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Lip repositioning using polymethylmethacrylate-based cement and crown lengthening: case report with 12-month follow-up

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Abstract

Introduction: The excessive gingival display (EGD), also known as gummy smile, is one of the most prevalent complaints from patients looking for a more esthetic smile. Among the treatment options for this problem are gingivectomy, with or without osteotomy, crown lengthening, botulinum toxin, lip repositioning surgery and orthognathic surgery — many times along with orthodontic treatment, depending on the cause of the problem. More recently, a polymethylmethacrylate-based (PMMA) cement has been used to fill the subnasal depression, in order to decrease lip movement and reposition the upper lip, decreasing the gingival exposure. **Objective:** This article reports a clinical case with 12-month follow-up, in which a PMMA cement was used to fill the subnasal depression, in conjunction with crown lengthening, to solve the EGD problem of a patient.

Keywords: Excessive gingival display. PMMA cement. Aesthetic crown lengthening.

Introduction

Nowadays, the search for aesthetics has gained a strong appeal, especially due to the advent of the social media, and to achieve it, a perfect smile is particularly important (Tawfik *et al*., 2018). Most people believe that the perfect smile has some particular characteristics such as good symmetry between teeth, gingivae, and lips, with both intra and extraoral harmony (Garber and Salama, 1996). The analysis of the frontal and lateral views of these structures should be made with the goal of determining the lips positioning and vertical dimensions, and delimiting facial proportions (Mostafa, 2018). One condition that may interfere with the harmony of the face is the presence of an excessive gingival display (EGD), also known as gummy smile, which is defined as a high smile line that shows more than 2mm of the gingiva when the patient is smiling (Robbins, 1999; Torres *et al*., 2017).

EGD is perhaps one of the most frequently cited complaints by patients seeking aesthetic rehabilitation, so the indication for its correction is becoming a common treatment modality in dental practices. This is a multifactorial condition that may have dentoalveolar or non dentoalveolar etiology (Robbins, 1999). As dentoalveolar discrepancies, we can cite: short clinical crowns, gingival overgrowth, altered passive eruption, and extrusion, which can be treated with orthodontic treatment and/or periodontal plastic surgery (Garber and Salama, 1996). As non dentoalveolar discrepancies, we can cite: vertical maxillary excess, hyperactive, incompetent or even short lips — in which cases, a multidisciplinary approach is necessary, involving orthognathic surgery, botulin toxin, lip repositioning surgery, and a combination of therapies in order to improve the aesthetic results (Mostafa, 2018; Santos-Pereira *et al*., 2021).

Some patients have a lack of lip support due to marked depression of the anterior process of the maxilla. For these patients, lip repositioning is often combined with crown lengthening and the addition of a polymethylmethacrylate (PMMA) cement to fill this depression and decrease the gingiva exposure and EGD (Torres *et al*., 2017; Arcuri *et al*., 2018). PMMA is a cross-chain polymer material compatible with human tissues, and since World War II it has been used in medicine, for cranioplasties in neurosurgeries, secondary to

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decompressive craniectomy. More recently, it has been used in dentistry as a filler material for subnasal depression, being an innovative way of dealing with gingival smile, and is still the reconstructive material most used by many professionals, because it is one of the most biocompatible alloplastic materials available to date, inducing low foreign body reaction and providing adequate protection to adjacent neural tissues (Torres *et al*., 2017; Arcuri *et al*., 2018; Frazer *et al*., 2005).

Therefore, the present article aims to report a clinical case of EGD treatment by means of aesthetic crown lengthening and lip reposition using a PMMA-based cement.

Case report

A 20-year-old female, ASA 1, non-smoker, came to the clinic complaining of excessive gingival exposure when smiling. During the initial appointment, a clinical examination was performed, and intraoral and facial photographs were taken (Figures 1 and 2), in addition to a cone beam computed tomography (CBCT) scan, requested to diagnose the relation of the cementoenamel junction (CEJ) with the gingival margin and bone crest. When examining the CBCT scan in conjunction with the full smile frontal and profile face photographs, besides the gingiva covering the enamel, an excess of buccal bone volume was observed, increasing the gingival evidence, as well hypermobility of the upper lip, causing it to lodge in the concavity of the anterior alveolar bone, forming a crease in the upper lip during smiling. The treatment proposed was the clinical crown lengthening from teeth #16 to #26 with osteoplasty, to reduce the buccal gingival volume, associated with bone cement graft to add volume to the uppermost part of the alveolar bone, providing lip support.

