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Management of Gummy Smile in Orthodontics

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ABSTRACT: Gummy smile, also known as a high smile line, is characterized by excessive gingival display during smiling. This condition affects both aesthetic appearance and patient confidence. This manuscript discusses the etiology, classification, and comprehensive management strategies for gummy smile, including orthodontic, surgical, and minimally invasive techniques.

Keywords: Gummy smile, high smile line, orthodontic treatment, gingival display, aesthetic dentistry.

I. INTRODUCTION:

A pleasing smile is a critical component of facial aesthetics, and excessive gingival display, commonly referred to as a gummy smile, can detract from the overall appearance. This condition is multifactorial, with potential causes ranging from dental, skeletal, to soft tissue origins. This manuscript aims to review the etiology, classification, diagnosis, and treatment options for gummy smile.As the smile expands and approaches laughter the lips separate, mouth angles curve upwards and superior teeth are exposed to view. As the angles of the mouth extend and the lips separate, the mesial half of the
maxillary first molars and the mandibular second premolar may be exposed, while the front upper lip lifts up reaching the superior incisive collar.

According to the dental traditional literature there are three categories of smile line:

• normal smile line, when during smile teeth have been showed and inferior rim of upper lip discovered 1-2 mm of free gum;

• low smile line, when the inferior rim of upper lip covered over then 25% of superior incisive crown;

• high smile line, when inferior rim of upper lip discovered over 2 mm of free gum.

Normally between upper lip and superior incisive collar (smile line) there should not be free gum over 2 mm. If this is the case, thensmile is defined “gummy”. Causes for gummy smile could be different. It could be caused by hereditary, congenital or acquired factors.

The smile starts with contractions of muscle bundles originating from nasiolabial fold and upper lip levator muscles, which fibers by the fold inserted to upper lip. Medial muscle bundles pull the upper lip upward on anterior teeth level and lateral muscle bundles pull the upper lip upward on posterior teeth level. The lip then meets resistance at the fold because of the heavy cheek fat. The fold deepens. The levators, notably the zygomatic major and the levator superior, rise the lip, fold and cheek to a higher level.5 In the final stage of smile, contraction of periocular muscles caused a

winking of the eyes. Furthermore everyone has an anatomical and functional muscular variability of nasolabial fold and this could change the individual capacity to show gum during smile.

Sometimes gummy smile has been related to a specific morphological pattern, characterized by palatal plane post-rotation, a higher divergence of mandibular plane on cranial base, an excessive maxillary length, a short crown of maxillary incisive and a short length of upper lip.8,9 Among them the only parameter with statistical significance was the maxillary length or distance between subnasal point and incisal border.This measure showed maxillary vertical excess and according to a case control study,10 in subjects with high smile line it was higher 2-3 mm than in controls.Vertical maxillary excess (VEM) had to be valued on molar level, which during smile was under lip commeasure.

According to Peck et al. studies, overbite and overjet excesses are associated to clinical check of gummy smile. In subjects with moderate and heavy II classes, lip resisted to lowering during age. Excessive gum exposure could be associated to a pathological passive eruption with a modifiable relationship between gum and amelo-cementic junction so that a great part of anatomic crown has been covered by the gum. Clinically in this case the anatomic crown had a square form for gum covering tooth and the smile had a large space from the inferior border of the upper lip to the tooth. Peck et al. discovered a moderate statisticalcorrelation between clinical crown length and smile line position: a high smile line is associated to short clinical crown and vice versa.

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Methods:

This study involved a comprehensive review of existing literature and case studies on gummy smile management. Various treatment modalities, including orthodontic interventions, surgical procedures, and minimally invasive techniques, were evaluated for efficacy and outcomes.

*Etiology

ETIOLOGY OF GUMMY SMILE

It is essential to determine the etiology of a gummy smile in order to optimize treatment. There are three main etiologies, which may in some cases be combined.

Many authors have tried to define normality in the esthetics of the smile and face. The smile cannot be considered apart from the surrounding face, nor the face without the smile. Esthetic assessment is important to selecting treatment objectives.

After examining all the components of the face, the practitioner focuses on intraoral examination, analyzing the various smile components, and especially the teeth and periodontium.

Although clinical analysis is primordial in gummy smile, radiography enables:

• skeletal etiology to be confirmed;

• the occlusion plane and the orientation of the palatine plane to be analyzed;

• and dental-labial relations to be assessed.

To analyze this form, the patient needs to be examined at rest, to assess upper lip length.

Cutaneo-mucosal etiology is revealed by various factors:

• upper lip length, considered thin if < 20 mm ,increasing the visibility of teeth at rest.

• another cause may be upper lip levator muscle hypertonicity during smiling, leading to excessive gum exposure

According to Peck and Peck, subjects with gummy smile have more effective upper lip muscles.

