

## Case Report

# A modified technique that decreases the height of the upper lip in the treatment of gummy smile patients: A case series study

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Delayed passive eruption is conventionally treated with osteotomy and osteoplasty, which is limited to the vicinity of cemento-enamel junction. The aim of the present study was to evaluate clinical outcome of three gummy smile patients with delayed passive eruption submitted to an extended osteoplasty in the buccal aspect of anterior maxilla. Digital photograph images of maximal smile were taken in order to assess the results before and 9 months after surgery. All maxillary incisors were evaluated. In comparison with baseline, all patients presented lip drooping (calculated in  $7.9 \pm 1.7\%$ ), increase in crown length ( $18.2 \pm 2.7\%$ ), and a decrease in the gingival display ( $46.6 \pm 2.7\%$ ). On the other hand, considering specifically the decrease in gingival display,  $19.7 \pm 3.8\%$  of it was due to the amount of lip drooping, while  $26.9 \pm 1.2\%$  was due to the increase in crown length. Within the limits of the present study, it could be concluded that after the extended osteoplasty, upper lip has slightly dropped and was less tensioned, which provided a more harmonious smile.

**Key words:** Gum, smiling, osteoplasty, mucogingival surgery, aesthetics.

## INTRODUCTION

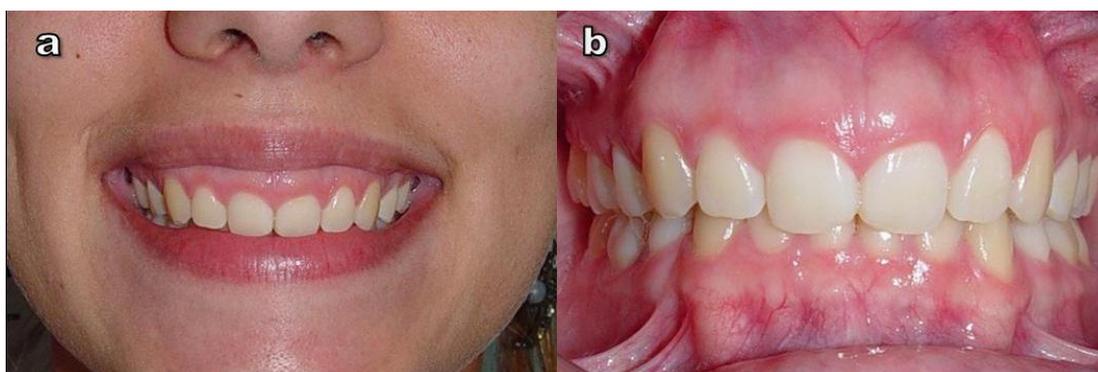
Smile is considered an important aesthetic reference, thus, the study of the alterations that lead to its disharmony, as well as, the techniques used for its correction have played a rather more relevant role within dentistry. Gingiva excessive exposure during smile is also referred to as "gummy smile", being diagnosed in cases where, during smile, gingival display measures more than 3 mm from its margin up to the upper lip line (Allen, 1988; Garber and Salama, 1996). It might be caused by labial

hyperactivity, gingival overgrowth, delayed passive eruption (DPE), vertical maxillary excess (VME), or a combination of them (Robbins, 1999; Monaco et al., 2004).

Labial hyperactivity is characterized by marked contraction of the upper lip elevator muscles. Some approaches are proposed to contain labial movement, such as surgical procedures (Rosenblatt and Simon, 2006; Jorgensen and Nowzari, 2001) or use of medication (Polo, 2005). An alternative is a surgical procedure to remove a strip of alveolar mucosa, described to reduce oral vestibule in the anterior region, and thus, reduce labial elevation (Rosenblatt and Simon, 2006; Litton and Fournier, 1979; Humayun et al., 2010). In these cases, the short-term result is satisfactory; however, in long-term periods, they are discouraging (Rosenblatt and Simon, 2006) due to the possibility of recurrence. Surgeries that aim muscular amputation to limit labial elevation during smile, on their turn, show satisfactory outcomes (Miskinyar, 1983; Jorgensen and Nowzari, 2001);

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**Abbreviations:** DPE, Delayed passive eruption; VME, vertical maxillary excess; HLL, the height of the lip line; LC, length of the crown; LG, length of gingiva; CC, spearman correlation coefficient.