The CBCT scan was analyzed using the Blue Sky Plan planning software (Figure 3), in which the tissue phenotype was diagnosed as ranging from intermediate to thick, with a minimum thickness of 1.25 mm on tooth #13 and a maximum of 1.93 mm on tooth #15.

The amount of gingiva to be removed during gingivectomy was defined in the Blue-Sky Plan, in which the distance from the CEJ at the gingival apex to the gingival margin of each tooth was measured.

Figure 1. Initial extraoral frontal view showing the excessive gingival display.

Figure 2. Initial lateral extraoral view.

Figure 3. Blue Sky Plan images of the maxillary incisors showing the distance from the cemento-enamel margin to the buccal plate.

Surgical technique

The patient was sedated with midazolam 15 mg orally 30 minutes before the procedure. Amoxicillin 2g and dexamethasone 8 mg orally were prescribed 1 hour before the procedure. After intraoral and extraoral antisepsis, local anesthesia was performed with 4% articaine + epinephrine 1:100,000.

Markings were made by drilling small holes with a periodontal probe at the apex of each maxillary tooth, using the measurements made in the planning software, in addition to guiding marks on the mesial and distal of each tooth, for the correct design of the incision.

The gingivectomy was then performed with a Rhosse BP-100 Plus electronic scalpel with a 0.4 x 10 mm active-tip needle electrode angled at 45º, joining the marking points. Once the gingivectomy was completed, an intrasulcular incision was made from the distal of tooth #16 to the distal of tooth #26, and a full flap was opened, for bone exposure (Figure 4). In the first instance, osteoplasty was performed using a 3018-diamond bur with a long shank, reducing the bone volume to facilitate osteotomy and creating protrusions and cavities in the root and interdental areas, respectively. The bone thickness was shaped to form an intermediate gingival phenotype throughout the maxilla. After osteoplasty, osteotomy was performed using an H207D bur (Komet), leaving a distance of 3 mm from the CEJ to the bone crest (Figures 5 and 6). Once this step was finished, the PMMA radiopaque bone cement with orthopedic G1 Standard Viscosity (G21, Italy) was manipulated, mixing the powder with the liquid in a stainless steel recipient, according to the manufacturer's instructions. After 4 minutes, the cement reached the ideal phase for manipulation, and was positioned with a slight excess in the incisive fossa, then copiously irrigated with cooled saline solution,

Figure 4. Intraoral frontal view after full thickness flap debridement.

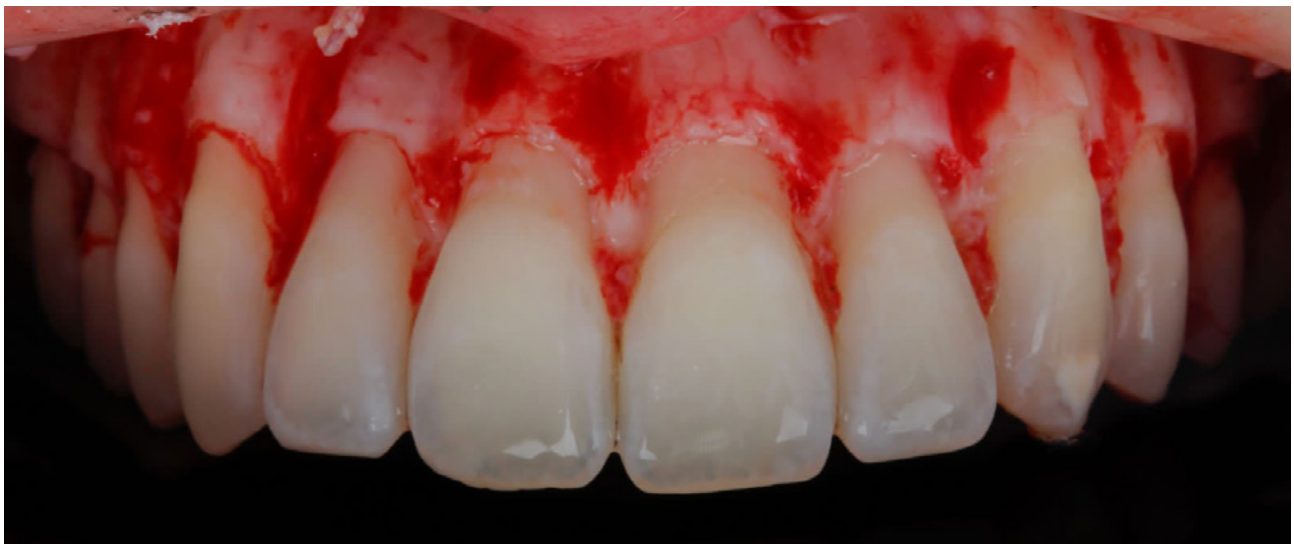

Figure 5. Intraoral frontal view after the osteotomy for crown lengthening.

