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Therapeutic Approaches to a Gummy Smile: A Narrative Review

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Abstract

Smiling is a fundamental facial expression in social interaction and non-verbal communication. However, a gummy smile, defined by excessive gingival exposure when smiling, can negatively affect facial aesthetics and self-confidence. This narrative review aims to evaluate the current knowledge regarding both surgical and non-surgical treatment options for gummy smile correction. An electronic search was conducted across five major databases, PubMed, Cochrane, ScienceDirect, Springer, and Google Scholar, for articles published between 2010 and 2024. This narrative review was based on a systematized literature search, and the selection process was reported using a Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram. Of the 147 initially identified articles, 64 met the inclusion criteria, including 46 clinical trials, 15 systematic reviews (six with meta-analysis), and three cross-sectional studies. The findings were synthesized narratively, without new pooled analysis. Our findings highlight that treatment choices depend on the underlying etiology, whether alveolo-skeletal, dento-periodontal, or orofacial myofunctional. Surgical interventions may involve gingivectomy, crown lengthening, lip repositioning, or orthognathic surgery. Non-surgical options include orthodontics (with or without mini-screws) and aesthetic treatments such as botulinum toxin or hyaluronic acid fillers. Advances in aesthetic dentistry now allow for effective, tailored solutions, though proper diagnosis and case selection remain critical. A multidisciplinary approach is recommended to determine the most appropriate treatment strategy for each patient.

Categories: Dentistry
Keywords: dentofacial orthopedics, gummy smile, lip repositioning, mini-screws, orthodontics, orthognathic surgery, treatment

Introduction And Background

Nowadays, patients seek orthodontic care less for functional reasons and more to enhance smile aesthetics [1,2]. The increasing emphasis on facial and smile aesthetics prompts clinicians to undertake a meticulous analysis of the smile's fundamental components, with careful attention to the dynamic interplay among teeth, gingiva, and lips. The smile represents a critical aesthetic parameter in modern society, and discrepancies such as excessive gingival display can constitute a psychological burden or impose substantial psychosocial limitations [3,4]. The harmony of a smile primarily depends on three anatomical components: the teeth, lips, and gingiva. These elements must exhibit balanced proportions and spatial relationships. The alignment, position, and dimensions of the maxillary incisors, as well as the height and contour of the gingival margin, directly influence smile aesthetics. Ideally, the gingival margin should follow the curvature of the upper lip, and the smile should expose the full crowns of the maxillary incisors with little or no visible gingiva, generally not more than 2 mm [5,6].

Definition and prevalence

A gummy smile, or excessive gingival display, is the exposure of an excessive band of gum above the upper teeth during smiling. It is generally defined as gingival exposure exceeding 2 mm, and in some reports 3 mm, measured above the cementoenamel junction (the line where the enamel of the crown meets the root) of the maxillary teeth [5-11]. In this review, a gingival display of up to 2 mm is therefore considered normal, a display between 2 and 3 mm is considered borderline, as it is judged acceptable by many observers [11-13], and a display greater than 3 mm is considered a gummy smile. Moreover, perception differs between professionals and laypeople; orthodontists consider a lip-to-gingiva distance of 2 mm unaesthetic, whereas the general public perceives gingival display as unaesthetic only from about 4 mm [11].

Gummy smile is a common variation in the population, with a reported prevalence ranging from 10.5% to 29% [14,15]. It is more frequent in females (14%) than in males (7%) [5,16].

Clinical forms

Several classifications have been proposed to describe the clinical presentation of a gummy smile.

According to the smile line: Tjan et al. distinguished low, average, and high smile lines; a high smile line,

which reveals the full length of the maxillary anterior crowns together with a continuous band of gingiva, corresponds to a gummy smile [5].

According to severity: Gingival display is commonly graded as mild or borderline (2 to <3 mm), moderate (3 to <4 mm), or severe (⩾4 mm) [17]. In cases of skeletal origin, Garber and Salama graded vertical maxillary excess into three degrees according to the amount of gingival exposure (2-4 mm, 4-8 mm, and >8 mm), each associated with a different level of treatment invasiveness [8].

According to location: Mazzuco and Hexsel described anterior, posterior, mixed, and asymmetric gummy smiles, depending on whether the excessive display involves the incisor region, the premolar-molar region, both, or one side predominantly [18].

These classifications are clinically relevant because the type and severity of gingival display directly influence the choice of treatment.

Etiology

A gummy smile may result from multiple, often combined factors, including alveolo-skeletal (related to the jaw bones and the bone supporting the teeth), dento-periodontal (related to the teeth and their surrounding gum and bone), or orofacial myofunctional (related to the lips and facial muscles) etiologies. Although its diagnosis is relatively straightforward, identifying its underlying causes is more complex. In most cases, the etiology is multifactorial [2,19-21], and a thorough review of the medical history, together with a comprehensive facial, profile, and cephalometric analysis under both static and dynamic conditions, is essential [19,20].

Skeletal and Dento-Alveolar Causes

Vertical maxillary excess, in which the upper jaw has grown excessively downward, is the most common cause [16]. Maxillary prognathism and upper alveolar protrusion, in which the upper jaw or its tooth-bearing bone is positioned too far forward, are sagittal causes, often associated with lip incompetence, increased muscular tension, and anterior open bite [22-24]. Anterior dento-alveolar extrusion, as seen in maxillary deep bite (overbite >3 mm), places the incisal edges low relative to the stomion (the contact point between the upper and lower lips) [25]. Compensatory dento-alveolar extrusion (over-eruption of the teeth with their supporting bone) secondary to tooth wear in bruxism (teeth grinding) may produce the same effect [26,27]. Microdontia (abnormally small teeth), by reducing crown size, also increases relative gingival display [3].