**Figure 1.** Initial aspect of the (a) smile, and an (a) intraoral view of Case 1.

nevertheless, there is always the risk of paresthesia. Administration of botulinum toxin (type A) led to a satisfactory effect, although temporary, and reapplications are required at intervals of 3 to 6 months (Polo, 2005).

Gingival overgrowth can also affect the smile aesthetic. This alteration can be caused by specific medicaments, hereditary, hormonal, or idiopathic factors (Wynne et al., 1995). Its correction is well described in dental literature, and is performed by means of gingivectomy or gingivoplasty (Goldman, 1951; Levine and McGuire, 1997; Coslet et al., 1977).

The VME is an osseous developmental alteration, also referred to as long face syndrome. Subjects commonly show a normal upper third of the face; the medium third has narrow nose and nostril base; and the lower third is elongated. Commonly, there is a long interlabial distance, which may or not be associated with open bite; maxillary anterior teeth excessive display or even complete exposure when lips are in rest position; and excessive exposure of the gingiva during smile (Schendel et al., 1976). To correct this syndrome, orthognathic surgeries (Le Fort I) with anterior maxillary intrusion are indicated, usually preceded by orthodontic therapy (Redlich et al., 1999; Ataoglu et al., 1999; Fowler, 1999).

Finally, DPE is characterized by alterations during the passive phase of eruption, allowing the crestal bone to be maintained very close or at the cemento-enamel junction level, preventing the gingival tissue to assume its appropriate physiological apical positioning (Duarte et al., 2001). Thus, marginal gingiva covers most part of dental crown, making it short, and increasing gingival exposure during smile. Conventionally, its treatment involves internally beveled incision or intrasulcular incision; followed by osteotomy; and osteoplasty, which is limited to the proximity of the crown (Allen, 1988; Levine and McGuire, 1997; Coslet et al., 1977; Narayan et al., 2011). However, Ribeiro et al. (2004) described a case of DPE in which an extended osteoplasty was carried out to remove bone

excess in the buccal aspect of the anterior teeth roots. This procedure resulted in expressive aesthetic improvement, not only for the adequacy of bone-gingiva architecture, but also for allowing a better adaptation of the upper lip, nevertheless, clinical parameters were not quantified.

The aim of the present study was to evaluate clinical outcome of gummy smile patients with delayed passive eruption submitted to an extended osteoplasty in the buccal aspect of anterior maxilla.

