informed about surgical risks and postoperative discomfort reported a higher level of satisfaction with the surgeon ( $P < .031$ ).	Most patients who sought combined orthodontic and surgical treatments were women. Participants were more likely to be satisfied when they were given <i>information concerning discomfort and surgical risks</i> .
Nonvalidated questionnaire One question addressing the factors affecting patient satisfaction (yes or no answer)	Gender Age Diagnosis at the start of treatment: Mandibular prognathism Mandibular retrognathic Open bite Laterognathism Nerve dysfunction: None Minor hypoesthesia Serious hypoesthesia Paresthesia Mandibular movement: Maximum opening Deviation initial Deviation intermediate Deviation terminal Maximum protrusion Maximum laterotrusion right Maximum laterotrusion left Temporomandibular function: TMJ function Muscular pain TMJ joint pain Pain on mandibular movement	Patients in group 1 (dissatisfied with outcomes of orthodontic treatment combined with orthognathic surgery) reported higher levels of TMJ pain ( $P < .05$ ) and pain on mandibular movement ( $P < .05$ ) than those in group 2 (satisfied with outcomes of orthodontic treatment combined with orthognathic surgery).	Symptoms of <i>TMJ dysfunction</i> are correlated with patient satisfaction
Nonvalidated questionnaire with incorporations: the Rosemberg Index of Self-Esteem and the Hospital Anxiety and Depression Scale	This study just presented descriptive statistics	Z test and Fisher's exact test for the comparison of preoperative and postoperative proportions, Wilcoxon's two-sample rank test to analyze self esteem index (RIS), and the Hospital Anxiety and Depression Scale	<i>Lack of explanation after surgery</i> ; after care follow-up was poor. Study strongly suggested providing information for family and friends.
Three questions regarding treatment satisfaction and stability	Gender Respondents' age: <20 years 20–29 years 30–39 years ≥40 years Category of skeletal malocclusion: Skeletal Class I Skeletal Class II Skeletal Class III Category of surgical procedure: Mandibular setback Mandibular setback and Le Fort I Mandibular advancement Mandibular advancement and Le Fort I Maxillary surgery Other procedures	More male than female patients expressed satisfaction ( $P < .001$ ). There were no statistically significant differences for age. Dissatisfaction was most frequently reported among patients with skeletal Class II ( $P < .001$ ). Dissatisfaction was most frequently reported after advancement of mandible whether reported as the only procedure or in combination with other osteotomies ( $P < .001$ ). Satisfaction was most frequently reported by patients who underwent mandibular setback as the only procedure or in combination with maxillary surgery ( $P < .001$ ).	The patients' stated reasons for dissatisfaction: <i>impaired nerve function</i> ( $n = 11$ ), <i>relapse</i> ( $n = 11$ ), <i>appearance</i> ( $n = 8$ ), <i>TMJ problems</i> ( $n = 8$ ), and other reasons ( $n = 9$ ). The low dropout rate contributed to the representativeness of the findings and may be due to the regular postoperative follow-up examinations.

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**Table 1.** Continued

Author(s), Date, and Country	Sample (Size, Sex, and Age)	Timing of Assessment	Patient Recruitment	Method of Administering Survey and Response Rate
Kim et al. <sup>21</sup> 2009, Korea	n = 44	2 and 6 mo after the postoperative orthodontic treatment was completed	Consecutive patients undergoing orthognathic surgery (from March 2003 to December 2005) from the Department of Oral Maxillofacial Surgery at Ewha Woman's University Hospital	Follow-up appointment and structured interview Response rate: 100%
Oland et al. <sup>20</sup> 2010, Denmark	n = 118 patients and 47 control subjects (matched for age and gender) 67 female and 51 male patients	After postsurgical orthodontic treatment was completed Patients were assessed at 2 times: T0 (before surgery) and T1 (after surgery and orthodontic treatment)	Consecutive patients undergoing orthognathic surgery at the Department of Oral and Maxillofacial Surgery, Aarhus University Hospital in Denmark during 2000 and 2001 Response rate: 66,9%	After postsurgical orthodontic treatment follow-up: questionnaires, personal interviews, and clinical examinations. Response rate: 89% 118/132
Oland et al. <sup>19</sup> 2011, Denmark	n = 118 patients treated and 47 control subjects (matched for age and gender) 51 men and 67 women Mean age = 25 y	After completion of postsurgical orthodontic treatment Patients were assessed at 2 different times: T0 (before surgery) and T1 (after surgery and orthodontic treatment)	Consecutive patients undergoing orthognathic surgery at the Department of Oral and Maxillofacial Surgery, Aarhus University Hospital in Denmark during 2000 and 2001 Response rate: 69,8% 118/169	Questionnaires, personal interviews, and clinical examinations. Response rate: 89% 118/132
Pahkala et al. <sup>18</sup> 2007, Finland	n = 82 53 female and 29 male subjects Age = 32 y	6 months and 10 y after appliance removal	All patients from 1998 and 2004 at the Kuopio University Hospital in Finland	Data collected from 13 questions administered during a follow-up consultation Response rate: 100%



