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Patient's perceptions and self-esteem before and after periodontal surgery for altered passive eruption type 1B: 18-months follow-up

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Abstract

Objective: This study aimed to evaluate self-esteem and patient's satisfaction before and after surgical correction of altered passive eruption (APE) type 1B in the anterior maxilla, in a three and 18-months follow-up; and postoperative pain and discomfort.

Materials and Methods: Twelve individuals (mean age 23.3±4.2 years) were submitted to gingivoplasty, osteoplasty and osteotomy, and answered to questionnaires including the Visual Analog Scale (0-10).

Results: At baseline, patients expressed that esthetics, in general, had a high importance in their lives (8.0±1.3), as well as the smile esthetics (8.5±1.6). Self-esteem improved from baseline (3.6±2.4), compared to the 3rd (9.3±0.8) and 18th month (9.1±0.6) ($p<0.001$). Satisfaction with the smile increased from baseline (4.1±3.1) up to the 3rd (9.5±0.6) and 18th postoperative month (9.4±0.5) ($p=0.002$). At the 3rd day after surgery, pain decreased significantly (4.1±2.8 to 0.7±1.2, $p=0.001$) and discomfort remained mild (2.7±2.4 to 0.6±0.8, $p>0.05$). Correlation analysis revealed that the greater the aesthetic demand of the patient at baseline, the greater was the increase in self-esteem (correlation coefficient >0.9, $p<0.001$).

Conclusion: In the present study, surgical procedure led to an improvement in patient's self-esteem and satisfaction with the smile's aesthetics, which was maintained up to the 18th month of follow-up. Pain and discomfort reached a mild degree in the first three postoperative days.

Keywords: Periodontal surgery. Alveolar bone. Clinical trial. Gingiva. Periodontal healing.

Introduction

Smile is considered an important aesthetic reference, and anatomic characteristics that compromise its harmony play an important role in the dynamic appearance of the face (Garber and Salama, 1996). In Periodontology, excessive gingival display, also known as "gummy smile", may represent a common clinical challenge (Çetin *et al*., 2021), which requires from the clinician not only dedication to study the theoretical basis, but also to keep an open mind to try different materials and train varied techniques on mucogingival surgery to achieve successful clinical outcomes in medium and long terms.

Excessive gingival display is classified among the mucogingival deformities and conditions around teeth (Caton *et al*., 2018). Possible causes are lip hyperactivity, gingival enlargement, vertical maxillary excess, altered passive eruption (APE) or a combination of them (Ribeiro *et al*., 2012). The diagnosis is performed by evaluating the distance between the gingival margin and the apical border of the upper lip; and, usually, values from 3 to 4 mm have been used as the cut-off point (Allen, 1988; Geevarghese *et al*., 2019).

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Lip hyperactivity is caused by marked contraction of the elevator muscles of the upper lip, and procedures to restrain labial movement may be chosen, such as the injection of botulinum toxin, surgical muscle resection, or reduction of the oral vestibule by means of a lip repositioning maneuver (Dos Santo-Pereira *et al*., 2021). Gingival overgrowth may be caused by the use of specific medications, genetic factors or even be idiopathic, leading to an increase in soft tissue volume that requires control of local inflammation followed by soft tissue excision (American Academy of Periodontology, 2004). Vertical maxillary excess occurs when the lower third of the face is longer than the others, and its correction may demand orthodontic treatment and orthognathic surgery (Humayun *et al*., 2010). Finally, APE is characterized by changes during the passive phase of the eruption, causing a more coronal positioning of the gingival margin, beyond the cervical convexity of the crown (Mele *et al*., 2018). Clinical crowns are shortened, have a square shape, and gingival display may be excessive at smiling. Furthermore, according to Aghazada *et al*. (2020), individuals with APE are more likely to develop gingival inflammation and have impaired resolution, compared to individuals without APE. A plausible explanation is that the increased volume of the tissue is susceptible to constant and repeated local trauma, makes proper hygiene difficult, and creates a favorable environment for the development of periodontal pathogens (Pilloni *et al*., 2021).