Dento-Periodontal Causes

Altered passive eruption results from failure of the gingiva to migrate to its normal position at the end of tooth eruption, leaving the gingiva covering part of the anatomical crowns, which appear short [19,21,27]. Gingival enlargement (an overgrowth of the gum tissue, also called hyperplasia or hypertrophy) may be genetic, inflammatory, drug-induced, or associated with orthodontic treatment [28].

Muscular (Orofacial Myofunctional) Causes

A short upper lip, measured from subnasale (the base of the nose) to the inferior border of the upper lip (approximately 23 mm in men and 20 mm in women), is a frequent cause [9]. Hyperactivity of the upper lip elevator muscles during spontaneous smiling also results in excessive gingival display [20].

Management

Depending on the etiology and severity, management of a gummy smile may be surgical or non-surgical. Surgical interventions include gingivectomy, crown lengthening, lip repositioning surgery, and, in more complex cases, orthognathic surgery. Conversely, non-surgical treatments encompass orthodontic techniques, sometimes assisted by temporary anchorage devices (TADs, small screws placed in the bone to provide a fixed point of support), as well as aesthetic procedures such as hyaluronic acid or botulinum toxin injections [29,30].

Objectives of the review

This review aims to synthesize the evidence published between 2010 and 2024 on surgical and non-surgical interventions for excessive gingival display, comparing their indications, outcomes, and limitations to guide clinical decision-making. More specifically, it addresses the following question: in patients with excessive gingival display (population), what are the indications and reported outcomes of surgical and non-surgical interventions (interventions), and how do these modalities compare with one another (comparison) in terms of reduction of gingival display, stability or relapse over time, and patient satisfaction (outcomes)?

The review is organized as follows: the Methodology section describes the search strategy and selection

criteria; the Results section presents the selection process and the characteristics of the included studies; and the Discussion reviews the therapeutic options according to the underlying etiology, from the least to the most invasive, before addressing the limitations of this work.

Review

Methodology

Study Design

This study is a narrative review based on a systematized literature search. It was not designed as a systematic review; the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 flow diagram was used only to report the identification and selection of studies transparently, and no meta-analysis was performed.

Information Sources and Search Strategy

The electronic databases searched included PubMed, Cochrane Library, SpringerLink, ScienceDirect, and Google Scholar. To identify relevant publications addressing various therapeutic approaches for gummy smile, a search strategy combining multiple Medical Subject Headings (MeSH) descriptors was employed. The keywords used included gummy smile, excessive gingival display, orthodontic treatment, mini-screws, aligners, conventional orthodontic appliances, orthognathic surgical treatment, surgical treatment, non-surgical treatment, periodontal treatment, and botulinum toxin. These terms were used both individually and in combination, applying various Boolean operators (AND, OR) to broaden the search scope and enhance sensitivity. For example, the following search string was used in PubMed: ("gummy smile" OR "excessive gingival display") AND ("orthodontic treatment" OR "mini-screws" OR "aligners" OR "conventional orthodontic appliances" OR "orthognathic surgical treatment" OR "surgical treatment" OR "nonsurgical treatment" OR "periodontal treatment" OR "botulinum toxin"), with filters for publication date (2010-2024) and language (English, French); this string was adapted to the syntax of each database (Appendices). The same search terms were used in the other databases. The search covered articles published between 2010 and 2024; the exact date of the last search was not recorded.

Eligibility Criteria

Inclusion criteria were (1) studies addressing the treatment of gummy smile or excessive gingival display; (2) publication between 2010 and 2024; (3) articles written in French or English; (4) systematic reviews, meta-analyses, clinical trials, or cross-sectional studies; and (5) full text accessible. Conversely, excluded from this analysis were in vitro studies, isolated case reports, letters to the editor, opinion pieces, and other publications that did not meet the methodological standards required for this review. Publications before 2010 were not eligible for inclusion in the study corpus; they were cited only as background references, to define key concepts (e.g., smile line, gingival thresholds), or to describe the original version of established techniques and protocols (e.g., lip repositioning, botulinum toxin injection sites).

Study Selection

After removal of duplicates, records were screened using titles and abstracts, and the full texts of potentially relevant articles were then assessed against the eligibility criteria.

Data Extraction

For each included study, the following data were extracted: title, authors, year of publication, study design, study population (sample size, sex, age, and severity of gingival display when reported), comparison groups, and type of treatment. The included studies were then grouped by treatment modality. Outcome measures were not standardized or systematically extracted; when discussed, outcomes are reported as defined by the authors of each study.

Risk-of-Bias Assessment

Consistent with the narrative design of this review, no formal risk-of-bias assessment of the included studies was performed. The study design of each article is reported below to allow readers to determine the level of evidence.

Synthesis Methods

A qualitative (narrative) synthesis was performed; no meta-analysis or meta-regression was performed, and therefore no pooled effect sizes, confidence intervals, or heterogeneity statistics are reported. Quantitative pooling was not considered appropriate because of the marked heterogeneity of the included studies in terms of the etiology of gummy smile, study designs, interventions, outcome measures, and follow-up

durations. Studies were grouped by treatment modality, and the modalities were discussed according to the etiology they address, following the therapeutic gradient from the least to the most invasive option. Where studies reported divergent results, these discrepancies are described in the text rather than resolved statistically.