**Table 1.** Extended

Psychometric Tool Used to Assess Satisfaction	Variables Assessed for Association to Satisfaction	Factors Significantly Associated With Satisfaction	Authors' Conclusion and Factor Related to Satisfaction
Nonvalidated questionnaire (14 items)	This study just presented descriptive statistics	Factors were compared by calculating means and standard deviations.	Dissatisfaction related to preoperative orthodontics more than 3 months. Of the patients, 95.5% were dissatisfied with long duration of orthodontics. Perioperative dissatisfaction was related to communication of information about possible sequel and the recovery period and patients' consent for the surgical procedure.
Structured interview Post Surgical Patient Satisfaction Questionnaire	Symptoms of oral dysfunction before and after orthodontic treatment combined with orthognathic surgery: Symptom free Mild symptoms Severe symptoms Clinical oral function before and after orthodontic treatment combined with orthognathic surgery: No dysfunction Mild dysfunction Moderate dysfunction Severe dysfunction Type of surgery: Bimaxillary surgery Maxillary or mandibular surgery	Patients who reported no symptoms after treatment were more satisfied than those who reported severe symptoms ( $P = .04$ ). Patients without signs of clinical dysfunction after treatment were more satisfied with outcomes than those who had severe clinical dysfunction ( $P = .01$ ). Patients who had a bimaxillary surgical procedure were more satisfied with treatment outcomes than those who had an isolated maxillary procedure and those who had an isolated mandibular procedure ( $P = .03$ ).	High level of satisfaction was experienced by patients after orthognathic surgery (a self-fulfilling prophecy). Result of an <i>improvement in the patients' functional outcome</i> . Patients' overall satisfaction was <i>unrelated to age, gender, and type of surgery</i> performed.
Questionnaire on motives for surgical-orthodontic treatment (modified version, three questions added) Problems with oral function (modified version, one question added) Post Surgical Patient Satisfaction Questionnaire	Pretreatment motives for orthodontic treatment combined with orthognathic surgery: Oral function Appearance Social disease Prevention	The greater the prominence the patients had given to oral functional motives before treatment, the lower the overall treatment satisfaction ( $P = .03$ ). The greater the prominence the patients had given to social motives before treatment, the lower the overall treatment satisfaction ( $P = .02$ ). Given increasing prominence to social motives correlated negatively with healing satisfaction ( $P = .01$ ). Giving increasing prominence to appearance motives correlated positively with treatment satisfaction ( $P = .03$ ). High degrees of the motive fulfillment correlated positively with all aspects of treatment satisfaction and applied to all four motive scales ( $P < .03$ ).	Time of healing influenced patient satisfaction (patients undergoing bimaxillary treatment were more satisfied). Patients who scored the greatest values of self-concept and social interaction after treatment were most satisfied. Other motives (not surgery) were related to the overall satisfaction.
Nonvalidated questionnaire Temporomandibular disorder evaluated by clinical dysfunction indexes	Surgery type: Mandibular advancement Mandibular setback Change evaluated as improved, no change, or worsened in the following: Chewing ability TMJ Anatomical occlusion Facial pain and headache Change in self-confidence: Improved No change Long-term neurosensory deficit: Yes No Symptoms of oral dysfunction before and after orthodontic treatment combined with orthognathic surgery: Symptom free Mild symptoms Severe symptoms Age Gender	The $\chi^2$ test according to Pearson showed significant difference between groups. Multiple logistic regression was used to associate satisfaction and treatment outcome. Age and sex were associated with high satisfaction in the logistic regression. There was a high correlation between patient satisfaction and subjective TMJ ( $P = .023$ ) and facial pain ( $P = .010$ ).	In addition to functional and morphologic reasons, psychological factors should be emphasized when presenting or comparing treatment alternatives to patients.

<sup>a</sup> TMJ indicates temporomandibular joint.