Coslet *et al*. (1977) proposed a widely accepted classification for APE that guides the clinician to specifics treatment modalities. "Type 1" corresponds to periodontium with wide band of attached gingiva; "type 2", to narrow band of attached gingiva; subgroup "A" is attributed to cases in which the distance from the cementoenamel junction (CEJ) to the crestal bone (CB) is about 1.5 to 2 mm, leaving space for connective tissue attachment; and subgroup "B" is used when the CB is near or at CEJ level. Type 1B is the most frequent (Arenas and Jurado, 2019), and its correction is performed by means of periodontal surgery, combining gingivoplasty, osteoplasty and osteotomy. In a previous study, Ribeiro *et al*. (2004) described an extended osteoplasty technique to be used in these cases, which focused on the reduction of the buccal bone plate thickness, prioritizing the scalloped architecture of anterior maxilla. Furthermore, this reduction on the profile improves the accommodation of the upper lip, which becomes less tensioned during smile, and potentially improves aesthetics (Ribeiro *et al*., 2012).

The perception of the characteristics of a pleasant and attractive smile is not a consensus, not even between layperson and dental professionals (Tosun and Kaya, 2020), which justifies the conduction of patient-centered researches. Silva *et al*. (2015), Cairo *et al*. (2012) and Ribeiro *et al*. (2014) registered that six months after periodontal surgical correction of APE, patients reported improvement with the appearance and satisfaction with smile, although the type of APE included in those studies had not been specified. In a general manner, according to Mele *et al*. (2018) and Zucchelli *et al*. (2018), there is little documentation about the patient's view after surgical correction of APE. Therefore, to the best of our knowledge, only Andrade *et al*. (2022) investigated the degree of patient's self-esteem before and after periodontal surgery for APE, however, the follow-up period and classification of conditions were not clarified. Thus, this study was designed to evaluate self-esteem and patient's satisfaction before and after surgical correction of APE type 1B in the anterior maxilla, in a three and 18-months follow-up; and postoperative pain and discomfort, in a short-term period.

Materials and Methods

This prospective study was approved by the institutional Ethics Committee (Protocol #3.134.154) and was conducted in accordance with the Declaration of Helsinki of 1975, as revised in 2013. The sample consisted of all 12 patients diagnosed with APE who sought care at the Periodontics clinic, from July to December 2019, with chief complaint of gingival smile. No restrictions in terms of gender and socio-demographic (ethnicity, education and religion attendance) factors were attributed. They were invited to participate in the study, and to sign an Informed Consent Form, after having enough time to read it. A researcher was available for a verbal explanation about the procedures and the risks involved; and a witness was present at the time of signing. Patients were included according to the following inclusion criteria: (1) diagnosed with APE; (2) with gingival display of 3 mm or more at smile; and (3) age 18 years or older. Exclusion criteria were: (1) smokers patients; (2) pregnant and lactating women; (3) diagnosed with periodontitis; (4) antimicrobial or anti-inflammatory therapies during the previous two months; (5) previous mucogingival surgery at the region to be treated; (6) systemic conditions that could affect tissue healing (e. g., diabetes); and (7) use of orthodontic appliances.

Participants had a dental record filled with demographic, socioeconomic, history of general and oral health data. Self-reported skin color was registered, considering the following options: white, yellow, brown, black, other. And a questionnaire was applied with questions from Q1 to Q4 (Table 1). Questions were answered by making a cross on a 100 mm visual analog scale (VAS), as previously described by Spin-Neto *et al*. (2014). The end points of the scale for Q1 and Q2 were "least important" and "most important"; and for Q3 and Q4 were "worst possible" and "better possible".

Clinical measurements were performed at baseline, with reference to teeth #13 to #23. Values were assessed at mesio-buccal, buccal, disto-buccal,

Table 1. Questions applied to the patients.

