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Using of a Surgical Guide in Gingival Counturing to Improve the Aesthetic: A case report

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ABSTRACT

Background: 'Gummy smile' constitutes a relatively frequent esthetic disadvantage characterized by excessive display of the gums during upper lip smiling. One situation that can lead to gummy smile is APE. There are many important diagnostic factors connected with APE. These include making a correct diagnosis; considering facial and oral features before considering the most appropriate periodontal treatment.

Purpose: The purpose of writing this article is to describe the treatment management of an excessive gingival display in a patient with altered passive eruption (APE) of the maxillary anterior teeth with surgical guide.

Case: A 20-year-old female patient came to the Periodontology Clinic at RSGM Airlangga
University that expressed discontent with her smile, due to the display of gingiva when she smiles. The patient did not have problems with the periodontal tissue and had no history of systemic diseases such as diabetes, high blood pressure, and had no history of allergies to food and drugs. **Case Management:** After analyzing the clinical examining, gingivectomy with surgical guide was chosen for this case.

Conclusion:. The use of digital technologies significantly simplified the treatment process for a complex gingivectomy case and enhanced the precision of the gingivectomy procedure.

Keywords: Gummy smile, altered passive eruption, digital technologies, surgical guide

Introduction

An attractive smile would be ideally a perfect set of teeth along with good-looking peri-oral and facial esthetics. The association and relationship between three components of teeth, lip framework, and the gingival scaffold determine and control the esthetic appearance of a smile. The amount of gingival appearance on smiling is very significant to smile attractiveness. The amount of Gingival

Display is an important characteristic in a person's own satisfaction with her/his smile. Patients with Excessive Gingival Display are often uncomfortable and embarrassed about it and some of them are affected psychologically. [1]

Gingival smile is known by a variety of terms including "gummy smile, excessive gingival display, high lip line, short upper lip, and full denture smile". [1] 'Gummy smile' constitutes a relatively frequent esthetic disadvantage characterized by excessive display of the gums during upper lip smiling. One situation that can lead to gummy smile is APE. [2]

There are three kinds of smile: high, medium and low. The high smile is considered normal when presented with exposed gingiva of 2 to 3 mm. If the exposure presents more than 3 mm, the gummy smile is characterized.[3] The medium smile is known to be more attractive and it is characterized by presence of tooth, interdental gingiva and the edge of free gingiva around the cervical portion of the teeth, and is completely exposed [2], with a normal gingival appearance between the inferior border of the upper lip and the gingival margin of the anterior central incisors during a normal smile is 1-2 mm.[4]

Patients with a high smile line who expose a large band of gingiva may be classified as having a 'gummy' smile (Figure 1). It's important to establish the aetiology for the 'gummy' smile, as not all will be well-suited to periodontal plastic surgery procedures. For example, conditions such as vertical maxillary excess may require maxillofacial surgery to resolve, and a hypermobile lip may benefit from botulinum toxin injections or lip repositioning surgery.[3]

Figure 1. *Gummy Smile*

ALTERED PASSIVE ERUPTION (APE)

Passive eruption commences after the tooth's anatomical crown has fully erupted and is characterised by the apical shift of the dentogingival junction. The length of the clinical crown increases as the epithelial attachment migrates apically. Apical migration of the dentogingival junction continues until it reaches a physiologic distance of 0.5 – 2.0mm coronal to the cementoenamel junction (CEJ). If alterations occur during the passive phase of tooth eruption, the gingival margin may fail to retract to the full extent, giving rise to the phenomenon of altered passive eruption.

