INTRODUCTION
The main common purpose of the various types of dental specialty is based around the restoration of the health and aesthetic and masticatory function of a patient. Today, however, people often seek dental treatment for aesthetic reasons, forcing professionals to find ways of achieving more harmonious and symmetrical smiles, in order to ensure satisfactory rehabilitation.1,2

Factors normally involved in the aesthetic consideration of a smile are related to the lips, positioning, size, shape, and teeth color, as well as the proximity between the gingival tissue and the teeth.3,4 Other factors associated with aesthetics are related to health, tooth discoloration, morphology and suitable gingival contours, all of which are considered essential to an attractive smile.5 Among the many disorders that can compromise the aesthetics of a smile are gingival excess or exacerbated gingival display, a medical condition known as gummy smile.6

Gummy smile is recognized by the American Academy of Periodontology (AAP) as a deformity and mucogingival condition that affects the area around the teeth.7 Allen (1998) stated that gum exposure of less than 2-3 mm can be considered attractive, with overexposure (> 3 mm) generally considered unattractive and known as gummy smile, which is usually considered an aesthetic problem.8,9 However, perception of excessive gingival display is also subject to cultural and ethnic preferences. In some European countries gingival display of up to 4 mm or more is acceptable, while exposure greater than 2-3 mm is considered unsightly in the USA.7

The main etiological factors related to gummy smile involve gingival (altered passive eruption), skeletal (vertical maxillary excess) and muscle (upper lip hyperfunction) characteristics.10 Altered passive eruption occurs when the periodontal complex does not migrate apically in the direction of the cementoenamel junction, covering part of the clinical crown, resulting in short teeth.10 This covering may have aesthetic complications, especially in patients with a high smile line. The prevalence of gummy smile is 10% among the population aged between 20 and 30 years, and is more common among women than men.11

Some consequences of this change are the short clinical crown and excess of gingival tissue.12 For the diagnosis and planning of the altered passive eruption, some authors suggest the association of radiographic analysis13,14, transgingival probe measurement15 and more recently, the use of cone beam computed tomography.16 The therapeutic procedure will depend on the etiology and the seriousness of the case that can indicate the removal of excess and remodeling of gingival tissues.17 The gingivectomy procedure is indicated when there is the need of remodeling of gingival tissues only, while the elements are with their crown partially open. When the bone level is adjacent to the cemento-enamel junction or even covering it, the gingivectomy is performed along with the osteotomy.13

In these cases, surgical techniques to lengthen the clinical crown can effectively resolve aesthetic problems.18 Other recommended treatment procedures are apically positioned flaps, orthodontics, dentistry, orthognathic surgery, myotomies and even the use of botulinum toxin.13 Lengthening the clinical crown involves removing a strip of gum tissue, with or without bone resectioning.11 It is considered a common technique for the restoration of periodontal space in case of caries and fractures, as well as for the correction of aesthetic disorders.20

The aim of this study was therefore to conduct an integrative review of scientific evidence relating to the periodontal surgery techniques used to treat gummy smile.

METHODOLOGY
An integrative literature review was performed to analyze and evaluate existing scientific knowledge of the subject. The bibliographic search was performed in the first semester of 2015, in the PubMed, Scopus and Web of Science databases, in addition to a manual search of articles cited in the studies selected for the review.

The following search strategy was used: ((smiling OR gummy smile) AND (treatment) AND (gingivoplasty OR gingivectomy OR crown lengthening) AND (esthetics OR surgery, plastic)). This strategy was based on DeCS (Health Science Descriptors) indexed descriptors and the main terms found in a reading of a number of relevant articles prior to the study. The search was performed by two independent examiners. In case of disagreement, the reviewers met to discuss the inclusion or exclusion of the article.

Scientific articles on aesthetic periodontal surgery in English, published on any date, and which were controlled and/or randomized clinical studies, prospective cohort studies, case series or case reports were included in the study. Studies in Portuguese and Spanish that involved other types of surgery (orthognathic surgery, myotomies, or lip repositioning) or non-surgical treatments (orthodontics, dentistry, botulinum toxin), or were literature reviews or appeared as not complete in the database were excluded. Studies not available in the databases were requested by direct contact with the author or by purchasing the magazine. Duplicate articles were considered only once.

Following initial selection based on titles and abstracts, the full...
texts were read, and information relating to the following variables was gathered: authors, year, objectives, methodological characteristics of the study, sample (age, gender, number of participants), surgical technique, follow-up period, main results and conclusions.

RESULTS

The results found in the databases searched are shown in the flowchart in Figure 1. A total of 69 references were found in the PubMed database. Following analysis based on the inclusion criteria and reading of the available abstracts, 12 articles were selected. Nine references were found in the Scopus database, and three articles were selected using the same criteria. Seven references were found in the Web of Science database, with only one item included after the inclusion and exclusion criteria were applied.

Of the articles analyzed in full, two case reports, two case series and one randomized controlled trial of the subject were found. These were published between 2008 and 2014. The average age of patients undergoing surgery for gummy smile correction was 26 years. A total of 48 patients undergoing surgery and follow-up monitoring by researchers were included in the studies, of whom 37 were women and 11 were men. The predominant surgical technique was based on the use of gingivectomy with osteotomy, with follow-up times of two months, six months or 12 months (one study only). The main findings relate to patient satisfaction after surgery. In all cases the patients were satisfied with the cosmetic results. There was no difference between surgical techniques in studies that compared the two.