(Q1) How important is the aesthetics in your life?
(Q2) How important is the aesthetics of the smile in your life?
(Q3) How is your self-esteem?
(Q4) How satisfied are you with the look of your smile?
Pain
(Q5) Did you feel pain after surgery?
(Q6) How was the pain on the day of the surgery?
(Q7) How was the pain on the first day after surgery?
(Q8) How was the pain on the second day after surgery?
(Q9) How was the pain on the third day after surgery?
Discomfort
(Q10) Did you feel discomfort after surgery?
(Q11) If yes, what did you feel?
(Q12) How was the discomfort on the day of surgery?
(Q13) How was the discomfort on the first day after surgery?
(Q14) How was the discomfort on the second day after surgery?
(Q15) How was the discomfort on the third day after surgery?
Additional information
(Q16) Did you take any medication in addition to the prescription?
(Q17) If yes, which one and for how long?
(Q18) Were you unable to work?
(Q19) If yes, for how many days?
(Q20) Did you need any additional treatment due to surgical complications?
(Q21) Did the surgery change your self-esteem?
(Q22) Considering the experience (surgery, postoperative period and result), would you choose to undergo the procedure again?
(Q23) Would you recommend this procedure to someone with a similar problem?

mesio-palatal, palatal, and disto-palatal surfaces, using a North Carolina periodontal probe (Hu-friedy Mfg. Co., Chicago, IL, USA) with regard to the following parameters: Plaque index (PI) (Ainamo and Bay, 1975), Gingival index (GI) (Ainamo and Bay, 1975), Probing Depth (PD), Clinical Attachment Level (CAL), Bleeding on Probing (BOP) (Mühlemann and Son, 1971), Suppuration, and Mobility (Miller, 1950). Gingival phenotype (De Rouck *et al*., 2009) and type of APE (Coslet *et al*., 1977) were evaluated on the most buccal aspect of the anterior maxillary teeth.

According to the needs of each patient, as part of the treatment plan, training in oral hygiene, and meticulous periodontal scaling and planing were carried out (American Academy of Periodontology, 2011). Patients were considered able to be operated when they reached less than 10% bleeding sites (Chapple *et al*., 2018). The surgical procedure was performed as previously described by Ribeiro *et al*. (2012), starting with extraoral antisepsis with 2% chlorhexidine, and intraoral antisepsis with 0.12% chlorhexidine. Infiltrative anesthesia was performed bilaterally from teeth #14 to 24, with injection of 4% articaine hydrochloride with 1:100,000 epinephrine. Bleeding points were created in the buccal aspect of gingiva, corresponding to the height of CEJ evaluated at probing. The first incision performed was an internal bevel incision (Fig. 1) extending between the distal surface of teeth #13 to #23; the bleeding points were used as reference, introducing the blade slightly coronal to it, in an approximate angle of 45 degrees. The final shape of the incision should respect the anatomical characteristics of the patient, seeking to achieve a scalloped contour, and to balance the height of gingival margin form central incisors and canines, maintaining lateral incisors approximately 1 mm more coronal. A number 3 scalpel was used to mount a 15c scalpel blade, which was repeatedly changed whenever the operator noticed the loss of the cutting ability. The pressure exerted on the soft tissue was enough to gently touch the bone, forming a precise, sharp cut line; and the tip of a McCall curette was passed through the incisions, to disrupt remaining periosteal fibers. A second incision was performed, of sulcular type, extended between the distal site of teeth #14 to #24. The gingival collar band was removed with a McCall periodontal curette, and the mucoperiosteal flap was gently elevated using a sharp #9 Molt periosteal elevator, to avoid soft tissue tearing and maintain the integrity of the periosteum. Eventually, a gauze was pushed to help detaching the periosteum. An extended osteoplasty was performed by initially creating verticals grooves to guide bone removal, in the buccal bone plate, corresponding to each interdental area. For this, a 3017HL diamond bur mounted on a high-speed handpiece was used under abundant irrigation with sterile saline solution. These grooves were linked by carving a scalloped shape in the bone, so that after healing, the gingiva could follow this architecture. Then, for osteotomy, Ochseinbein microchisels were also used to establish a distance of approximately 2 mm between CEJ and CB on the buccal site, seeking to ensure harmony in the bone contour as a whole. The height of interproximal bone was not altered, to prevent the occurrence of postoperative papilla loss. Flap was repositioned, and a wet gauze compression was made in the area. The suture performed was continuous, using 4.0 nylon thread, in a combination of vertical and horizontal mattress sutures, as described in Figure 2. Special care was taken to insert the needle perpendicular to the tissue (Fig. 3), and to accommodate the tip of the papilla under the suture thread. Finally, surgical periodontal dressing without eugenol was placed. Patients were given postoperative written instructions, suggesting the ingestion of cold and soft food on the first days following surgery. All patients were instructed on oral hygiene, and to use intraoral rinse (0.12% chlorhexidine gluconate, every 12 hours, for seven days). Patients were prescribed antibiotics (500 mg amoxicillin, every eight hours, for seven days), anti-inflammatory (100 mg nimesulide, every 12 hours, for three days) and analgesic (500 mg dipyrone sodium, every six hours on the first two days after surgery, in case of pain). They were told to contact the researchers to solve any further doubts. Sutures and periodontal dressing were removed in the seventh day after surgery.