Altered passive eruption was first defined by Goldman and Cohen.[5] Coslet et al. later developed a classification system, based upon the relationship between the gingiva and the underlying alveolar bone (Table 1).[6] According to Nart et al., altered passive eruption may affect around 35% of the population. The gingival margin position in relation to the CEJ and buccal bone crest as well as the crown-root–alveolar crest relationships need to be evaluated to ascertain if a 'gummy' smile is due to altered passive eruption.[7]

TABLE 1

CLASSIFICATION OF ALTERED PASSIVE ERUPTION

Classification	Description	
Type 1A	Wide band of keratinised tissue (> 2mm)	Distance between CEJ and alveolar bone crest 1.5 – 2mm
Type 1B	Wide band of keratinised tissue (> 2mm)	CEJ and alveolar bone crest close or at same level
Type 2A	Narrow band of keratinised tissue (≤ 2mm)	Distance between CEJ and alveolar bone crest 1.5 – 2mm
Type 2B	Narrow band of keratinised tissue (≤ 2mm)	CEJ and alveolar bone crest close or at same level

Table 1. *Classification of APE*

IDEAL GINGIVAL AESTHETICS

The ideal gingival architecture consists of several features:

- Gingival zenith position: The gingival zenith is the most apical point of the gingival outline. According to Chu et al., the gingival zeniths of the maxillary central incisors should be approximately 1mm distal to the midline of the crown, the zeniths of the lateral incisors 0.4mm distal and the zeniths of the canine usually centralised along the long axis (Figure 2).[8]
- Relative gingival margins: Apicocoronally the zeniths of the lateral incisors should be 1mm coronal to central incisors and canines (Figure 2).
- The gingival aesthetic line is defined as the line joining the tangents of the central incisor and canine zeniths. The gingival aesthetic line angle is that formed at the intersection of this line to the maxillary dental midline. The ideal angle is between 45 and 90 degrees (Figure 3). In the same respect, gingival symmetry between the right and left side of the mouth is an important consideration.
- Approximate ideal width-to-height tooth ratios are as follows: central incisor = 80%, lateral incisor = 70%, and canine = 75%.[9]

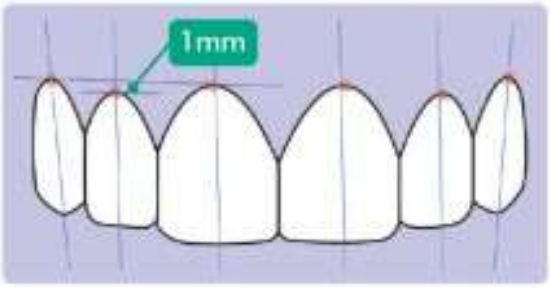

Figure 2. *Ideal gingival aesthetic*

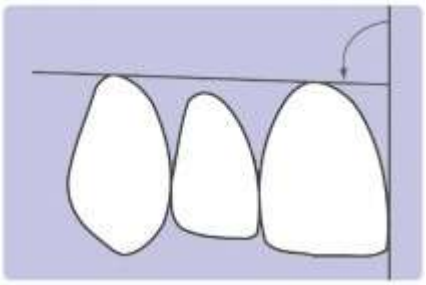

Figure 3. *Gingival aesthetic and angle*

TREATMENT PLANNING FOR APE

The harmonious relationship between the teeth and surrounding gingival architecture plays a crucial role in smile esthetics, as societal standards often emphasize symmetry, proper tooth alignment and a balanced gingival display as key components of an attractive smile.[10] The planning phase prior to the surgical procedure is critical for a successful outcome.

It is important to confirm periodontal health and optimal plaque control prior to any elective aesthetic surgical procedures. For this reason, if the patient is diagnosed with periodontitis, this needs to be treated first. Other local factors such as the crown:root ratio, level of the furcation entrance, root proximity and endodontic status of the tooth should also be assessed. The reference point or finish line would need to be determined. This is usually the CEJ for altered passive eruption cases but could also be a reference point on the tooth, existing/provisional restorations or that guided by a surgical stent. Evaluating the gingival architecture and extent of the smile will determine how much and how many teeth will require crown lengthening.[3]