Results

The database searches in PubMed, Cochrane Library, ScienceDirect, SpringerLink, and Google Scholar using the search strategies identified 147 articles published between 2010 and 2024. After removal of 45 duplicates, 102 references were screened by title and abstract, of which 21 were excluded. The full texts of three articles could not be retrieved, and 78 full-text articles were assessed for eligibility. Of these, 65 met the inclusion criteria; as two of them reported the same publication, 64 distinct studies were finally included [14,17,29-90], comprising 46 clinical trials, 15 systematic reviews (six of which included a meta-analysis), and three cross-sectional studies (Figure *1*, Tables *1*-*6*). These published meta-analyses were included as primary sources of evidence; their results are reported narratively, and no new pooled analysis was performed in the present review.

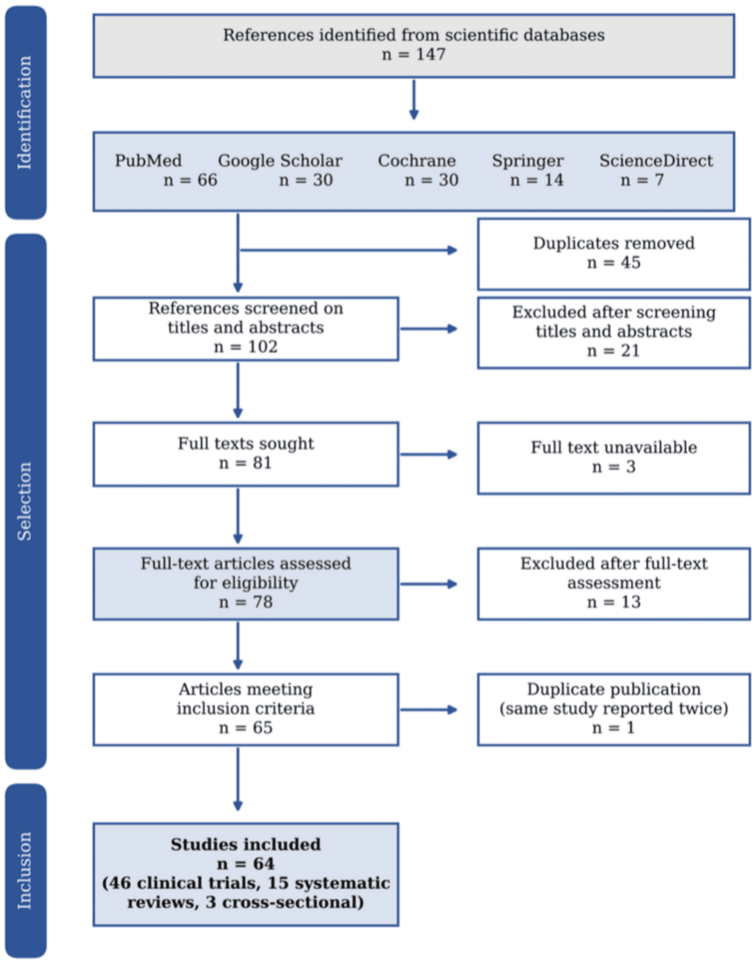


FIGURE 1: Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram illustrating the article selection process.

Article	Author (year)	Study design	Study population	Treatment
Effective approach for improving a gummy smile: upward movement of the maxillary occlusal plane using midpalatal miniscrews and a modified transpalatal arch	Miyazawa et al. (2024) [30]	Clinical trial	16 patients	Miniscrews
Efficacy of infrazygomatic crest implants for full-arch distalization of maxilla and reduction of gummy smile in Class II malocclusion	Shaikh et al. (2021) [31]	Clinical trial	10 patients; age 15–30 years	Miniscrews
Evaluation of dentoalveolar changes following maxillary incisor intrusion with one vs two anterior miniscrews in subjects with gummy smile: a randomized clinical trial	Manikandan et al. (2024) [32]	Randomized clinical trial	43 patients (31 females, 12 males); age 20–40 years	Miniscrews
Gummy smile correction by intruding upper incisors with mini-screw implant: an esthetic evaluation by the golden facial mask	Liu et al. (2010) [33]	Clinical trial	17 patients (16 females, 1 male); age 16–40 years	Miniscrews
Intrusion of anterior teeth to improve smile esthetics	Chandrasekharan and Balaji (2010) [34]	Clinical trial	21 patients (12 females, 9 males); age 12–18 years	Miniscrews
Non-surgical correction of gummy smile using temporary skeletal mini-screw anchorage devices: a systematic review	Alshammery et al. (2021) [35]	Systematic review	—	Miniscrews
Intrusive arch versus miniscrew-supported intrusion for deep bite correction	El Namrawy et al. (2019) [36]	Randomized clinical trial	30 patients (21 females, 9 males); age 17–29 years. Group 1: incisor intrusion with miniscrews; Group 2: intrusion with intrusive arches	Miniscrews; orthodontic treatment

TABLE 1: Orthodontic treatment with skeletal anchorage (miniscrews) (n = 7).