## CASE REPORTS

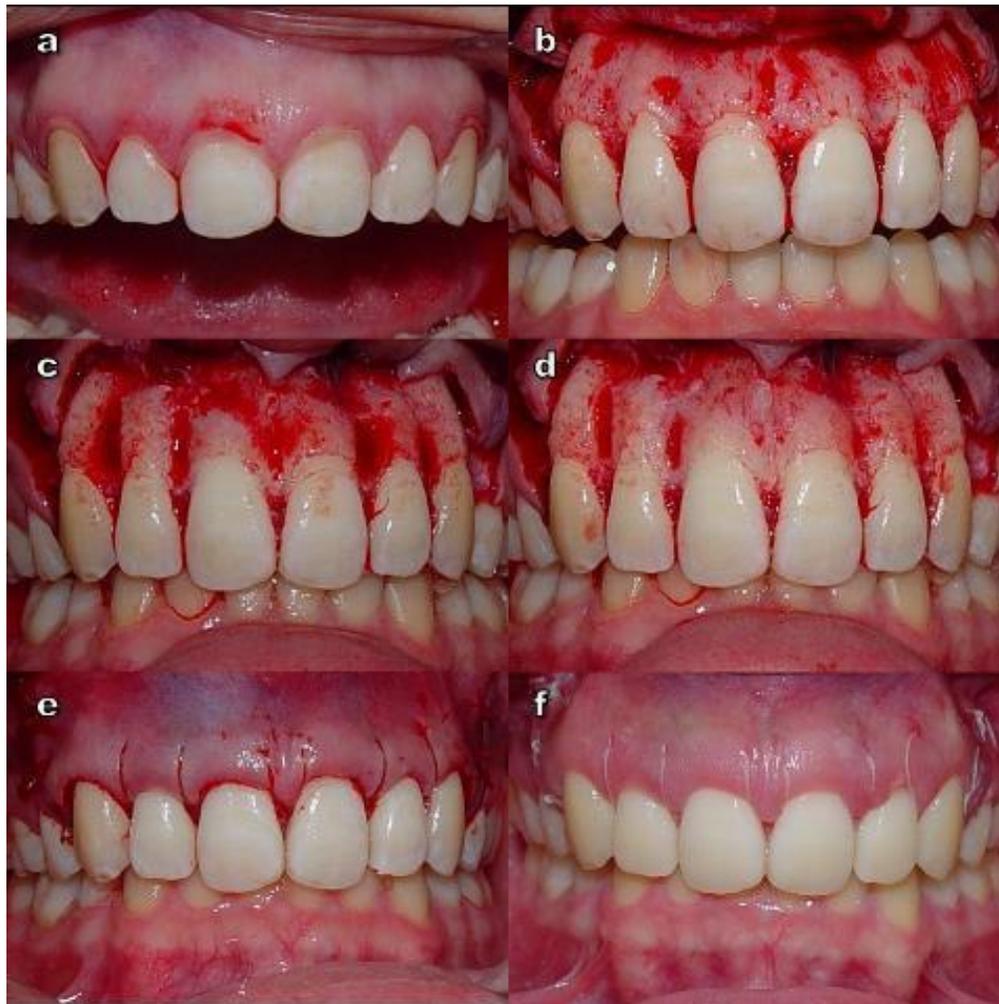
Three young adult female subjects with DPE and submitted to surgery to correct gummy smile in the clinic of Periodontology at the São Paulo State University – UNESP, were included in the present study. The patients sought for treatment for being dissatisfied with their smile aspect due to excessive exposure of gingiva. This study was conducted according to the Declaration of Helsinki, and all patients gave their informed consent.

DPE diagnosis was based on the clinical evaluation of the crowns, and through osseous probing. All the patients had short clinical crowns, and at least two buccal sites (among teeth 13 to 23) with the distance from the cemento-enamel junction to the lower bone crest inferior or equal to 1.0 mm, evaluated under anesthesia with the use of a North Carolina periodontal probe (HU-FRIEDY, Chicago, IL, USA).

Patients were in good general health, did not take any medication and were with no tobacco habit reported. Prior to surgery, patients were submitted to basic periodontal therapy, and the sites operated did not present marginal bleeding, bleeding on probing, or probing depth higher than 3 mm. All the patients had a strip of attached gingiva wider than or equal to 5 mm.

### Case 1

A 25-old female was diagnosed with DPE associated with VME (Figure 1). On radiographic examination, the pre-sence of radicular resorptions had been detected, probably due to previous orthodontic therapy. Thus, treat-ment plan included periodontal surgery with osteotomy and osteoplasty, after that patient was guided for orthognathic surgery. In this case, minimal osteotomy was planned, to prevent from greater loss of supporting bone, while