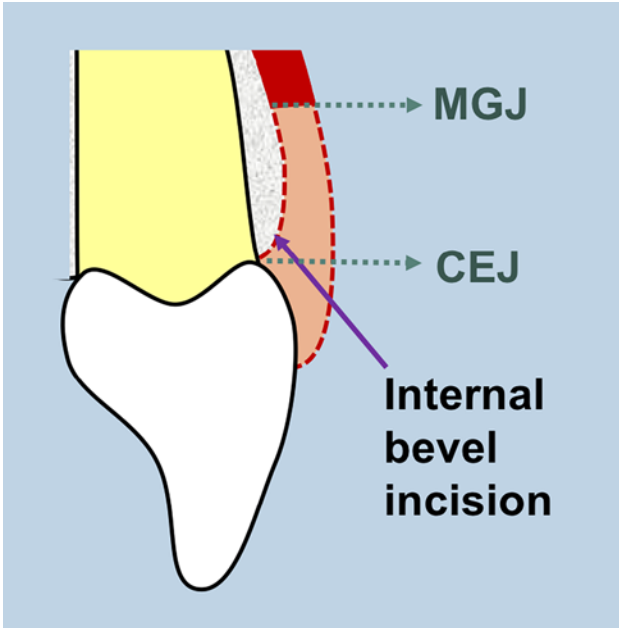

Figure 1. In the internal bevel incision, the scalpel blade was inserted at an angle of approximately 45° and slightly coronal to the cementoenamel junction (CEJ). Note the position of mucogingival junction (MGJ) delimiting a wide attached gingiva.