—: not applicable (review article)

Article	Author (year)	Study design	Study population	Treatment
A systematic review and meta-analysis comparing surgical and nonsurgical treatments for excessive gingival display	Maleki et al. (2024) [37]	Systematic review and meta-analysis	—	Miniscrews; gingivectomy and crown lengthening; V–Y cheiloplasty; lip repositioning; guided bone regeneration; botulinum toxin
Impact of orthognathic surgery on the treatment of gummy smile: an integrative review	Tomaz et al. (2020) [38]	Systematic review	—	Orthognathic surgery
Comparison of smile attractiveness in cases with gummy smile treated with botulinum toxin and maxillary impaction surgery: a retrospective study	Borba et al. (2024) [39]	Clinical trial	26 patients. Group 1: 13 (12 females, 1 male) treated with botulinum toxin; Group 2: 13 (9 females, 4 males) treated with maxillary impaction surgery	Orthognathic surgery; botulinum toxin
Treatment of gummy smile: nasal septum dysplasia as etiologic factor and therapeutic target	Wei et al. (2015) [40]	Clinical trial	46 patients; age 18–49 years	Reinforcement and/or extension surgery of the nasal septal cartilage
Effect of V-Y plasty on lip lengthening and treatment of gummy smile	Dilaver and Uckan (2018) [41]	Clinical trial	14 patients; age 18–30 years; gummy smile ≥3 mm	V–Y cheiloplasty

TABLE 2: Comparative reviews, orthognathic surgery, and other surgical approaches (n = 5).

—: not applicable (review article)

Article	Author (year)	Study design	Study population	Treatment
Treatment of excessive gingival display using conventional esthetic crown lengthening versus computer-guided esthetic crown lengthening: a randomized clinical trial	Borham et al. (2024) [42]	Randomized clinical trial	16 patients; age 20–40 years. Control: conventional method; Study: double surgical guide	Gingivectomy
Assessment of two techniques for aesthetic crown lengthening (flapless piezo-surgery and open flap technique): a randomized controlled clinical split-mouth trial	ALsahli et al. (2021) [43]	Randomized clinical trial (split-mouth)	16 patients (9 females, 7 males); age 20–36 years; 32 surgeries. Control side: open-flap; Test side: flapless	Gingivectomy; flap technique
Open-flap versus flapless esthetic crown lengthening: 12-month clinical outcomes of a randomized controlled clinical trial	Ribeiro et al. (2014) [44]	Randomized clinical trial (split-mouth)	28 patients (20 females, 8 males); age 21–40 years. Open flap in one quadrant vs flapless in the contralateral quadrant	Gingivectomy; flap technique
Smile correction using an esthetic crown lengthening with either diode laser or scalpel - a comparative clinical patient perspective study	Koppolu et al. (2017) [45]	Randomized clinical trial	14 patients (8 females, 6 males); age 18–30 years. Conventional vs laser gingivectomy	Gingivectomy; laser
Gummy smile management using diode laser gingivectomy versus botulinum toxin injection - a prospective study	Mossaad et al. (2021) [46]	Randomized clinical trial	24 females; age 25–35 years; gummy smile >3 mm. Group 1: diode laser gingivectomy; Group 2: botulinum toxin	Laser gingivectomy; botulinum toxin

TABLE 3: Periodontal surgery (crown lengthening, gingivectomy, laser) (n = 5).

Article	Author (year)	Study design	Study population	Treatment
A comparison between modified and conventional surgical techniques for surgical lip repositioning in the management of the gummy smile	Alammar et al. (2018) [47]	Randomized clinical trial	22 patients; age 18–38 years; gummy smile 4–6 mm. Group 1: 11 conventional; Group 2: 11 modified lip repositioning	Lip repositioning
A comparison of self-perceived oral and facial esthetics in patients after lip repositioning surgery with modified and conventional techniques	Al Jasser (2023) [48]	Cross-sectional study	200 patients. Control (n = 100): conventional; Test (n = 100): modified lip repositioning	Lip repositioning
A modified approach in lip repositioning surgery for excessive gingival display to minimize post-surgical relapse: a randomized controlled clinical trial	AlJasser (2023) [49]	Randomized clinical trial	200 females. Control (n = 100): conventional technique (LipStaT®); Test (n = 100): modified technique with additional periosteal sutures	Lip repositioning
Awareness of gummy smile and its treatment by lip repositioning technique among dental interns and postgraduates: a questionnaire study	Srivastava et al. (2020) [50]	Cross-sectional study	10-item questionnaire administered to 200 oral healthcare professionals	Lip repositioning
Clinical and psychological impact of lip repositioning surgery in the management of excessive gingival display	Dawadi et al. (2024) [51]	Clinical trial	14 patients; age >18 years; gummy smile >4 mm; upper lip mobility >8 mm	Lip repositioning
Clinical efficacy of lip repositioning technique and its modifications for the treatment of gummy smile: systematic review and meta-analysis	Mendoza-Geng et al. (2022) [52]	Systematic review and meta-analysis	—	Lip repositioning
Effectiveness of different modalities of lip repositioning surgery for management of patients complaining of excessive gingival display: a systematic review and meta-analysis	Younespour et al. (2021) [53]	Systematic review and meta-analysis	—	Lip repositioning