The amount of keratinised tissue needs to be assessed as this will determine the surgical approach: resective versus apically positioning tissues (or a combination of both). It is preferable to leave at least 2 mm of keratinised tissue post-surgery to enable the patient to maintain an optimal level of plaque control more comfortably than if there was only (non-keratinised) lining mucosa remaining. The position of the bone and the distance between the bone level and reference point will then determine the amount of bone removal that will be required, if any. Good quality periapical radiographs and bone sounding will be useful to help determine the position of the bone and for beneficial biological width (Figure 4) summarises the various surgical approaches. During the planning phase, involvement of the patient will ensure that patient expectations are met, or unrealistic expectations are clarified. Annotated photographs (Figure 5), composite mock-ups in the mouth and wax-ups can all be helpful for the patient to visualise the result.[3]

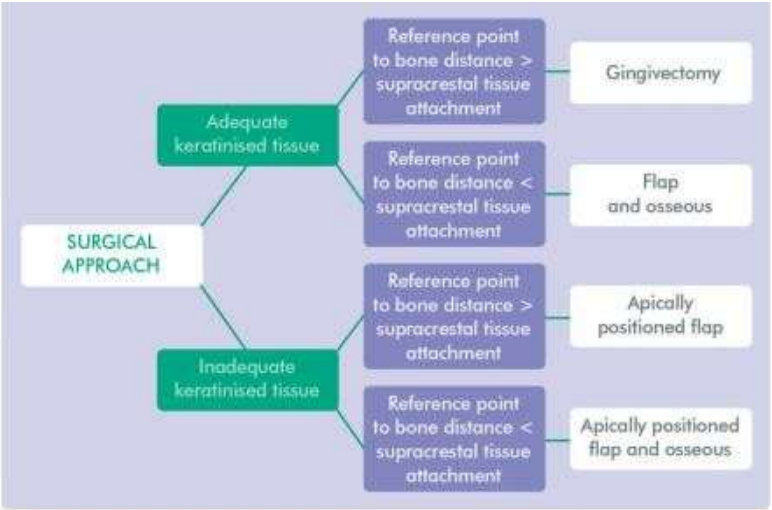

Figure 4. *Surgical approaches*

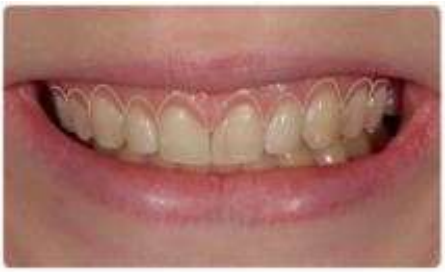

Figure 5. *An example of an annotatted photograph*

Further, digital technologies have transformed the planning and execution of such procedures, offering clinicians greater control and predictability.[11] In this context, Digital Smile Design (DSD) has emerged as a revolutionary tool. Originally introduced by Coachman, et al., in 2017, DSD allows clinicians to design the ideal smile using facially guided analysis based on extraoral photographs and dynamic video documentation.[12] The use of surgical guide based on DSD further enhances communication between clinician and patient, allowing the patient to visualize and approve the proposed result prior to treatment.[13] These guidance also serve a critical clinical role, acting as physical guides for soft tissue procedures [14] with the aim of improving the aesthetics of the anterior interdental papillae.[15]

Case Report

A 20-year-old female patient presented to Periodontology Clinic RSGM Airlangga University and expressed discontent with her smile, due to the display of gingiva when she smiles. Intraoral and extraoral evaluation revealed a gummy smile (Fig. 6) and short anterior teeth (confirmed by the

Chu esthetic gauge) (Fig. 8), affecting the esthetic appearance. No periodontal issues were noted even and no bleeding on probing was observed. From radiographic examination no abnormalities was found (Figure 7). The patient claimed to have no history of high blood pressure, diabetes, and other systemic diseases. The patient claimed to have no history of drug allergies and food allergies.