**Table 2.** Newcastle-Ottawa Quality Assessment Adapted for Cross-Sectional Studies<sup>a</sup>

	AlKharafi et al. <sup>23</sup> 2014	Kim et al. <sup>21</sup> 2009	Boch et al. <sup>24</sup> 2007	Espeland et al. <sup>22</sup> 2008	Cunningham et al. <sup>4</sup> 1996	Pahkala et al. <sup>18</sup> 2007	Oland et al. <sup>20</sup> 2010	Oland et al. <sup>19</sup> 2011
Sample-selection criteria (maximum of four asterisks)								
1) Representativeness of the sample a) Truly representative of the average in the target population* (all subjects or random sampling); b) Somewhat representative of the average in the target population* (nonrandom sampling); c) Selected group of users; d) No description of the sampling strategy.	c	c	c	c	c	c	b*	b*
2) Sample size a) Justified and satisfactory*; b) Not justified.	b	b	b	b	b	b	b	b
3) Nonrespondents a) Comparability between respondent and nonrespondent characteristics is established, and the response rate is satisfactory*; b) The response rate is unsatisfactory or the comparability between respondents and nonrespondents is unsatisfactory; c) There was no description of the response rate or the characteristics of the respondents and nonrespondents.	c	c	c	*	b	c	c	c
4) Ascertainment of the satisfaction level a) The measurement tool was validated*; b) The measurement tool was not validated, but the tool is available or described*; c) There is no description of the measurement tool.	b*	b*	—	b*	c	b*	a*	a*
Comparability (maximum of two asterisks) The subjects in different outcome groups (satisfied or not satisfied) are comparable based on the study design or analysis. Confounding factors are controlled. a) The study controls for the most important factor (satisfaction of patients; select one)**; b) The study controls for any additional factor.*	—	—	—	—	—	—	—	*
Outcome (maximum of one asterisk) <sup>b</sup> Assessment of the outcome from the patient's point of view a) Independent blind assessment*; b) Record linkage; c) Self-report*; d) No description.	c*	c*	c*	c*	c*	c*	c*	c*
Summary score (maximum of seven asterisks)	2	2	1	3	1	2	3	3

<sup>a</sup> Letters in the reference columns correspond to those in the first column. A study can be awarded a maximum of one asterisk (representing "yes") for each numbered item within the Selection and Outcome categories. A dash indicates no award.

<sup>b</sup> For Outcome, patient satisfaction has to be assessed by interview or self-reported questionnaire. The asterisk will be given for item "c" instead of the "b" (record linkage is not applicable for this scenario).

concepts need to be properly differentiated.<sup>26</sup> Results suggest that health care shortly after surgery promotes satisfaction not just for the patients but also for family and friends.

Although common sense dictates that genioplasties and related minor surgical procedures further improve esthetic outcomes, this systematic review did not consider these factors so that it was clear that the results were based only on the major surgical procedures and not on these minor auxiliary esthetic procedures. By doing so the effects of the most significant part of the surgical procedure are clearly differentiated.<sup>30-32</sup>

It has to be noted that more than 85% of the assessed patients were satisfied with the results. This high satisfaction level has been previously shown in a review related to orthognathic interventions and improvement in quality of life<sup>11</sup> as well as in other related studies.<sup>2,32</sup> Still, 15% of patients were not fully satisfied. This is where the sugges-

tions from the systematic review can be used to prevent these dissatisfaction levels. It has to be noted that patients who undergo some types of orthognathic surgical procedures (ie, mandibular setbacks) are more likely to be satisfied with the final outcome. These types of surgical procedures are usually closely linked to specific malocclusions (in this example Class III malocclusion with mandibular excess).

Patients' motivation to seek combined orthodontic-surgical treatment depends on subjective factors. The perceived social benefits of the treatment outcomes were correlated with satisfaction<sup>33</sup> and reported to be one of the significant motivations to accept the orthodontic-surgical treatment plan.<sup>34</sup> Patients who reported improvements in self-confidence and higher levels of self-concept and social interaction after treatment showed higher levels of satisfaction with outcomes.<sup>18</sup> Accordingly, a recent study presented strong evidence of the impact of a malocclusion and its negative influence on emotional and social dimensions.<sup>10</sup>

## Limitations

A clear limitation of this study is related to the different timing of the satisfaction assessment as the time frame could influence perception of satisfaction. Memory bias should be considered when assessing patients within a 9-year interval after treatment completion.<sup>24</sup> Also, the interpretation of results could differ when the results derive from face-to-face interview, mailed questionnaire or structured interview by phone. Two studies<sup>4,21</sup> only presented descriptive statistics, which hampers comparison with statistically significant results.

There is need to develop surgical outcomes questionnaires with confirmed standard psychometric properties, such as validity and reliability.<sup>35</sup>

## CONCLUSION

Although a number of factors were identified that were associated with patients' satisfaction or dissatisfaction with orthodontic treatment combined with orthognathic surgery; the available evidence was limited. Listed factors should therefore be considered cautiously.