Effectiveness of lip repositioning surgeries in the treatment of excessive gingival display: a systematic review and meta-analysis	Dos Santos-Pereira et al. (2021) [54]	Systematic review and meta-analysis	—	Lip repositioning
Excessive gingival display: treatment by a modified lip repositioning technique	Silva et al. (2013) [55]	Clinical trial	13 patients (11 females, 2 males); age 19–49 years; gummy smile ≥4 mm	Lip repositioning
Lip repositioning for the treatment of excess gingival display: a systematic review	Tawfik et al. (2018) [56]	Systematic review	—	Lip repositioning
Modified lip repositioning surgery with and without dual-layered suturing for treatment of gummy smile patients	Adel (2024) [57]	Randomized clinical trial	20 females; age 25–37 years. Group 1: standard technique; Group 2: double-suturing method	Lip repositioning
Modifying gummy smile: a minimally invasive approach	Abdullah et al. (2014) [58]	Clinical trial	12 patients (10 females, 2 males); age 20–29 years; gummy smile 4–6 mm	Lip repositioning
Evaluation of the internal dual muscle traction approach as an adjunct to the modified surgical lip repositioning method: a randomized clinical report	Hazzaa et al. (2022) [59]	Randomized clinical trial	20 patients; gummy smile ≥3 mm. Control: modified lip repositioning alone; Test: with internal dual muscle traction	Lip repositioning; myotomy
Correction of excessive gingival display: lip repositioning with/without myotomy	Dodge (2021) [60]	Randomized clinical trial	20 patients; age >18 years; gummy smile >2 mm. Group 1: without myotomy; Group 2: with myotomy	Lip repositioning; myotomy
Lip repositioning with or without myotomy: a randomized clinical trial	Tawfik et al. (2018) [61]	Randomized clinical trial	20 patients; age ≥18 years; gummy smile >3 mm. Group 1: with myotomy; Group 2: without myotomy	Lip repositioning; myotomy
Lip repositioning with or without myotomy: a systematic review	Ardakani et al. (2021) [62]	Systematic review	—	Lip repositioning; myotomy
Myotomy of the levator labii superioris muscle and lip repositioning: a combined approach for the correction of gummy smile	Ishida et al. (2010) [63]	Clinical trial	14 patients; age 15–35 years	Lip repositioning; myotomy

TABLE 4: Lip repositioning surgery with or without myotomy (n = 17).

—: not applicable (review article)

Article	Author (year)	Study design	Study population	Treatment
Assessment of the efficiency of Botox and lip reposition in the correction of the gummy smile according to the patients' satisfaction	Makkiah (2017) [64]	Randomized clinical trial	24 females. Group 1: 12 BTX-A injections; Group 2: 12 lip repositioning	Lip repositioning; botulinum toxin
Botox as an adjunct to lip repositioning for the management of excessive gingival display in the presence of hypermobility of upper lip and vertical maxillary excess	Aly and Hammouda (2016) [65]	Clinical trial	7 females; age 17–25 years; mean gummy smile 6–8 mm	Lip repositioning; botulinum toxin
Botulinum toxins and lip repositioning surgery with repeated botulinum toxin injection: a combined approach for gummy smile treatment	Adel (2023) [66]	Clinical trial	10 females; age 25–37 years	Lip repositioning; botulinum toxin
Comparative efficacy of Botox and surgical lip repositioning in the correction of gummy smile	Makkeiah et al. (2021) [67]	Randomized clinical trial	24 patients; age 18–41 years; gummy smile >4 mm. Group 1: 12 BTX-A; Group 2: 12 lip repositioning	Lip repositioning; botulinum toxin
Evaluation of soft tissue changes on lateral cephalometric X-ray associated with lip repositioning surgery and/or botulinum toxin injections in gummy smile cases: a randomized clinical study	Adel et al. (2021) [68]	Randomized clinical trial	30 females; age 23–30 years; gummy smile 4–6 mm. Group 1: lip repositioning; Group 2: botulinum toxin; Group 3: botulinum toxin followed by lip repositioning after 14 days	Lip repositioning; botulinum toxin
Use of botulinum toxin before surgical lip repositioning: a randomized clinical trial	Antunes et al. (2022) [69]	Randomized clinical trial	18 patients; age 18–50 years; gummy smile >3 mm. Test: botulinum toxin 15 days before lip repositioning; Control: lip repositioning only	Lip repositioning; botulinum toxin
A standardized technique for gummy smile treatment using repeated botulinum toxins: a 1-year follow-up study	Adel (2022) [70]	Clinical trial	200 females; age 25–45 years; gummy smile 4–6 mm	Lip repositioning; botulinum toxin

TABLE 5: Lip repositioning combined with botulinum toxin (n = 7).

BTX-A: botulinum toxin type A

Article	Author (year)	Study design	Study population	Treatment
Application of botulinum toxin at the Yonsei point for the treatment of gummy smile: a randomized controlled trial	Gong et al. (2024) [71]	Randomized clinical trial	49 patients. Group 1: 6 U of BTX-A at the Yonsei point (3 U per side); Group 2: same dose at the levator labii superioris alaeque nasi bilaterally	Botulinum toxin
Assessment of prolonged effect of repeated botulinum toxin-A injection for gummy smile correction	Yousri et al. (2024) [72]	Randomized clinical trial	16 patients; age 18–30 years; gummy smile >3 mm. Group 1: two injections at 4-month intervals; Group 2: three injections at 4-month intervals	Botulinum toxin
Botulinum toxin A in the management of a gummy smile: a clinical controlled preliminary study	Costa et al. (2022) [73]	Randomized clinical trial	20 patients (18 females, 2 males); age 19–39 years. Group 1: 4 points (2 U/point), LLSAN and LLS; Group 2: 2 points (2 U/point), LLSAN only	Botulinum toxin
Botulinum toxin-A in the treatment of excessive gingival display: a clinical study	Soris et al. (2022) [74]	Clinical trial	15 patients (10 females, 5 males); age 18–40 years; gummy smile >2 mm	Botulinum toxin
Botulinum toxin type A for the treatment of	Rasteau et	Systematic		Botulinum