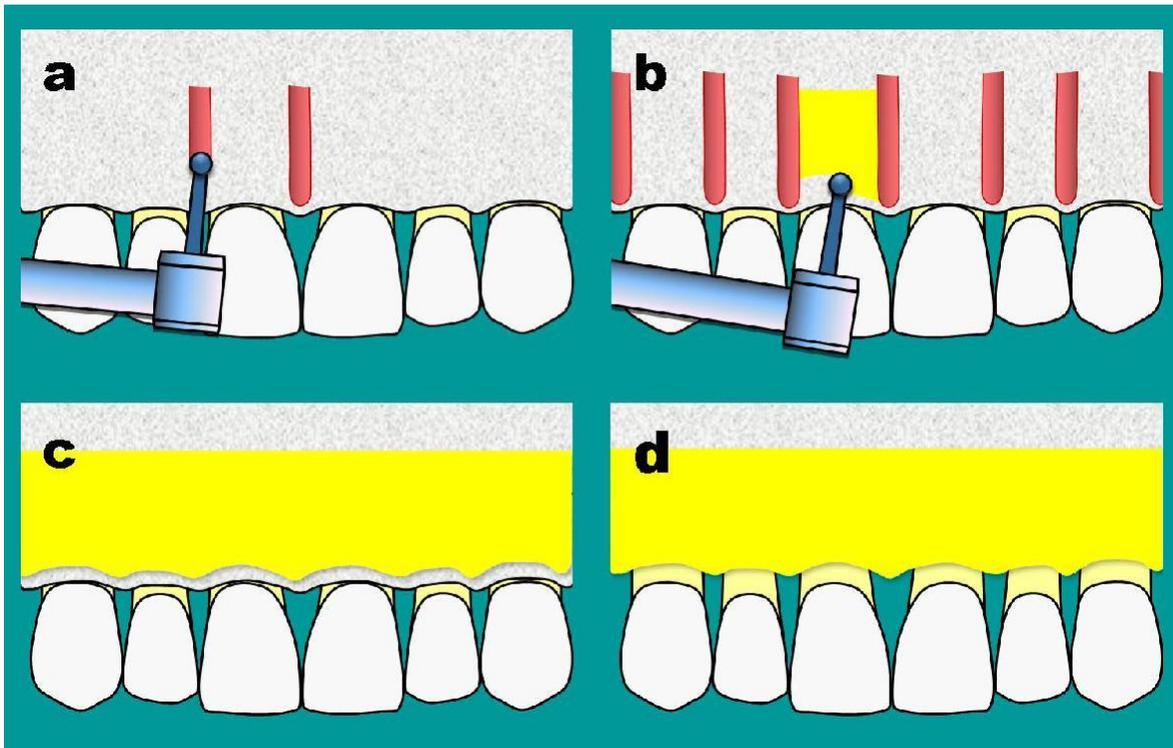
**Figure 2.** In Case 1 patient: (a) internal-beveled and intramuscular incisions were performed in the buccal aspect of teeth 14 to 24; in the distal of which releasing incisions were carried out; (b) a mucoperiosteal flap was elevated to expose the buccal aspect of alveolar bone; (c) the osteoplasty was initiated with groove creation to guide the amount of bone to be removed; (d) the grooves were then connected, respecting patient's anatomy, and the osteotomy was performed. Then, (e) the flaps were repositioned and sutured and (f) sutures were removed 5 days after surgery.

osteoplasty was extended, to improve gingival architecture. Surgical sequence of events described here was also performed