Figure 6. *A. Baseline clinical aspect. B. Measurement gingival display*

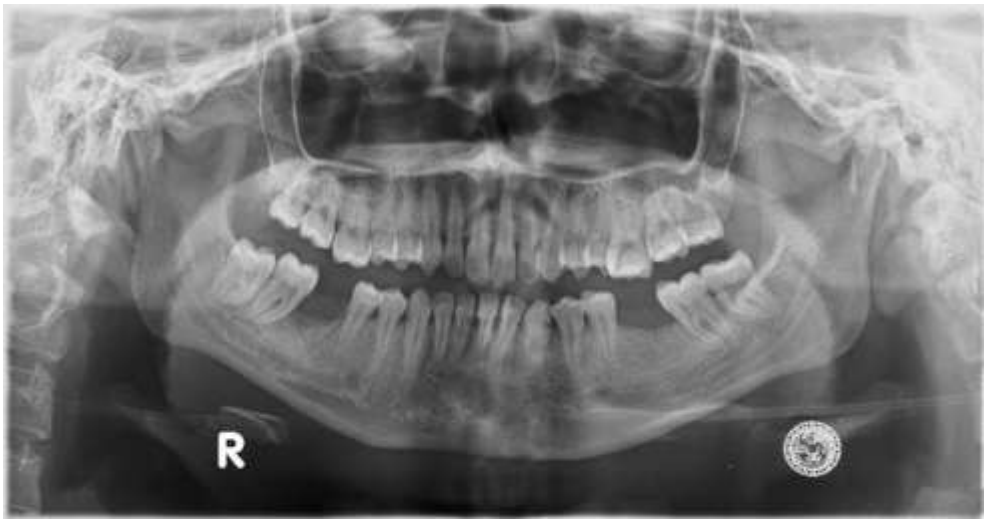

Figure 7. *Radiographic examination*

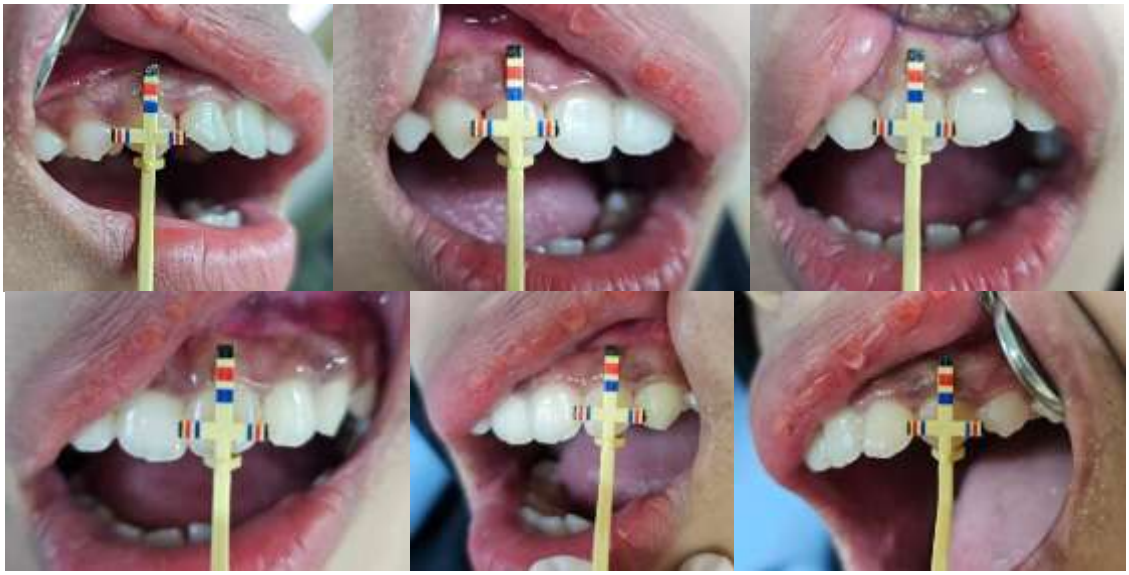

Figure 8. *Clinical evaluation using the Chu proportion gauge, indicating reduced height of the maxillary teeth relative to ideal proportions.*

Based on the clinical examination, the patient was diagnosed with mucogingival deformity and conditions around the teeth (excessive gingival display) with plaque etiology and accompanying conditions in the form of altered passive eruption (APE) with beneficial biological width (2,04 mm) (Fig. 9). The treatment plan in phase 1 is dental health education (DHE), scaling teeth in the upper and lower regions. The planned phase II treatment is gingivectomy in regions 13, 12, 11, 21, 22, 23.