Dento-periodontal origin

Secondly, there are three forms of dento-periodontal etiology:

• abnormal maxillary incisor size, with clinically short crowns due to relative microdontia or bruxism; the gum exposed during smiling looks all the greater in comparison with the shortness of the incisors;

• gingival hypertrophy and hyperplasia, defined as abnormal hypertrophic development of the gum, especially at the interdental papillae, covering part or even all of the crown, with esthetically displeasing results ;•Finally, impaired passive eruption is an abnormality of dental developmental, which is arrested or delayed.

Gum tissue is then in a coronary position with respect to the enamelcement junction, inducing pronounced gummy smile and short, square teeth.

In all the above situations, the amount of gum exposed in smiling appears greater if the incisors are short, creating an unfavorable gum/ crown ratio with excessive gum exposure.

Alveolo-skeletal origin

Most often, however, gummy smile is of alveolo-skeletal origin: basal, alveolar or a combination of the two. This is due to excessive vertical growth of the maxilla or superior alveolar bone, causing discrepancy between the upper lip and gum line in spontaneous smiling. This is the most common etiology .

It may be related to superior labioversion, an anteroposterior abnormality localized at the incisors, with excessive vestibular inclination of the teeth. **T**his leads to dento-mucosal sliding of the upper lip, revealing a wide band of Gum.

*Diagnosis

Treating the smile is a challenging task for orthodontists. One historical reason for this fact is that in the 20th century, particularly in the 1950s and 1960s, orthodontic diagnosis and treatment werebased on cephalometry and, therefore, esthetic concepts were defined primarily based on a profile view of the patient. Nevertheless, in their orthodontic records orthodontists continued to focus on the use of plaster models, which provide but a static record of occlusion, neglecting the dynamic analysis of speech and smile, as well as the evaluation of morphological and functional characteristics of the lips. Since the act of smiling is a dynamic process, the beauty of a smile depends not only on correct dental and skeletal positioning, but also on the anatomy and function of the lip muscles, over which orthodontists must recognize that they exercise little or no control.

Despite the etiologic factors involved in the gummy smile, some issues should be necessarily considered during clinical evaluation. Systematic recording of (a) interlabial distance at rest, (b) exposure of upper incisors during rest and speech, (c) smile arc, (d) width/length ratio of maxillary incisors and (e) morphofunctional characteristics of the upper lip by means of a checklist . All these records can be very useful in the diagnostic stage. By including these data in the orthodontic consultation file one ensures that information key to the treatment plan are not forgotten or overlooked.

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TREATMENT OF GUMMY SMILE

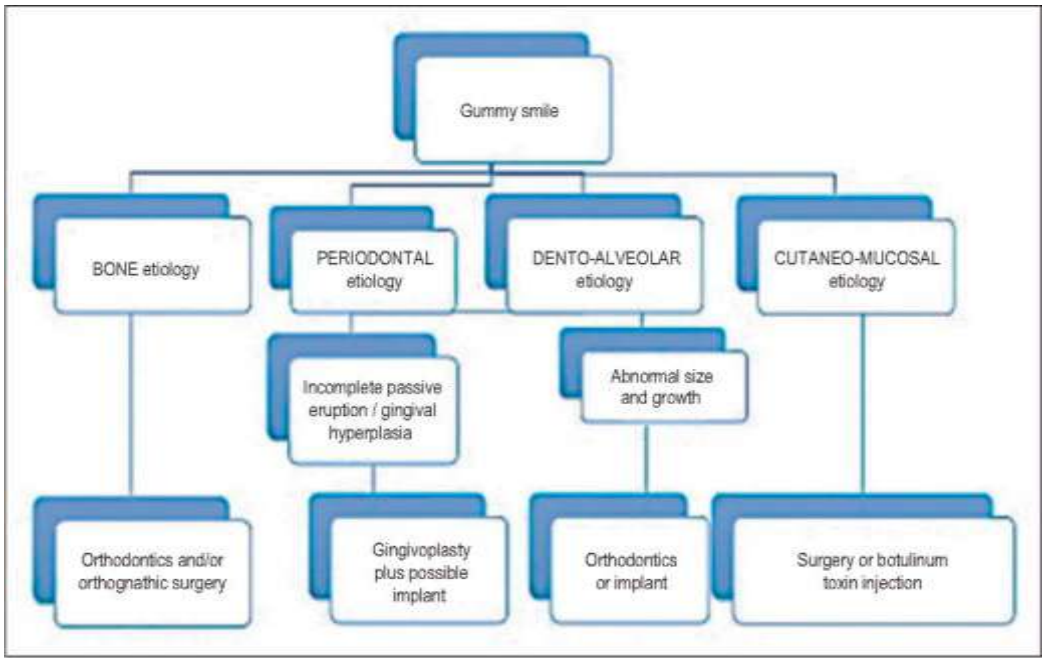
Treatment options for excessive gum exposure in smiling depend on the specific diagnosis.