excessive gingival display - a systematic review	al. (2022) [75]	review	—	toxin
Botulinum toxin for the treatment of excessive gingival display: a systematic review	Nasr et al. (2016) [76]	Systematic review	—	Botulinum toxin
Clinical and electromyographic evaluation of botulinum toxin type A in the treatment of gummy smile: a prospective clinical study	Mate et al. (2021) [77]	Clinical trial	10 patients; age 18–35 years; gummy smile >3 mm	Botulinum toxin
Comparison of two botulinum toxin injection methods for treatment of excessive gingival display	Aldhaher et al. (2022) [78]	Randomized clinical trial	40 patients. Group 1: 20 patients, 2.5 U at one site per side; Group 2: 20 patients, 5 U at two sites per side	Botulinum toxin
Correction of gummy smile using botulinum toxin	Ashekhi et al. (2021) [79]	Clinical trial	37 patients (34 females, 3 males); age 19–41 years; gummy smile >3 mm	Botulinum toxin
Dose and injection site of botulinum toxin type A for gummy smile management: a systematic review and bibliometric analysis	Wang et al. (2024) [80]	Systematic review	—	Botulinum toxin
Duration of effectiveness of botulinum toxin type A in excessive gingival display: a systematic review and meta-analysis	Chagas et al. (2018) [81]	Systematic review and meta-analysis	—	Botulinum toxin
Effects of different doses of abobotulinumtoxinA for the treatment of anterior gingival smile	Hexsel et al. (2021) [17]	Randomized clinical trial	41 patients; age 18–70 years; gummy smile >2 mm. Mild (2 to <3 mm): 2.5 U/side; moderate (3 to <4 mm): 5 U/side; severe (≥4 mm): 2.5, 5 or 7.5 U/side	Botulinum toxin
Effects of dose and injection site on gingival smile treatment with botulinum toxin type A: a prospective study	Gong et al. (2023) [82]	Clinical trial	55 patients	Botulinum toxin
Efficacy of botulinum toxin for treating a gummy smile	Cengiz et al. (2020) [83]	Randomized clinical trial	28 patients (21 females, 7 males); age 19–38 years; gummy smile 2–8 mm. Group 1: LLSAN; Group 2: orbicularis oris	Botulinum toxin
Esthetic perception of gummy smile with the application of botulinum toxin, via eye-tracking	Bastos et al. (2022) [84]	Cross-sectional study	58 participants (23 females, 35 males); age 18–75 years	Botulinum toxin
Evaluation of a neurotoxin as an adjunctive treatment modality for the management of gummy smile	Gupta and Kohli (2019) [85]	Clinical trial	10 patients; age 18–27 years	Botulinum toxin
Evaluation of the botulinum toxin effects in the correction of gummy smile 32 weeks after application	Vieira et al. (2022) [86]	Clinical trial	35 patients (30 females, 5 males); gummy smile >2 mm	Botulinum toxin
Individual factors of botulinum type A in treatment of gummy smile: a prospective study	Gong et al. (2021) [87]	Clinical trial	14 patients (13 females, 1 male); age 23–48 years; gingival display >2 mm	Botulinum toxin
Non-surgical management of the gingival smile with botulinum toxin A - a systematic review and meta-analysis	Rojo-Sanchis et al. (2023) [88]	Systematic review and meta-analysis	—	Botulinum toxin
OnabotulinumtoxinA for the treatment of a “gummy smile”	Suber et al. (2014) [14]	Clinical trial	14 patients (13 females, 1 male); age 23–48 years; gummy smile >2 mm	Botulinum toxin
The effect of botox for the correction of the gummy smile: a systematic review	Razmaitė and Trakinienė (2021) [89]	Systematic review	—	Botulinum toxin
The role of botulinum toxin A in the management of different types of excessive gingival display: a systematic review	Lam et al. (2022) [90]	Systematic review	—	Botulinum toxin

To evaluate the effect and longevity of botulinum toxin type A (Botox®) in the management of gummy smile - a longitudinal study up to 4 years follow-up	Rajagopal et al. (2021) [29]	Non-randomized clinical trial	32 patients; age 18–40 years. Group 1: gummy smile <5 mm, 3 U; Group 2: gummy smile >5 mm, 5 U	Botulinum toxin

TABLE 6: Botulinum toxin injections (n = 23).

—: not applicable (review article); LLSAN: levator labii superioris alaeque nasi; LLS: levator labii superioris; BTX-A: botulinum toxin type A; U: units

Discussion

As outlined above, the management of gummy smile depends on the accurate identification of its underlying etiology and severity. The following sections review the available therapeutic options according to these etiologies.

Therapeutic Gradient

The therapeutic decision-making for gummy smile depends on the accuracy and specificity of the diagnosis and must take into account its multifactorial etiology. In this context, the concept of the "therapeutic gradient" should guide the clinician's decision-making process. When multiple treatment options are available, it is recommended to begin with the least invasive technique and then assess its outcomes. If the result is satisfactory, the treatment is deemed successful with minimal morbidity. Otherwise, more invasive therapeutic approaches may be considered subsequently [91].

Therapeutic Abstention

Given that a gummy smile is not always perceived as unaesthetic, there are situations where therapeutic abstention represents the preferred option; this also applies to patients who are unmotivated or non-compliant. As mentioned above, the threshold at which gingival display is perceived as unaesthetic is lower for orthodontists (2 mm) than for the general public (4 mm) [11].