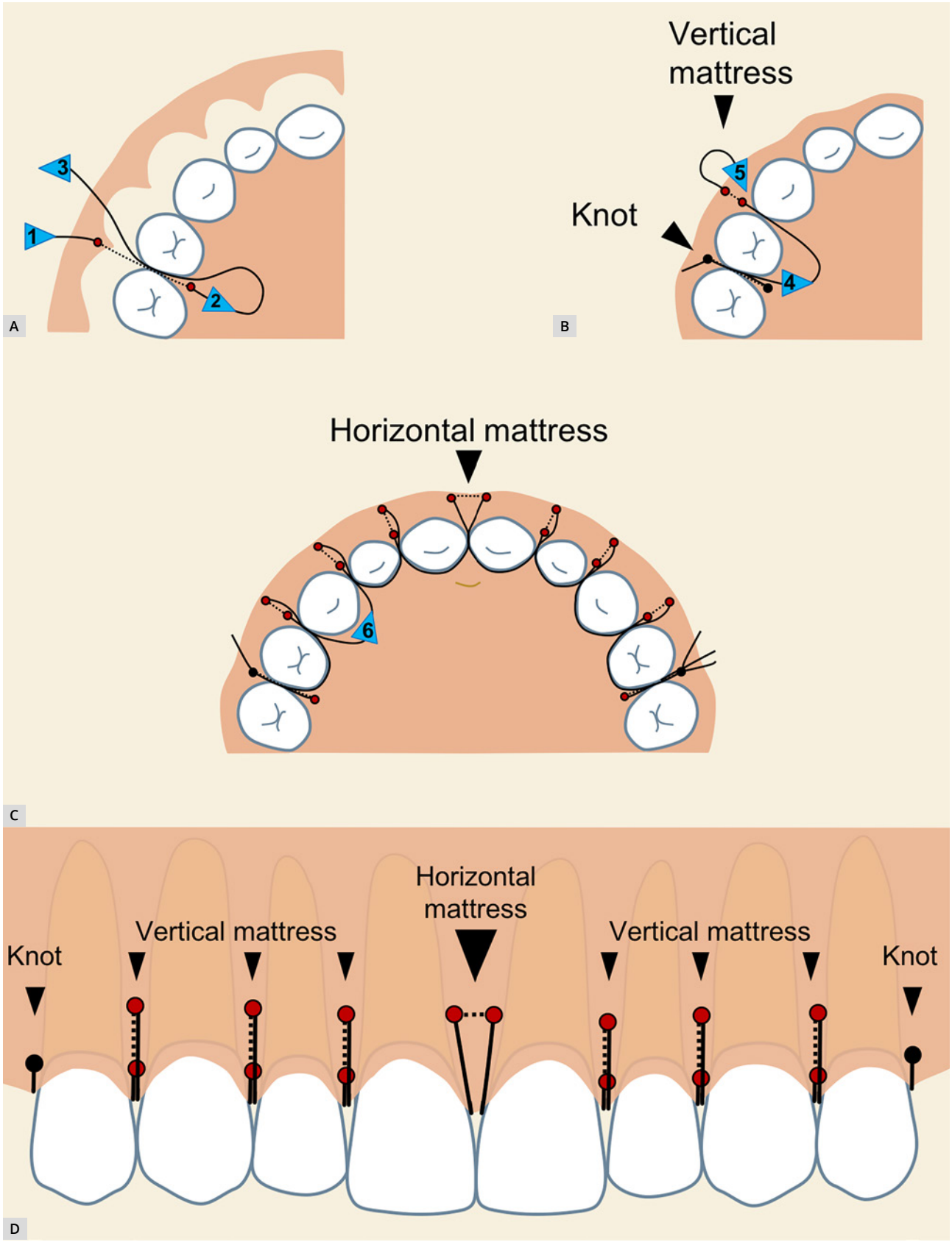

Figure 2. Continuous suture sequence, starting with (A) a knot on the distal site of tooth #14. (B) Vertical and (C) horizontal mattress sutures were performed. (D) The suture was completed with another knot at the distal site of tooth #24.