As seen above, etiology is varied, and treatment has to take account of thisAs mentioned in the Introduction, gummy smile is not necessarily displeasing and in some cases abstention may be the attitude of choice; likewise if the patient is not motivated or cooperative.

n all other situations, adapted treatment should be planned. **Surgical treatment for gummy smile of cutaneo-mucosal origin**

In cutaneo-mucosal etiologies, reconstruction surgery of the soft tissue, and notably of the upper lip, may correct gummy smile. Whatever the abnormality of the lip, the objective is to weaken the lip levator muscles to achieve a more coronary position and reduce gum expose .

More recently, type A botulinum toxin injection, essentially described by Polo in 2005, has provided a nonoperative solution. Reduced exposure is obtained by weakening upper-lip levator muscle contractility. This is reversible, and injection has to be renewed.



- *Orthodontic Approaches*: Intrusion of anterior teeth using miniscrews and three-piece intrusion arch techniques.
- *Surgical Interventions*: LeFort I osteotomy and lip repositioning surgery for skeletal discrepancies.
- *Minimally Invasive Techniques*: Botulinum toxin A injections and gingivectomy for soft tissue-related gummy smiles.

II. DISSCUSION

The proposed modified classification should aid the clinician in identifying the possible intraoral and extraoral causes of GS in adult patients. Several authors agree that the most common extraoral cause of a GS is VME, with the most prevalent intraoral cause being altered eruption. 3,4 When centric relation/maximal intercuspation contact is not present or stable, such as in class II patients, where there is a significant overbite and a step between posterior occlusal and incisal planes, there may be dento-alveolar compensatory eruption to maintain the vertical dimension of occlusion, 20 which results in an increased appearance of the GS. When factors such as excessive tooth wear or altered eruption increase the visibility of pink/white proportion, the authors identify this as a “perceived gummy smile” (PGS). This occurs when gingival exposition during smiling is within the normal range (or slightly increased), though a reduction in anterior clinical crown height due to wear or altered eruption gives the perceived appearance of a GS.

Lip characteristics such as lip height, muscle hyperactivity, and position have also been associated with GS4, and patients with high smile lines.

Diagnosis of intraoral alterations between the proportion of gingiva and teeth is mainly based on the presence of tooth size reduction and/or the presence of excess gingiva. A pink/white tissue alteration may result when teeth are smaller due to excessive wear,attrition, and/or erosion. 23,24

Frequently, the wear of anterior teeth is due to bruxism or diurnal tooth clenching, 25 though the presence of an abnormal envelope of function may also cause anterior teeth wear and/or irregular incisal margins.

Excess gingiva is one of the major intraoral causes of GS and STS. The patient should be instructed on correct oral hygiene to reverse plaque-induced gingivitis. The excess gingiva could also be due to the side effects of some common drugs. 8-10 If there is no presence of gingivitis nor contributory medical history, the situation may be due to one of the types of altered eruption.

When the tooth height is reduced due to wear or altered eruption, the GS and STS could coexist. At first impact, the clinical signs of these two conditions may be similar, which is why the authors maintain that it is fundamental to consider these two closely linked conditions during the diagnostic phase and treatment management.

If there is no incisal wear, bone sounding under local anesthesia and diagnostic radiographs are of paramount importance in order to locate the position of the bone in relation to the CEJ. This aspect is necessary for choosing the surgical technique of the different subclasses of altered eruption. The type of altered eruption the patient has must be diagnosed in order to manage the GS and obtain the correct proportions and position of the teeth within the face, as well as to predict the possibility of evolution of the eruptive stages of the teeth.

The parallel profile radiograph technique was proposed to measure the dentogingival unit of anterior teeth. Cone-beam radiography can also be used to diagnose the presence of altered eruption, however the authors believe periapical radiographs used with a radiopaque marker may be less invasive to detect in an approximative manner the presence or absence of an altered eruption (AltErX technique). Another interesting approach is proposed by Cairo et al, in which a mathematical formula is used to detect APE by comparing the proportions of the radiographic and clinical crowns.

There are contrasting reports in the literature as to the ideal amount of tooth and gingival visibility during smiling. 30,31 The authors believe that the characteristics that make up the GS cannot always be considered as factors that define a displeasing smile. Many gummy smiles have visibility of the gingiva that is greater than 4 mm but may, nonetheless, be attractive, indicating that a moderate exposure of gingival tissue alone is not sufficient to create a displeasing smile. Some GS patients with full and well-defined lips, teeth regular in proportion and length, and adequate muscular tone, can compensate the effect of the GS and result in a pleasing smile.

Conclusion:

Gummy smile is a complex condition requiring a multidisciplinary approach for effective management. Understanding the underlying etiology is crucial for selecting the appropriate treatment modality. Future research should focus on long-term outcomes of various treatment options and the development of less invasive technique

III. CONCLUSION:

Gummy smile management has evolved with advancements in orthodontics and surgical techniques. A multidisciplinary approach ensures optimal aesthetic outcomes and patient satisfaction. Further research is needed to explore less invasive methods and their long-term effectiveness.Gummy smile is a complex condition requiring a multidisciplinary approach for effective management. Understanding the underlying etiology is crucial for selecting the appropriate treatment modality. Future research should focus on long-term outcomes of various treatment options and the development of less invasive technique

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