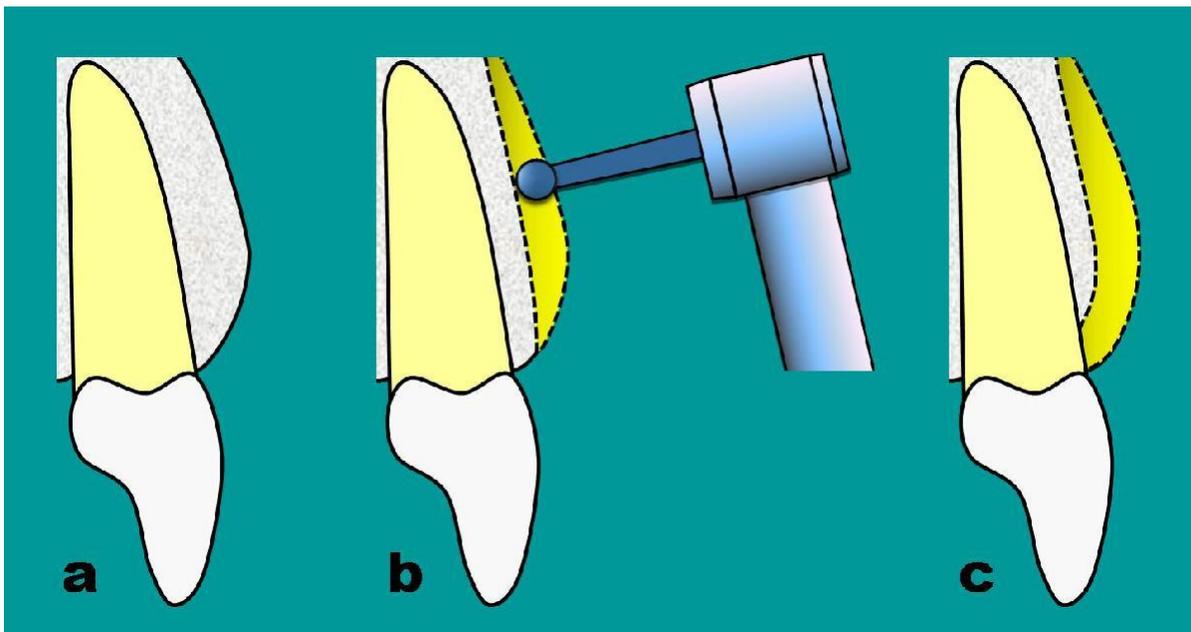
for the other patients and only the amount of bone removal varied. Initially, local anesthesia was given with 2% mepivacaine HCl with epinephrine 1: 100.000 (SEPTODONT, Saint-Maur des Fossés, France). Bleeding points were created in buccal aspect of the gingiva, corresponding to the height of cemento-enamel junction. An internally beveled incision was performed slightly coronally to the bleeding points (Figure 2a), which was followed by an intrasulcular incision, and then releasing incisions. A mucoperiosteal flap was raised (Figure 2b), and the tissue collar was removed. Then, osteoplasty was carried out under copious saline irrigation with the aid of a round diamond bur of gross granulation mounted in high-speed handpiece. Initially, in the interdental area, grooves were created to guide bone removal (Figure 2c). The grooves were linked maintaining an anatomic contour, so that the excess of bone tissue over the roots was removed, so that after the healing

process, the gingiva could follow this architecture. After that, osteotomy was performed in buccal aspect to lengthen the clinical crown (Figure 2d), with chisels and periodontal curettes. In this case, a distance of 1.0 to 1.5 mm was maintained between bone crest and cemento-enamel junction. The amount of bone removal varies to allow the maintenance of the height and contour of gingiva in harmony with normal pattern, with crestal bone level of the central incisors in an apical position in comparison to the lateral incisors, and at the level of the canines. In current case, special care was also taken to maintain at least a 1: 1 crown to root ratio. Finally, the flap was repositioned and sutured with continuous sling sutures (Figure 2e), which were removed 5 days after surgery (Figure 2f). Schematic drawings of the surgical procedures are presented in Figures 3 and 4.

Amoxicillin 500 mg, a capsule 3 times a day for 7 days starting 1 h before surgery was prescribed to the patient, along with anti-inflammatory piroxicam 20 mg, a tablet a day for 4 days starting 1 h



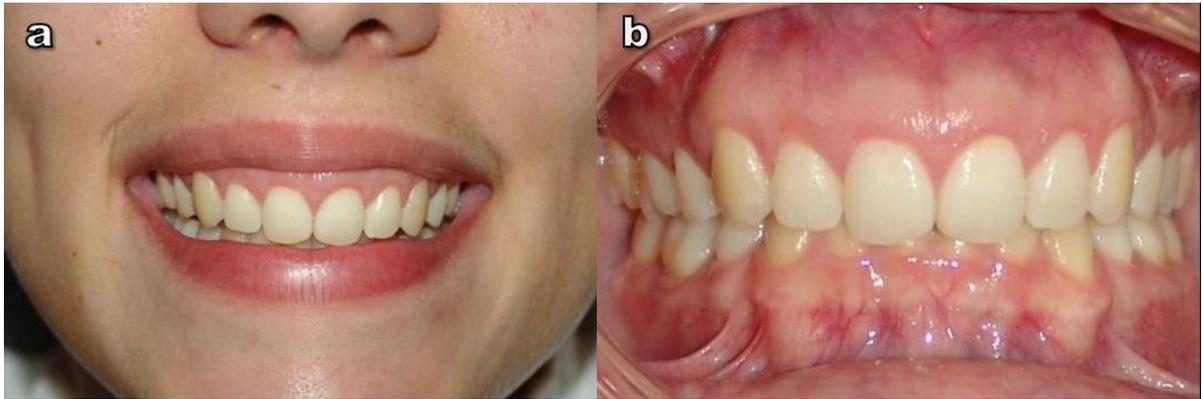
**Figure 3.** Schematic drawing of the surgery in a frontal view: (a) Grooves were surgically created in the interdental areas, and then (b) linked to remove the excess of bone. Final aspect after (c) osteoplasty, and (d) osteotomy.