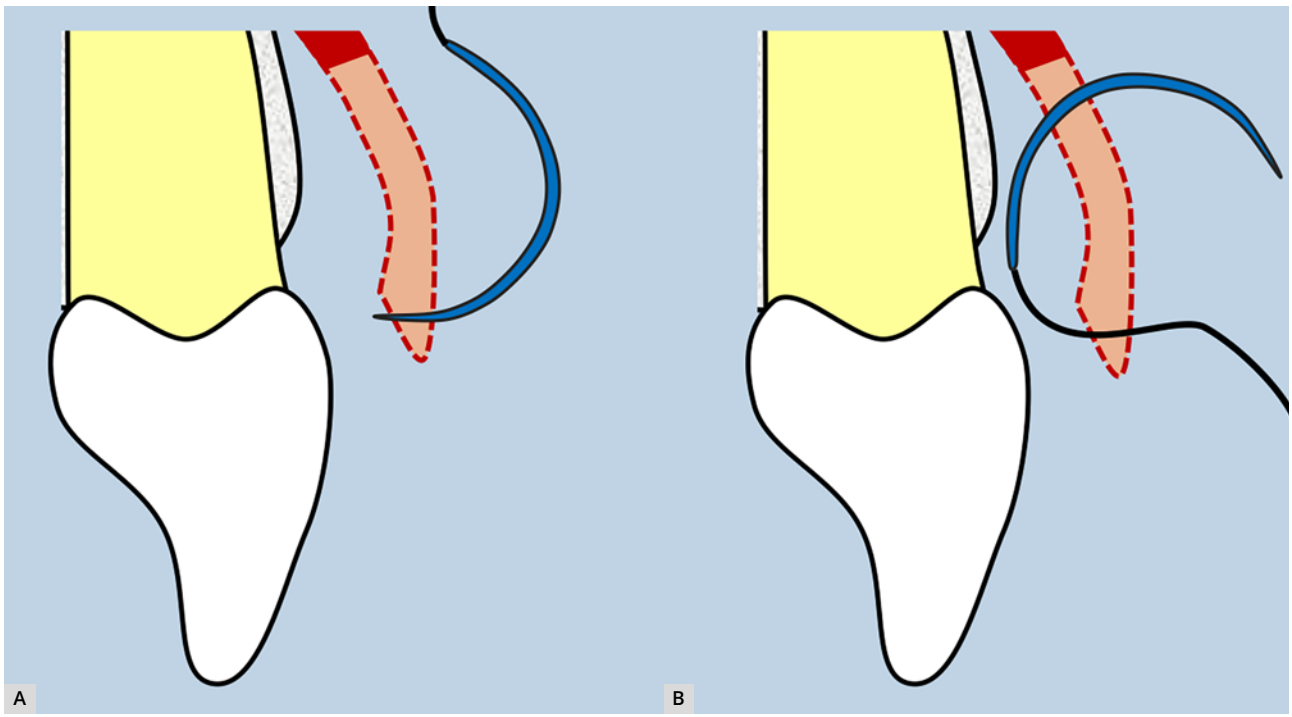

Figure 3. Detail of the vertical mattress suture, where (A) the needle was inserted in a coronal position of the flap, and (B) leaves the flap in a more apical position.

Assessment of the patient's perception of pain and discomfort was made by using another questionnaire applied to all patients, which was given to the patients on the day of the surgery, and they were asked to fill it in every evening, considering the worst score of the day for each question. Questions Q5 to Q20 were included (Table 1). Questions Q5, Q10, Q16, Q18 and Q20 demanded a dichotomous answer ("Yes" / "No"). Questions Q11, Q17 and Q19 accepted a short answer. Questions Q6 to Q9, and Q12 to Q15 were answered by using the VAS. In these cases, the endpoints of the scale were "No discomfort" or No pain" in one side, and "Worst possible" in the other side.

Follow-up recall appointments (Fig. 4) were performed 3 and 18 months after surgery, when a shorter questionnaire was applied, repeating questions Q3, Q4, and including questions Q21, Q22, and Q23, which demanded a dichotomous answer ("Yes" / "No").

Minimum sample size was calculated on 12 patients, by using an online calculator for paired *t*-test (*http://calculoamostral.bauru.usp.br/calculoamostral/calculos.php*). The sample size was based on a previous study (Andrade *et al.*, 2022) considering VAS values from self-esteem as the primary outcome parameter (standard deviation of the difference was 1.66), the significance level was set at 5 %, power of 80%, design effect of 2, and effect size of 1.75.

Figure 4. Clinical aspect of the patient's smile. (A) At baseline, note gingival exposure and short clinical crowns. (B) At 3 months follow-up after surgery.

Data analysis was performed using a specific program (Jamovi, Sydney, Australia). All clinical evaluations were performed by the same experienced and trained examiner (A.E.F.P.), with intra-examiner reliability assessed by calculating the standard error (0.42 mm) and Spearman's correlation coefficient (0.90), considering the CAL measure. All questionnaire applications were made by the same trained researcher (S.C.A.R.). The interpretation of the results was made using a ruler positioned close to the line, and the corresponding value in centimeters was registered. The intensity of sensation was classified according to McCaffery and Beebe (1993).

The null hypothesis was based on the absence of difference between the periods of data collection (alpha = 5%). The unit of analysis was the patient. The experimental data were submitted to the Shapiro-Wilk normality test, those with normal distribution were analyzed by the ANOVA tests, followed by the *post-hoc* Bonferroni test, *t*-test and Pearson's correlation. Data with non-normal distribution were analyzed using Friedman tests, followed by Durbin-Conover *post-hoc* test, Wilcoxon test and Spearman's correlation. Values were presented as mean and standard deviation.