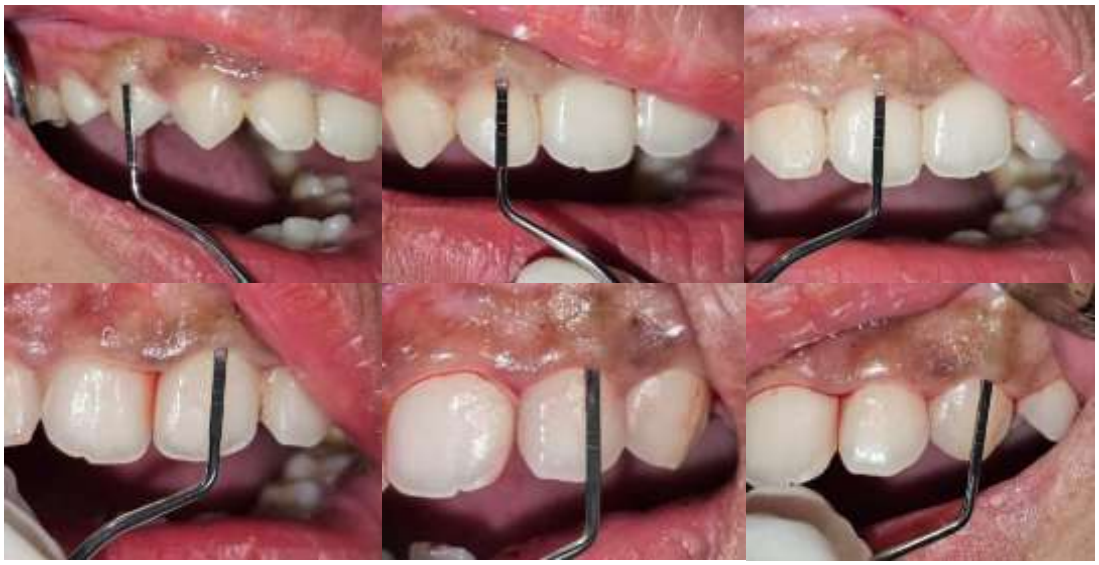

Figure 9. *Bone sounding examination*

Before surgery, its determined the desired final position of the gingival margin relative to the lip line. All of the patient's clinical measurements were then transferred to a stone cast. The patient's extraoral photograph was captured and imported into DSD, and a surgical guide was fabricated based on all patient clinical examination (Fig. 9).

Case Management

Gingivectomy is an appropriate treatment option for APE because of predictable results and minimal side effects for patients compared to other treatments. The gingivectomy procedure begins with asepsis in the patient by administering providone iodine, and continues with local anesthetic infiltration using septocaine in the mucobuccalfold of teeth region 13, 12, 11, 21, 22, 23. Crown teeth with width and length 13, 12, 11, 21, 22, 23 were measured using Chu's gauge and biological width was measured using bone sounding. Once the correct seating of the guide was verified intraorally, the gingivectomy procedure was performed using diode laser. The use of this minimally invasive technique contributed to shorter healing duration, reduced postoperative discomfort and a predictable esthetic outcome. The surgical procedure strictly followed the contours defined by the predesigned DSD guide, ensuring symmetry and harmony in the final gingival architecture (Fig. 10). Irrigation of the surgical area using saline.