**Figure 4.** Schematic drawing of the surgery in a lateral view, (a) previously and (b) after osteoplasty; and (c) after osteotomy.

before surgery; and mouth-rinse with 0.12% chlorhexidine digluconate solution for 1 min, twice a day for 7 days. Patient was

instructed on how to maintain the hygiene of the wound area, and was followed-up bi-weekly to motivate oral hygiene performance



**Figure 5.** Aspect of Case 1 (a) at smile, and (b) an intraoral view, 9 months after surgery.



**Figure 6.** Aspect of Case 2 (a) at baseline, and (b) 9 months after surgery. Note that lips were less tensioned in maximum smile.

up to the first month, monthly up to the third month, and finally recalled 9 months after surgery (Figure 5) for clinical evaluation.

### Case 2

A 24 year-old female (Figure 6) was presented with DPE. Osteotomy was performed to maintain crestal bone 2 to 3 mm apical to cemento-enamel junction, while osteoplasty was performed as previously described. Patient was followed-up for 9 months as previously described.

### Case 3

A 27-year-old female (Figure 7), presented with DPE was treated by means of osteotomy and osteoplasty as previously described. Osteotomy was performed to maintain crestal bone 2 to 3 mm apical to cemento-enamel junction. Patient was submitted to a provisional crown recontouring 6 months after surgery to close the diastemas, and was also followed-up for 9 months. Surgical procedures were well tolerated, and neither pain nor postoperative discomforts were reported.