Results

None of the participants were excluded or dropped out of the study. Twelve patients (n = 12) (Table 2) were included and returned to all the recalls (ten women and two men), aged between 18 and 32 years (mean age 23.3 ± 4.2 years); four patients had reported being white skinned; four, black skinned; three, brown skinned, and one, yellow skinned. Among the patients, ten were from the same city, and the others were from neighboring cities, in the same geographic region. All patients had thick and flat periodontal phenotype, APE classification type 1B, and were considered to have high aesthetic demand, based on the values attributed to questions about the importance of aesthetic on their lives (8.0 ± 1.3), as well as for the importance of the appearance of their smile (8.5 ± 1.6). Periogram data collected before and after non-surgical periodontal treatment, thus, before surgery, is presented in Table 3. Gingival health was established in all patients before they underwent surgery.

After the surgical procedure, there was no loosening of periodontal dressing or breaking of any sutures. There was a significant increase on the values of self-esteem (Table 4), with values rising from 3.6 ± 2.4, at baseline, to 9.3 ± 0.8 at 3 months, and then to 9.1 ± 0.6 at 18 months ($p < 0.001$, Friedman test). Considering the satisfaction with the aesthetics of the smile, there was also a significant improvement, from 4.1 ± 3.1, at baseline, to 9.5 ± 0.6 at 3 months, and then to 9.4 ± 0.5 at 18 months ($p = 0.002$, Friedman test). All twelve patients (100%) reported increased self-esteem as a result of the surgical intervention (Table 5).

Considering postoperative pain, the values detected on the third day after surgery (0.7 ± 1.2) were significantly lower than on the day of the surgery (4.1 ± 2.8) and on the first postoperative day (3.7 ± 2.5) ($p = 0.001$, Friedman test). Nine patients (75.0%) reported that they felt pain, and the intensity ranged from severe to mild. Regarding discomfort, there was no significant change in values over the first three days ($p > 0.05$, Friedman test). Nine patients (75.0%) reported discomfort after surgery. The description of the sensation that corresponded to Q11 was as following: three patients reported the occurrence of "swelling", three patients registered "swelling and bleeding", one patient reported "bleeding", one reported "pain

Table 2. Characteristics of the sample (n = 12).

Patients	Gender	Self-reported skin color	Age (years)	Importance of Aesthetics (Q1)*	Importance of the Aesthetics of the Smile (Q2)*
1	Female	Yellow	18	9.7	9.7
2	Male	Black	21	5.8	3.7
3	Female	White	21	6.9	9.4
4	Female	White	18	8.5	9.1
5	Female	White	24	10.0	8.3
6	Female	Brown	22	8.9	9.1
7	Female	Black	29	6.1	9.5
8	Female	Black	22	8.1	8.0
9	Female	Brown	28	9.3	9.3
10	Male	White	32	7.4	8.5
11	Female	Brown	24	7.5	9.7
12	Female	Black	20	8.3	7.4
Mean ± SD			23.3 ± 4.2	8.5 ± 1.6	8.0 ± 1.3

* Assessed by the Visual Analog Scale (range 0-10).

Table 3. Patients' periodontal data (mean ± SD) before and after non-surgical periodontal treatment (n = 12).

Parameter	Before	After	***p*-value**
PI (% of positive sites)	3.7 ± 12.8	0.8 ± 1.3	NS
GI (% of positive sites)	8.8 ± 11.2	2.7 ± 2.7	NS
BOP (% of positive sites)	20.8 ± 29.9	1.7 ± 1.7	0.04
PD (mm)	2.0 ± 0.7	2.1 ± 0.5	NS
CAL (mm)	0.1 ± 0.1	0.1 ± 0.2	NS
Suppuration (% of positive sites)	0.0 ± 0.0	0.0 ± 0.0	NS
Mobility (% of positive sites)	0.0 ± 0.0	0.0 ± 0.0	NS

Identical letters represent a statistically relevant difference ($p < 0.05$, Wilcoxon test). NS = Non-significant.

Table 4. Mean values and standard deviation (SD) of the scores of the Visual Analog Scale concerning self-esteem, satisfaction, pain, and discomfort (n = 12).