The precise guidance combined with the effective hemostasis and tissue-sparing action of the laser, contributed significantly to patient comfort and satisfaction during and after the procedure. Patients were given a prescription of mefenamic acid 500 mg 3 times a day and taken if pain occurs, and chlorhexidine gluconate 0.2% twice a day. Postoperative routine instructions were given to patients not to consume hot and spicy food or hot drinks for 3 days after surgery. The patient came for control 7 days postoperatively, denied any pain. The control patient returned 14 days later, there were no complaints of pain then debridement was carried out using saline irrigation (Fig. 11).

Figure 9. *Digital smile design*

Figure 11. *(A) Prosedur pembedahan gingivektomi. (B) Pre-operative clinical condition. (C) Clinical condition post-operative H+ 3 months post gingivectomy procedure. There was no sign of inflamation and the gingival zenith was in the expected position*

Discussion

In this case, gingivectomy can be considered a treatment choice for patient with APE cases classifed as type I and subclassifed as A. This decision was made because the beneficial biological width, which represents the sum of the epithelial and connective tissue measurements (A sulcus depth of 0.69 mm, an epithelial attachment of 0.97 mm, and a connective tissue attachment of 1.07 mm), has obtained (2,04 mm) [16], has reached based on the examination that has been carried out.

In this case, the treatment was performed using surgical guide from digital smile design, incorporating laser technology for the gingivectomy procedure. The patient presented with a gummy smile caused by excess gingival tissue and the treatment was focused on reshaping the gingiva without the need for bone removal. Laser-assisted gingivectomy was selected due to its precision, minimal invasiveness and ability to provide excellent esthetic results with faster recovery times.[17]

The use of surgical guides in this case offers several advantages. First, increased accuracy and precision: Each guide was optimized for different aspects of the treatment, providing better overall precision during the gingivectomy. Second, redundancy for increased confidence: The integration of guides from software platforms introduced an added level of safety, contributing to a more controlled and predictable outcome. With the use of surgical guide, operator can do less invasive, faster procedure and potentially safer because they provide a clear roadmap for the surgeon to follow. Guides can improved esthetics result by providing a precise guide for gingivectomy, the final result is more likely to have harmonious contours, which is particularly important for esthetic procedures. Finally, guides can reduced surgical time: digital planning and the use of a surgical guide can reduce the overall time spent in the surgical chair and provide better patient care: the increased accuracy and predictability of guided surgery can lead to a better experience for the patient, with potentially less discomfort and a faster healing time.

Digital smile design was developed using different software tools, which helped create a more detailed and realistic representation of the desired result.[18] These digital designs were essential in ensuring that the final outcome would meet the patient's esthetic goals. Based on these designs, surgical guides were then printed and designed digitally, ensuring precise control during the gingivectomy procedure. The laser-assisted gingivectomy was guided by a printed guide, which

minimized the risk of error and ensured that the gingival margins were sculpted with high accuracy.[19]

Careful diagnosis and treatment planning are important to predict the success of APE treatment. Measurements using Chu's aesthetic gauge have been used successfully to guide reduction of excess gingival tissue and improve tooth size proportions. These measurements include the tip of Chu's Proportion Gauge, which represents an objective mathematical assessment of the tooth size range.[20] The results obtained after 3 months of evaluation were said to be quite good, because the gingival margin was in the expected position.

An exaggerated display of gingiva or a gummy smile represents a concern for aesthetics that is emotionally disturbing for many. Dentists must understand the various causes, determine the right diagnosis, and make an aesthetic treatment plan that can be predicted clinically for the success of therapy in the gummy smile condition.

Conclusion

The integration of digital solutions, including the use of digital guides, significantly simplified the treatment process for a complex gingivectomy case. The use of digital technologies enhanced the precision of the gingivectomy procedure. This approach highlights the transformative potential of digital dentistry in addressing challenging clinical scenarios, offering both improved patient outcomes and greater efficiency in treatment planning and execution.

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Conflict of Interest:

There is no conflict of interest to declare.

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