Interceptive Treatment

Orthopedic appliances, such as the Equi-Plan by Planas and Julien Philippe plate, are used to prevent an alveolo-skeletal gummy smile by inhibiting incisor eruption through coverage of their eruption zones. In parallel, disarticulation of the lateral segments promotes their eruption, especially in the mandibular arch, thus triggering a vertical growth response [92-95].

Orthodontic Treatment

Correcting a gummy smile can be a particularly challenging objective for the orthodontist. Only a moderate gummy smile of alveolar origin is amenable to isolated orthodontic treatment. In contrast, in more severe cases, the gummy smile is rarely the primary treatment target; rather, it is addressed alongside the correction of malocclusion, which ultimately determines the treatment plan [1].

For a gummy smile of superior dento-alveolar origin, intrusion of the maxillary incisors is the treatment of choice. Various methods can be employed, including directional forces with high-pull traction on a continuous arch, the Ricketts base arch, a continuous arch with an exaggerated Spee curve in the maxilla, and mini-screws [25].

Notably, the advent of TADs as skeletal anchorage has provided an alternative to orthognathic surgery. They enable intrusion of the incisors and reduction of the gummy smile through endosseous anchorage. These mini-screws are placed at the midline (one mini-screw between the two central incisors), between the roots of the central and lateral incisors, or between the roots of the lateral incisors and canines. Bardideh et al. reported no significant difference between placing TADs between the lateral incisor and canine or between the central and lateral incisors. However, they emphasized that positioning mini-screws in the more posterior region (between the lateral incisor and canine roots) aligns the force vector closer to the center of resistance of the incisors, potentially resulting in less tipping during intrusion [96]. Similarly, a systematic review and meta-analysis of randomized controlled trials found that miniscrew-supported intrusion produced greater deep-bite correction and greater true incisor intrusion, with less maxillary molar extrusion, than conventional intrusion arches or J-hook headgear, although the certainty of the evidence was rated very low to low [97].

Regarding orthodontic treatment with aligners, several studies have concluded that vertical tooth

movement using aligners is limited, with a predictability of 41% according to Kravitz et al. [98-100]. More broadly, a systematic review with meta-analyses found that, in adult patients, aligner treatment was associated with poorer occlusal outcomes on the American Board of Orthodontics Objective Grading System, and with more cases of unacceptable results than treatment with fixed appliances [101]. Haouili et al. (2020) reported that the predictability of incisor intrusion is 33% for maxillary incisors and 34% for mandibular central incisors [102]. To improve outcomes, the combined use of attachments, anterior TADs, and elastics has been recommended to enhance aligner efficacy and retention [103-105]. A systematic review showed that composite attachments and other auxiliaries improved the control of anterior root torque and posterior anchorage, whereas the evidence regarding rotations and vertical movements, including incisor intrusion, remained limited [106]. Consequently, fixed appliances, possibly combined with skeletal anchorage, remain preferable when significant incisor intrusion is required to correct a gummy smile.

Orthognathic Surgery

In certain cases of severe gummy smile of skeletal origin, an orthodontic treatment combined with an orthognathic surgical approach is recommended, particularly for vertical maxillary excess, maxillary prognathism, and some severe cases of alveolar maxillary excess or dental protrusion. Le Fort I osteotomy and anterior segmental osteotomy are the most performed procedures for correcting a gummy smile. Beforehand, pre-surgical orthodontic preparation may be necessary to align the arches, eliminate dento-alveolar compensations if present, and coordinate the maxillary and mandibular arches in all three spatial dimensions [107].

Furthermore, the digitalization of orthognathic surgery planning, adopted in recent years, has had a significant impact both in streamlining intraoperative procedures and improving the predictability of the surgical outcome. The most common surgeries in this context are maxillary impaction procedures via Le Fort I osteotomy and Wassmund segmental interventions [108,109].

Periodontal Surgery

Gingivectomy and apically repositioned flap procedures can be performed alone or in combination with orthodontic treatment. Robbins (1999) defined healthy gingiva as having a minimum length of approximately 3 mm from the gingival crest to the alveolar crest [110]. Therefore, in cases of altered passive eruption, where the marginal gingival height exceeds 3 mm, the treatment of choice is gingivectomy, followed, if necessary, by esthetic crown lengthening to achieve the desired tooth dimensions and morphology.

However, when the diagnosis reveals bone levels close to the cementoenamel junction, a gingival flap, also called an apically positioned flap, combined with osteotomy is indicated. More recently, advances in laser surgery have simplified these interventions, thereby broadening the indications for gingivectomies. Surgical lasers, including Er:YAG, CO_2, Nd:YAG, and diode lasers, enable gingival reshaping procedures such as gingivectomy to correct gummy smiles caused by incomplete eruption or gingival hyperplasia [45,46,111].

Prosthetic Treatment

Only a prosthetic approach can lengthen the clinical crown when the gummy smile is due to a dimensional anomaly of the teeth, such as microdontia, with the gingiva correctly positioned [2,3].

Lip Repositioning Surgery

Lip repositioning surgery is indicated in cases of excessive gingival display resulting from a short upper lip, particularly in the context of vertical maxillary excess and/or hypermobility of the upper lip. Conversely, it is contraindicated in cases of insufficient attached gingiva or severe vertical maxillary excess [19].

Miskinyar described a technique involving myotomy and partial resection of one or both levator muscles of the upper lip bilaterally during lip repositioning surgery [112]. Litton and Fournier theorized the correction of gingival smile through surgical lip repositioning using dissection of the levator muscle [113]. Ishida et al. observed that lip length could be increased by myotomy of the levator labii superioris muscle combined with subperiosteal dissection of the maxillary gingiva and frenectomy [63]. More recently, Bhola et al. (2015) described the lip stabilization technique, which involves a vertical incision connecting a lower incision at the mucogingival junction to an upper incision in the vestibule [27].