Figure 6. Occlusal view showing the anterior maxillary concavity.

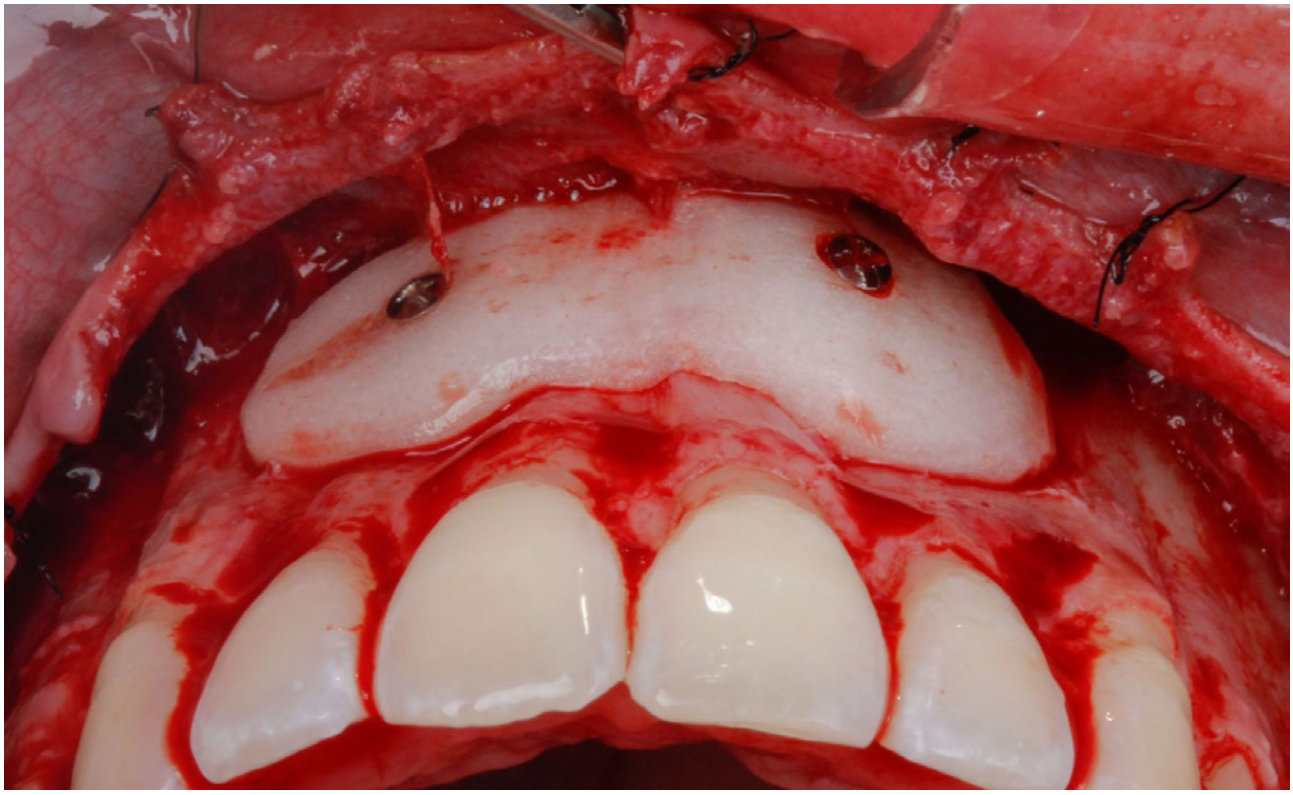

Figure 7. Occlusal view showing the PMMA cement fixed in position, filling the concavity.

to avoid overheating the bone — considering that the polymerization reaction is exothermic. This reaction took approximately 4 minutes more, and once finished, the graft was removed with cutters outside the mouth, smoothing the edges, limiting the extension between the canines area, piriform opening, and approximately 5 mm above the bone crest, and leaving a volume that made the profile of the alveolar bone straighter. The graft was then fixed with two self-perforating standard Bone Graft Screws (1.5 x 14 mm, Neodent, Curitiba/PR, Brazil), titanium made, placed at 30 rpm (Figure 7).

The suture technique was a modified mattress with knots on the palatal side, entering the needle at the base of the palatal papilla, exiting to the buccal and capturing the base of the buccal papilla, returning coronally buccal to the palatal, leaving a space of 1.5 mm between the needle entries and 1.5 mm from the tip of the papilla, and returning to the palatal on the back of the needle, so as not to capture the gingival tissue, closing the knot in the palatal. Thus, in addition to being a more esthetic suture, the buccal papilla was pressed against the palatal without pressing the tip, avoiding tissue loss and possible healing defects leading to double papilla or black space.