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## APPENDIX 1

### Databases and Individualized Truncations of Words (Updated March 29, 2015)

Database	Key Words
MEDLINE ( <a href="http://www.ncbi.nlm.nih.gov/pubmed">http://www.ncbi.nlm.nih.gov/pubmed</a> )	orthognathic surgery or surgery, oral or orthognathic surgical procedures or oral surgical procedures or osteotomy, Le Fort or osteotomy or mandibular osteotomy or maxillary osteotomy or osteotomy, sagittal split ramus AND patient satisfaction or patient preference or personal satisfaction
PubMed <sup>a</sup> ( <a href="http://www.ncbi.nlm.nih.gov/pubmed">http://www.ncbi.nlm.nih.gov/pubmed</a> )	(orthodon*[Title/Abstract]) AND (satisf*[Title/Abstract]) AND (patients[Title/Abstract] OR patient[Title/Abstract] OR patients'[Title/Abstract] OR patient's[Title/Abstract]))
EBM Review ( <a href="http://cochrane.bvsalud.org/portal">http://cochrane.bvsalud.org/portal</a> )	(consumer satisfaction.mp. or exp patient satisfaction/or patient*.mp.) adj3 satisf*.mp. AND (orthodontics or mandibular advancement or orthodontic anchorage procedures or orthodontic appliance design).mp. or exp orthodontic appliances/or exp orthodontics, corrective/or exp orthodontics, interceptive/or exp orthodontics, preventive/or (orthodontic* adj3 patient*).mp.
Web of Science ( <a href="http://apps.webofknowledge.com">http://apps.webofknowledge.com</a> )	(Patient satisfaction after orthodontic treatment) Refined by: research areas: (dentistry oral surgery medicine) AND documents types: (article) Timespan: All years. Search language=Auto
EMBASE ( <a href="http://embase.com/search">http://embase.com/search</a> )	(orthognathic surgery or maxillofacial surgery or craniofacial surgery or orthognathic surgical procedures or face surgery or oral surgery or osteotomy or maxilla osteotomy or mandible osteotomy) AND (satisfaction or patient satisfaction or patient preference or patient attitude or consumer)
LILACS <sup>a</sup> ( <a href="http://lilacs.bvsalud.org">lilacs.bvsalud.org</a> ) Scopus ( <a href="http://www.scopus.com">www.scopus.com</a> )	ortodontia or ortodoncia [Palavras] and satisfação do paciente [Palavras] or felicidad del paciente [Palavras] Title Abs Key (satisfaction after orthognathic surgery) AND doctype (ar OR re) AND subjarea (mult or agri or bioc or immu or neur or phar or mult or medi or nurs or ete or dent or heal)
Google Scholar ( <a href="http://scholar.google.ca">scholar.google.ca</a> )	Any idiom; Without patents and citations; Classified by relevance (100 most relevant articles). Patient satisfaction after orthognathic surgery

<sup>a</sup> Refined search (orthognathics) not included in the last selection because the final result was characterized by a reduced number of articles. Selection of the articles will be done manually.

**APPENDIX 2**

Articles Excluded and the Reason for Exclusion

Reference Number	Author and Date	Reason for Exclusion <sup>a</sup>
1.	Bailey et al. 1998	5
2.	Barbosa et al. 1993	7
3.	Bertolini et al. 2000	7
4.	Baherimoghaddam et al. 2014	7
5.	Busby et al. 2002	5
6.	Chatenay et al.	1
7.	Cheng et al. 1998	7
8.	Dantas et al. 2015	7
9.	Ek et al. 1997	7
10.	Flanary et al. 1983	7
11.	Flanary et al. 1985	7
12.	Forsell et al. 1998	5
13.	Frost and Peterson 1991	7
14.	Garvill et al. 1992	6
15.	Hagensli et al. 2014	7
16.	Holman et al. 1995	7
17.	Jager et al. 1995	5
18.	Kharrat et al. 2006	8
19.	Khattak et al. 2012	7
20.	Kiyak et al. 1985	5
21.	Kufta et al. 2014	1
22.	Lazaridou-Terzoudi et al. 2003	7
23.	Maurer et al. 2002	3
24.	Meade et al. 2010	4
25.	Motego et al. 2003	4
26.	Narayanan et al. 2008	1
27.	Nurminen et al. 1999	7
28.	Olson et al. 1980	7
29.	Ostler et al. 1991	7
30.	Ponduri et al. 2011	7
31.	Rocha et al. 2008	7
32.	Rispoli et al. 2004	7
33.	Rustemeyer et al. 2010	7
34.	Shalhoub 1994	6
35.	Silva et al. 2013	7
36.	Siow et al. 2002	2
37.	Tomizawa et al. 1981	5
38.	Trovik et al. 2012	5

<sup>a</sup> 1 indicates review, conference paper, book, or personal opinion; 2, patients with congenital defects; 3, surgery for treatment of sleep apnea; 4, orthognathic surgery combined with other specialties; 5, treatment combined with esthetic/cosmetic surgery or mini-implants; 6, mentioned patients' expectation without assessing satisfaction; 7, different target condition (no orthodontics, during orthodontics); 8, full copy of the study was not available.

**APPENDIX 2  
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