Botulinum Toxin Injections

Multiple authors agree that botulinum toxin injection is an effective, minimally invasive, and safe procedure that temporarily improves a gummy smile caused by muscular hyperactivity. Modification of lip position and movement using Botox is considered an appropriate choice due to its low morbidity and ease of use [85,114-116].

Mazzuco and Hexsel (2010), in their prospective study, classified Botox treatment for gummy smile into three types [18]: Corrective type: performed when the gummy smile is caused primarily by muscular activity; adjuvant type: used when multiple causes are present and additional treatments, such as orthodontics or lip repositioning surgery, are necessary; and palliative type: indicated when surgical intervention is required.

The Botox dosage varies between individuals depending on the volume of the upper lip muscle. Generally, men require higher units of Botox than women to achieve the same effect, due to a larger muscle volume. Treatment protocols generally recommend doses between 2.0 and 2.5 units of Botox, adjusted according to the desired degree of correction [14,15,17,18,78].

According to Suber et al. (2014), the upper lip elevator muscles and the levator labii superioris alaeque nasi muscles are considered effective injection sites for Botox treatment [14]. Injection sites and doses are individualized according to the type of gummy smile (anterior, posterior, mixed, or asymmetric), as determined by palpation and facial animation [18,117], and by the surface anatomy of the lip elevator muscles [118]; the main injection protocols described in the literature are summarized in Table 7.

Author	Indication/Type of gummy smile	Injection sites and doses
Polo (2005) [117]	Gummy smile due to hyperactivity of the lip elevator muscles (sites determined individually by palpation and facial animation)	Convergence zone of the levator labii superioris alaeque nasi and levator labii superioris muscles, and convergence zone of the levator labii superioris and zygomaticus minor muscles, about 0.5 cm lateral to the nasal ala; second series of points at the intersection of the levator labii superioris and zygomaticus major muscles, about 1.0 cm below and laterally, always above the orbicularis oris muscle
Mazzuco and Hexsel (2010) [18]	Anterior gummy smile	Nasolabial fold, 1 cm lateral to the nasal ala, to relax the levator labii superioris muscle; dose adjusted to the gingival exposure
Mazzuco and Hexsel (2010) [18]	Posterior gummy smile	Two malar points along the zygomaticus major and minor muscles: the first in the nasogenian groove at the site of greatest lateral contraction during smiling, the second 2 cm from the first, near the tragus
Mazzuco and Hexsel (2010) [18]	Mixed gummy smile	All the points described above, with the dose reduced by 50% at the point near the nasal ala
Mazzuco and Hexsel (2010) [18]	Asymmetric gummy smile	Same doses at the two malar points on the side with the greater gingival display; on the contralateral side, injection only at the lowest point of the nasogenian groove

TABLE 7: Botulinum toxin injection protocols for gummy smile.

Hyaluronic Acid Injections

The use of hyaluronic acid is also considered a non-invasive alternative for the treatment of gummy smile [24,119]. A small dose of hyaluronic acid can be injected at the same sites as Botox and can inhibit the movement of the deeper portion of the levator labii superioris alaeque nasi muscle, reducing the elevation of the upper lip during smiling [119]. Moreover, the effects of hyaluronic acid injections last significantly longer than those of Botox, ranging from six to eight months [24,119] compared to three to five months for Botox [29,81]. Additionally, the results are immediate, with localized volume enhancement observable [119].

Limitations

The strengths and weaknesses of this study are inherently linked to the limitations of the methods employed

during the various stages of the literature search, document selection, and data collection. Specifically, access to three articles was not possible due to the unavailability of their full texts. In addition, the search was limited to five databases and to articles published in English or French; gray literature was not searched, and the exact date of the last search was not recorded. Although recent publications up to 2024 were included, some relevant studies may therefore have been missed. Furthermore, study selection and data extraction were not performed independently by two reviewers, and no formal risk-of-bias assessment of the included studies was conducted. Outcome data, follow-up duration, relapse, and complications were not systematically extracted, which precluded a quantitative comparison between treatment modalities. These limitations are inherent to the narrative design of this review, and its conclusions should therefore be interpreted with caution.

Conclusions

A gummy smile represents a daily aesthetic challenge that requires an accurate diagnosis to determine an individualized therapeutic approach. Its management is based on a thorough analysis of often multifactorial etiologies and involves multidisciplinary collaboration. Regardless of the chosen treatment modality, the goal must be to achieve a stable and harmonious outcome.

Appendices

Search strategy used for each database

The same search string was used in all databases and adapted to the syntax of each search interface: (“gummy smile” OR “excessive gingival display”) AND (“orthodontic treatment” OR “mini-screws” OR “aligners” OR “conventional orthodontic appliances” OR “orthognathic surgical treatment” OR “surgical treatment” OR “nonsurgical treatment” OR “periodontal treatment” OR “botulinum toxin”)

PubMed: limits = publication date 2010-2024, English and French; records retrieved = 66.

Cochrane Library: limits = publication year 2010-2024; records retrieved = 30.

ScienceDirect: limits = years 2010-2024; records retrieved = 7.

SpringerLink: limits = date published 2010-2024; records retrieved = 14.

Google Scholar: limits = custom range 2010-2024; records retrieved = 30.

Total records retrieved = 147 (see Figure *1*).

The exact date of the last search was not recorded.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

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