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Abstract

An excessive gingival display, which commonly influences the appearance of the smile and the social behavior of patients, can be the result of various factors, including vertical maxillary excess, altered passive eruption (APE), and a short or hyperactive upper lip. Surgical stents and guides have been used more frequently in clinical crown lengthening procedures during recent years to promote a higher level of precision and more predictable results. The aim of this article is to describe a novel approach for treating patients with APE who have high esthetic demands.

**CASE REPORT**

**Introduction**

An attractive smile is commonly considered to be a symbol of beauty and well-being in modern society. Several factors may compromise smile esthetics such as the shape or position of the teeth, gingival health, gingival levels, and the presence of scars. In some patients, the altered relationship between the teeth, the alveolar bone, and the soft tissue may result in the clinical condition known as gummy smile.

Gummy smile was described by Allen as an excessive gingival display that is strongly related to an unesthetic smile appearance, influencing the social behavior of patients. Nowadays, it is considered to be one of the most common factors generating social discomfort. A single factor or a combination of factors may be present in patients with this clinical condition, including altered passive eruption (APE), vertical maxillary excess, and a short or hyperactive upper lip.

In patients affected with APE, the dento-gingival proportions are modified. Normally, the gingival margin is clinically identified by a scalloped line that, in a healthy state, follows the outline of the cementoenamel junction (CEJ) at a distance of 1 to 2 mm. In patients with APE, the scalloped line is significantly different, both in shape and degree of scalloping.

Coslet et al clearly described two different types of APE, with different kinds of related treatments. Commonly, the treatment options for APE are represented by gingivectomy or apically repositioned flap associated with osseous resective surgery. In particular, type 1 APE, characterized by an excessive amount of attached gingiva with shorter crowns, is a challenge for periodontists. In these cases, bone resection to re-establish biologic width space and to control soft tissue rebound is recommended.

Incorrect flap design or excessive bone resection may lead to residual gingival recession, while poor bone resection may result in only a partial resolution of APE. In this regard, a previously correct diagnosis, CEJ detection, anatomical crown height evaluation, and bone-to-tooth positioning play a key role in the final successful result.

Several authors have described different kinds of presurgical measurements such as calibrated standardized periapical radiographs of the involved teeth, or the use of a tooth shape guide. With the progress of technology and the improved precision of new digital devices, new methods such as surgical stents and guides have been introduced for presurgical assessment and for use during surgery. Most of these new methods relate to preprosthetic crown lengthening procedures.

The aim of this article is to describe a crown lengthening technique in combination with lip repositioning based on a digitally designed stent produced by cone beam computed tomography (CBCT), a stereolithographic model, and a digital impression study. This technique could guide both gingivectomies and bone recontouring during clinical crown lengthening in patients with gummy smile who have high esthetic demands.
Case report

A 45-year-old woman with no significant medical history and in good general health complained of poor tooth esthetics. She presented with a high lip line/gingival display and APE (Fig 1). A clinical extraoral examination revealed symmetric facial features with moderate maxillary growth excess associated with normal upper lip length (24 mm). An intraoral examination revealed a healthy periodontal situation associated with excessive attached gingiva width (Fig 2). An excess of 2 to 3 mm of gingiva covering the facial aspect of the anterior teeth was observed, which matched the data derived from the digital impression and the digital and stereolithographic model on the CBCT scan that had been taken previously.

The knowledge of the real dimension of the anatomic crown height through stereolithographic models, CBCT, and the relationship between the gingival dimension/position allowed for the correct diagnosis of type 1 APE (with subtype b in some teeth) and for the selection of the correct surgical approach.

After discussing the treatment options and sequences, complications, and possible results with the patient, a combination of surgical crown lengthening (first treatment phase) and a lip repositioning (second treatment phase) was decided upon.

Materials and methods

Diagnosis and surgical phases

Crown lengthening
A digital impression of the maxillary arch was taken using a digital intraoral scanner (Trios; 3Shape) (Fig 3). Particular care was taken regarding the soft tissue registration. After a model was created, a CBCT examination and stereolithographic model were performed which allowed for the assess-
ment of the correct relationship between the gingival margin position, tooth dimension, and bone volume. This last finding was mandatory in order to understand the correct position of the future gingival margin and the amount of intrasurgical bone resection. For this purpose, a surgical customized guide (Fig 4) was made to provide a precise adaptation of the teeth and soft tissue and a correct blade position. This custom-made guide had a 45-degree angulated apical portion to reproduce the correct beveled incision and bone resection in order to easily accomplish the scope of a controlled osteoplasty that avoided the risk of an excessive bone elimination, and to reestablish biologic width space (Fig 5).12