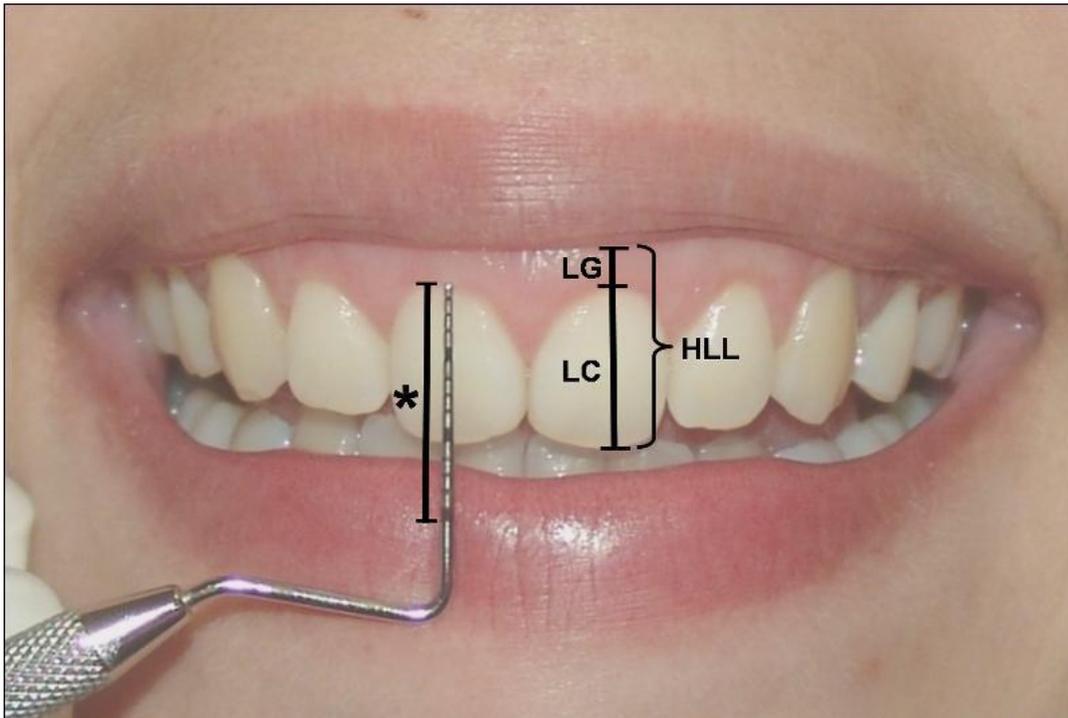
### Image assessment

Facial photographs in maximum smile were used for analysis (Strauss et al., 1997). As proposed by Peck et al. (1992), to reach the maximum smile, each subject was trained to achieve the same lip configuration at least twice successively before any photograph was taken. To analyze the photographs, appropriate software was used (IMAGEJ 1.34, National Institutes of Health, Bethesda, MA, USA). A vertical line was drawn in each tooth from 12 to 22, from the incisal border, passing through the zenith, up to the inferior border of the lip. The parameters corresponded to the height of the lip line (HLL), which was divided into the length of the crown (LC), and the length of gingiva (LG). To calibrate the images obtained in different periods, all values were transformed into a ratio, considering the length of periodontal probe in both photographs (Figure 8). Each measure was performed in triplicate, recorded at least one day apart, and their mean values were representative of each tooth. Mean values of all teeth were representative of the subject. The values were expressed in percentage.

One examiner (AEFP) performed all measurements, and intra-examiner reliability was determined by calculating the Spearman correlation coefficient (CC) between the first and second measure (CC = 0.998,  $p = 0.0000$ ), the second and third measure (CC =



**Figure 7.** Aspect of Case 3 (a) at baseline, and (b) 9 months after surgery. This patient had been submitted to crown recontouring 6 months after surgery.



**Figure 8.** Clinical measurements were performed considering the length of the crown (LC), length of the gingiva (LG) and the height of lip line (HLL). (\*) A periodontal probe was used as reference for calibration (Case 1 patient).

0.998,  $p = 0.0000$ ), and the first and third measure ( $CC = 0.998$ ,  $p = 0.0000$ ).

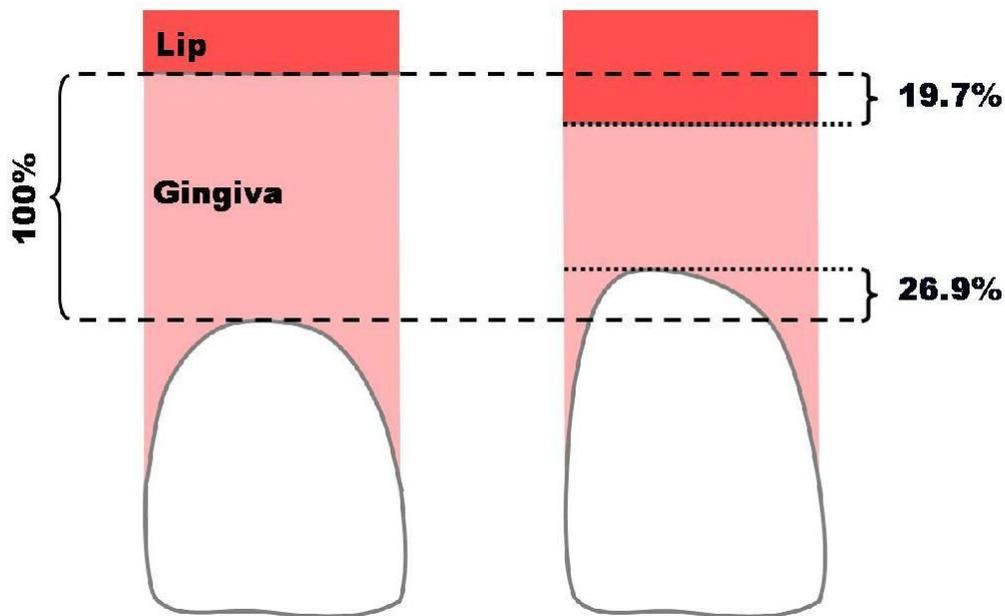
## RESULTS

Mean values from each patient at baseline and after surgery were presented in Table 1. Briefly, in comparison