A gummy smile has a major impact on the relationships, self-esteem and confidence due to a greater aesthetic need among females, especially with regard to an attractive smile. The main surgical technique chosen to lengthen the clinical crown was gingivectomy, with or without bone resection. These surgical procedures often require time and the use of sutures, and can cause postoperative morbidity for the patient. The personal satisfaction of the patient after treatment should therefore be one of the requirements for the success of the technique. A controlled randomized clinical study used the technique of gingivectomy with osteotomy, both open flap and flapless, in the same patient and obtained positive results during an evaluation period of 12 months for both techniques, showing that minimally invasive procedures can also be used to surgically treat a gummy smile.

Researches still add that the lengthening of the clinical crown and consequent osteotomy/osteoplasty are also a part of the “gummy smile” treatment. Ribeiro et al. emphasize that in cases of altered passive eruption, it is necessary the application of the osteoplasty technique to regularize the bone in the anterior maxilla. This procedure, in addition to the improvement of aesthetics, allows a better adaptation of the superior lip. Other authors also recommend the increase of the clinical crown at the anterior superior sextant, through osteotomy and osteoplasty, to correct the altered passive eruption. In periodontal plastic surgeries, it is also recommended the use of the gingivectomy technique or flap repositioned apically technique to alter the conformation of soft tissues that contour the teeth, as well as its relative proportion. Gingivectomy must be performed in the presence of inserted mucosa, enough keratinized that after the removal of gingival tissue, there is still keratinized mucosa. When there is little keratinized mucosa, about 2 to 3 mm, priority should be given to maintaining the MC and, therefore, the retail shifted apically is chosen.

The follow-up periods of the surgical cases treated were 3, 6 and 12 months. These are relatively short follow-up times, which may undermine the predictability of the outcome, which provides guidance to the medical professional and patients with respect to the recurrence and/or appearance of any problems that may occur over the passage of time, such as gingival recession. However, no studies were found that observe tissue change and aesthetic crown lengthening operation in the long term.

The absence of long follow-up periods can also impair the reliability of the results obtained and conclusions drawn. It would be ideal to follow cases for a considerably longer period, in order to affirm the success of the surgical techniques used. Another limitation of the conclusions is that the majority of the types of study found were reports and case series with small samples, and results based on subjective patient satisfaction, which did not compare the quality of the surgical techniques used.

A gummy smile has a major impact on the relationships, self-esteem
and attractiveness of patients. Its correction therefore improves both the aesthetics and confidence of the patient. In all the studies evaluated, there was great satisfaction with regard to the patient's smile after treatment, regardless of the technique and follow-up period.

There is a significant lack of controlled and randomized clinical studies addressing the treatment of gummy smile with periodontal surgery. It was considerably more difficult to find such studies than studies relating to non-surgical therapeutic approaches, such as botulinum toxin, which appeared more frequently in the database search.

CONCLUSIONS

Based on the results of the studies found, the most frequently used technique was gingivectomy with osteotomy, which demonstrated favorable results, both from an aesthetic and patient satisfaction perspective.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this article.

References


Table I. Description of the articles included for Integrative Review by Authors, Year, Study Design, Surgical Technique, Follow-up Period and Main Results

<table>
<thead>
<tr>
<th>Authors and year</th>
<th>Type of Study</th>
<th>Sample</th>
<th>Surgical Technique</th>
<th>Follow-up</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rossi, R. et al. 2008</td>
<td>Clinical Case Reports</td>
<td>2 patients</td>
<td>Open flap gingivectomy with bone resection</td>
<td>6 months</td>
<td>Patients were satisfied with the treatment. The smile line and quantity of soft tissue were aesthetically pleasing after six months.</td>
</tr>
<tr>
<td>Cairo, F. et al. 2012</td>
<td>Case Series</td>
<td>11 patients</td>
<td>Open flap gingivectomy with bone resection</td>
<td>6 months</td>
<td>All patients were satisfied with the final clinical results.</td>
</tr>
<tr>
<td>Narayanan, S. et al. 2011</td>
<td>Clinical Case Reports</td>
<td>2 patients</td>
<td>Gingivectomy with and without bone resection</td>
<td>2 months</td>
<td>Both techniques demonstrated good aesthetic results.</td>
</tr>
<tr>
<td>Ribeiro, FV et al. 2014</td>
<td>Randomized controlled clinical trial</td>
<td>28 patients</td>
<td>Gingivectomy with and without open flap</td>
<td>12 months</td>
<td>There was no significant difference between the techniques for the criteria evaluated: Visible plaque index, Bleeding on probing index, Relative position of gingival margin, Relative Clinical Insertion Level, Probing Depth, Bleding on Probing, height of keratinized gingiva. The patient’s perception and aesthetic appearance were also evaluated and the results were similar for both techniques.</td>
</tr>
<tr>
<td>Dharsiyan, K. et al. 2014</td>
<td>Case series</td>
<td>5 patients</td>
<td>Gingivectomy with and without bone resection</td>
<td>6 months</td>
<td>In all the elements undergoing surgery the clinical crown was lengthened. At the end of six months, there was a gain in crown length of about 2mm per tooth.</td>
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