After a local anesthetic of articaine with 1/100,000 epinephrine was administered, the surgical guide was placed in a secure position according to the occlusal teeth stops (Fig 6). Then, following the ‘gingival shape’ of the guide, the primary flap was designed with a 45-degree external bevel (Fig 7). The secondary flap was then removed, displaying the new real dimension of the clinical crowns. This was a split-thickness flap elevated at the level of the interdental papillae to preserve the volume and reduce postoperative papillae height shrinkage. The full-thickness elevation was done apically to allow for bone resection (Fig 8). From the CEJ, 3 mm of ostectomy was created with chisels and burs around the facial
aspect of the involved teeth (from the first right premolar to the first left premolar). The ‘bone aspect’ of the guide helped to re-establish the biologic width space (Fig 9). After bone recontouring and correct osteoplasty through the removal of the buccal exostosis (Fig 10), the flap was sutured with interrupted 6-0 resorbable sutures (Vicryl; Ethicon), which precisely adapted the flap to the new crown dimensions (Fig 11).

The patient was instructed not to brush for the first 2 weeks and to gently rinse the surgical area with 0.12% chlorhexidine gluconate twice a day. Postsurgical instructions included a soft and cold diet, and ibuprofen 600 mg was prescribed for 7 days to control postoperative discomfort. In addition, amoxicillin and clavulanic acid 1 gr were prescribed twice a day for 1 week.

Recall visits were scheduled for 2, 4, and 12 weeks postsurgery.

No adverse events and no soft tissue recession were observed during the postsurgical phase, and after 3 months the patient was scheduled for the lip repositioning procedure.
Lip repositioning

After the apical extension of the flap had been successfully accomplished in the first surgical phase, lip repositioning was performed in the second surgical phase.

A 12- to 15-mm-wide band of mucosal tissue was selected to be removed, according to a 1:2 ratio between the amount of gingival display and the amount of tissue removal.

After local anesthesia was administered, the surgical area was delimited with two parallel incisions to ascertain the amount of tissue to remove from the maxillary first molar (Fig 12).13

The coronal incision was planned in correspondence with the mucogingival junction following the scalloped line so as to avoid damage to the muscular tissue, nerves, and minor salivary submucosal glands. A partial-thickness dissection was performed to remove the superficial mucosa, leaving the underlying connective tissue exposed (Fig 13). The apical line was then sutured to the coronal scalloped line with 5-0 interrupted resorbable sutures (Vicryl), allowing for a coronal repositioning of the upper lip.

The patient was instructed to limit facial and labial movement for 2 weeks after the surgery. The dietary, brushing, and rinsing recommendations given to the patient after the first procedure were repeated.

Recall visits were scheduled for 1, 2, 4, and 16 weeks postsurgery, and the sutures were removed after 2 weeks.

The healing phase was uneventful, with only moderate tension that decreased progressively after 3 weeks.

The suture area in correspondence with the scalloped coronal line healed as a scar, which was hidden by the upper lip during full smile (Fig 14).

After 6 months, the patient was very satisfied with the final esthetic outcome, being pleased with the new tooth dimensions and lip position at maximum smile (Fig 15).
Discussion

Surgical stents and guides have been used more frequently in recent years for various kinds of guided implantology and bone reconstruction surgery, \(^ {14-17}\) and have also recently been introduced for clinical crown lengthening procedures, \(^ {18-21}\) One of the most important advantages of their use is the possibility of recognizing the real dimension of the anatomic crowns and making a correct diagnosis of APE in order to assess the most correct surgical approach. In this case, the possibility of knowing and previsualizing the final results led to the benefit of more effective communication with the patient and the dental laboratory about the final dimension of the teeth before the surgery. The CBCT and stereolithographic model-based guide also facilitated and increased the precision of the primary flap design and the amount of bone resection, avoiding soft tissue recession in both the early and late phases of healing and controlling the soft tissue rebound.

This novel approach cannot be considered completely free of complications. Although the position of the CEJ can be easily defined, a certain degree of reshaping of the alveolar bone is always needed, even if it is not crucial for the final outcome. The osteoplasty, which generally follows the ostectomy phase, is a pure clinical parameter that is impossible to pre-determine and which depends mainly on the shape of the alveolar process, which is sometimes more protruding and sometimes less related to the initial biotype of the patient; it is thus always related to the skill and expertise of the clinician.

In this case, the lip repositioning increased the patient’s satisfaction and reestablished a better teeth–gingiva–lip relationship.

Good short-term results have been reported about lip repositioning techniques; however, most of them are case series and case reports, and the stability of the lip position over time is still unclear, \(^ {13,22,23}\)

The two procedures of crown lengthening and lip repositioning are often combined to improve the final esthetic smile appearance, with less morbidity compared with orthognathic surgery, \(^ {24}\)

Conclusions

Digital custom-made guides can be safely used for clinical crown lengthening procedures in patients affected by APE with high esthetic demands, reducing recession defects or soft tissue rebound in the early and late phases of healing. They also increase the precision of flap design and the amount of bone resection. New digital devices allow for an improved diagnostic process and play a key role in the choice of the correct surgical approach and in patient communication. Further studies with longer follow-up are needed to confirm this finding.
References