with baseline, all patients presented lip dropping (mean HLL was reduced  $7.9 \pm 1.7\%$ ), increase in crown length (mean LC was increased  $18.2 \pm 2.7\%$ ), and a decrease in the gingival display (mean LG was reduced  $46.6 \pm 2.7\%$ ). On the other hand, considering specifically the decrease in gingival display,  $19.7 \pm 3.8\%$  of it was due to the amount of lip dropping, while  $26.9 \pm 1.2\%$  was due to the increase in crown length (Figure 9).

**Table 1.** Values in percentage, means and standard deviations (SD) of the length of the crown (LC), length of the gingiva (LG) and the height of lip line (HLL) at baseline and 9 months after, and their variation for each patient.

Case	Parameter	Baseline (%)	Final (%)	Variation (%)
1	LC	63.3	73.1	15.3
	LG	36.7	19.9	-45.7
	HLL	100.0	93.0	-7.0
2	LC	58.2	69.1	18.6
	LG	41.8	21.0	-49.7
	HLL	100.0	90.1	-9.9
3	LC	57.7	69.7	20.7
	LG	42.3	23.5	-44.4
	HLL	100.0	93.2	-6.8
Mean $\pm$ SD	LC	59.8 $\pm$ 3.1	70.6 $\pm$ 2.2	18.2 $\pm$ 2.7
	LG	40.2 $\pm$ 3.1	21.5 $\pm$ 1.8	-46.6 $\pm$ 2.7
	HLL	100.0 $\pm$ 0.0	92.1 $\pm$ 1.7	-7.9 $\pm$ 1.7



**Figure 9.** Schematic drawing (mean values in percentage) describing the role of lip drooping and crown lengthening in the reduction of gingival exposure at smiling. These values were calculated considering initial length of gingiva as 100%.

## DISCUSSION

In the current literature, the treatment of DPE involves clinical crown lengthening (Allen, 1988; Levine and

McGuire, 1997). However, a common observation in gummy smile case is the presence of a thick and irregular bone plate in the buccal aspect of anterior teeth, which tensions and displaces the lip to a more coronal position

during smile, increasing gingival exposure. Our clinical experience led us to give special attention to the removal of the excessive bone volume by means of an extended osteoplasty. This procedure focuses on the removal of bone thickness, and does not affect tooth support, thus, long-term injuries are not expected. It should also be considered that, for not being pathologic, gummy smile must be treated only if the patient is dissatisfied with his/her own appearance, as the proper diagnosis must always precede the choice for the best technique to be used.

The role of the extended osteoplasty in the height of the upper lip was more evident in Case 1, where osteotomy was minimal. Thus, although LC presented the smaller amount of increase (15.3%), there was an expressive reduction in gingival exposure (45.7%) and labial dropping (7.0%).

More expressive reduction in gingival exposure (49.7%) and labial dropping (9.9%) were observed in Case 2, because of the anatomic characteristic of the patient that presented the greatest amount of bone at baseline.

In its turn, Case 3 patient had been submitted to a provisional crown recontouring 6 months after surgery. The use of a restorative material in the incisal portion of the crowns may explain the greatest mean increase of LC observed among the patients (20.7%). With regard to the methodology used in the present study, the image of maximal smile was used for measurements because it was considered more reproducible than natural smile, particularly, in female subjects (Johnston et al., 2003). In addition, the assessment of the images was carried out as proposed by Peck et al. (1992), in whose study, the standard error of the upper lip line measurement at maximum smile was 0.18 mm, which could be considered clinically irrelevant. However, a randomized controlled clinical trial should be conducted to clarify the clinical benefits of this protocol.

## Conclusion

In conclusion, the completion of the surgical protocol proposed resulted in clinical crown increase and reduction of gingival exposure in the patients.

Furthermore, the upper lip slightly dropped and was less tensioned, which provided a more harmonic aspect to the patients. These results suggest that the technique presented is a useful resource for esthetic improvements in gummy smile patients.

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