The following post-operative medications were prescribed: Amoxicillin 875 mg 8/8h for 7 days, Dexamethasone 8 mg early in the morning for the next 2 days, Toragesic sublingual 8/8h for 5 days, and Paracetamol 750 mg 4/4h or 8/8h in case of pain. Mouthwash with chlorhexidine 0,12% was prescribed for 14 days, avoiding brushing the operated area until sutures removal — which were removed 10 days after the surgery. The patient returned for a final evaluation 12 months after the surgery, for new photographs and clinical analysis (Figures 8 and 9). No signs of gingival inflammation were visible, nor bleeding on probe. The patient was satisfied with the results of the procedure, even that still some gummy smile was visible.

Discussion

Procedures such as gingivectomy with crown lengthening are among the most used to solve EGD in patients that feel uncomfortable with this condition (Ribeiro *et al.*, 2014; Mantovani *et al.*, 2016). Other treatment options also include the use of botulinum toxin and myotomy of lip-elevating muscles (Santos-Pereira *et al.*, 2021; Kriegel *et al.*, 2007). The present case report shows a modality that included the crown lengthening by osteotomy and gingivectomy, and the use of a PMMA-based cement to fill the subnasal depression, thus preventing the upper lip from resting on it and reducing EGD. Other articles had already shown this type of treatment with success (Torres *et al.*, 2017; Arcuri *et al.*, 2018; Andrade *et al.*, 2021). The filling of the subnasal depression can promote reduction of the lip movement and improve the aesthetic results, as shown in some articles (Arcuri *et al.*, 2018; Andrade *et al.*, 2021), and seen in the present patient.

The use of PMMA in dentistry surgery is not new, but it has become a good alternative due to its properties, such as biocompatibility, low cost, rigidity, and easy preparation (Torres *et al.*, 2017; Arcuri *et al.*, 2018; Kriegel *et al.*, 2007; Andrade *et al.*, 2021; Reichenberger *et al.*, 2007; Groth *et al.*, 2006; Kim *et al.*, 2017). PMMA has been used for correction of bony defects in the face and skull and maxillofacial prosthesis for more than 70 years, with low complication rates (Torres *et al.*, 2017; Kriegel *et al.*, 2007; Andrade *et al.*, 2021; Reichenberger *et al.*, 2007; Groth *et al.*, 2006; Kim *et al.*, 2017; Cheng *et al.*, 2008), corroborating its safe use for lip repositioning by the filling of the subnasal depression, as in the present case report.

The first report of the use of PMMA cement for this objective was published by Torres *et al.* (2017), who prepared and adapted the cement directly to the bone surface, as in the present report. In order to assure the immobility of the cement, screws can be inserted directly through it.

Figure 8. Extraoral frontal view 12 months after surgery, showing reduction of the EGD.

Figure 9. Lateral view 12 months after surgery, showing reduction of the EGD.

More recently, another form of use for PMMA cement was described (Andrade *et al*., 2021), in which a 3D printed prefabricated cement was made before the surgery, using the DICOM archive. This simple procedure has advantages compared to the usual procedure, such as less operative time, improved physical properties of the cement, and no heat from the exothermic reaction that could lead to inflammatory events and bone necrosis (Kadher and Towler, 2016). To avoid this possible complication, abundant and constant irrigation with cooled saline is recommended, to ensure a moist interface between the PMMA and the bone (Abdo Filho *et al*., 2011). Another possible complication involved in this type of procedure would be the cement coming loose from the bone. In order to diminish this, we used two long screws (14mm) placed through the cement, attaching it to the maxillary ridge. If, even with this care, the cement came loose, the flap would have to be raised again and screwed back on, or another PMMA-based cement would have to be placed. In addition, the usual risks are those common to crown lengthening with osteotomy.

Although the patient of this case report was satisfied with the results obtained after the 12-month follow-up, we believe that if the thickness of the PMMA cement were greater, with approximately 7mm (Jaberi *et al*., 2013), maybe there would be less gingival exposure and still be a safe procedure. As this was our group's first case, this probably won't happen in the next ones, or the results will be improved on a case-by-case basis until we know better how to properly manipulate the cement or switch to the 3-D printed modality (Andrade *et al*., 2021).

Conclusion

Within the limitations of this case report, we can conclude that use of a PMMA-based cement to fill subnasal depression may be helpful, in conjunction with gingivectomy and/or crown lengthening, to treat EGD with success and safeness.

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