Parameter	**Period**	**Mean ± SD**	***p*-value**
Self esteem	(Q3) Baseline	3.6 ± 2.4[a,b]	<0.001
	(Q3) 3 months after	9.3 ± 0.8[a]	
	(Q3) 18 months after	9.1 ± 0.6[b]	
Satisfaction with smile	(Q4) Baseline	4.1 ± 3.1[c,d]	0.002
	(Q4) 3 months after	9.5 ± 0.6[c]	
	(Q4) 18 months after	9.4 ± 0.5[d]	
Pain	(Q6) On the day of the surgery	4.1 ± 2.8[e]	0.001
	(Q7) 1st day after	3.7 ± 2.5[f]	
	(Q8) 2nd day after	1.7 ± 1.9	
	(Q9) 3rd day after	0.7 ± 1.2[e,f]	
Discomfort	(Q12) On the day of the surgery	2.7 ± 2.4	NS
	(Q13) 1st day after	2.6 ± 1.9	
	(Q14) 2nd day after	1.5 ± 1.7	
	(Q15) 3rd day after	0.6 ± 0.8	

Identical letters represent a statistically relevant difference ($p < 0.05$, Wilcoxon test). NS = Non-significant.

Table 5. Frequency distribution of positive answers to dichotomous questions (n = 12).

Parameter	**Period**	**n (%)**
(Q5) Did you feel pain after surgery?	Up to the 3rd day after surgery	9 (75.0)
(Q10) Did you feel discomfort after surgery?		9 (75.0)
(Q16) Did you take any medication addition to the prescription?		3 (25.0)
(Q18) Were you unable to work?		8 (66.7)
(Q20) Did you need any additional treatment due to surgical complication?		0 (0.0)
(Q21) Did the surgery change your self-esteem?	3 months	12 (100.0)
(Q22) Considering the experience (surgery, postoperative period and result), would you choose to undergo the procedure again?		12 (100.0)
(Q23) Would you recommend this procedure to someone with a similar problem?		12 (100.0)
(Q21) Did the surgery change your self-esteem?	18 months	12 (100.0)
(Q22) Considering the experience (surgery, postoperative period and result), would you choose to undergo the procedure again?		12 (100.0)
(Q23) Would you recommend this procedure to someone with a similar problem?		12 (100.0)

internally at the nose", and one registered "discomfort due to periodontal dressing". In a general manner, the intensity of discomfort ranged from severe to mild. Three patients (25.0 %) took additional analgesic up to the third day after surgery (Q17). Eight patients (66.7%) were unable to work and rested at home for one day (Q19); while none (0.0%) sought professional follow-up due to post-surgical complications. All patients reported that would choose to undergo the procedure again and would recommend it to someone with a similar problem (100%).

Results concerning the correlation analysis are presented in Table 6. The greater the aesthetic demand of the patient registered at baseline (Q1 and Q2), the greater the increase in self-esteem at the 18th month follow-up (correlation coefficients of 0.90 and 0.90, respectively). Considering smile satisfaction, the same tendency was observed, with very strong correlations for questions Q1 and Q2 (correlation coefficients of 0.96 and 0.94, respectively). Other strong correlations were found for self-esteem.

Table 6. Correlation between the aesthetic demand and data collected for the Satisfaction with smile and Self-esteem (n = 12).

Parameter	Period	Correlation	Importance of Aesthetics (Q1)	Importance of the Aesthetics of the Smile (Q2)
Self-esteem (Q3)	Baseline	Coefficient "p" value	0.73** 0.01	0.73** 0.01
	3 months	Coefficient "p" value	0.62** 0.03	0.62** 0.03
	18 months	Coefficient "p" value	ns	ns
	Δ 3 months	Coefficient "p" value	ns	0.73** 0.01
	Δ 18 months	Coefficient "p" value	0.90* <0.001	0.90** <0.001
Satisfaction with smile (Q4)	Baseline	Coefficient "p" value	ns	ns
	3 months	Coefficient "p" value	ns	ns
	18 months	Coefficient "p" value	ns	ns
	Δ 3 months	Coefficient "p" value	ns	ns
	Δ 18 months	Coefficient "p" value	0.96* <0.001	0.94** <0.001

* Pearson's Correlation. ** Spearman's Correlation.

Discussion

During smile, excessive exposure of the gingiva causes different sensations in the observer. Current literature reveals that this condition not only compromises the individual's attractiveness (Tosun and Kaya, 2020), but also increases dissatisfaction with the appearance and minimize the quality of life of affected patients (Antoniazzi *et al*., 2017). More specifically, in cases where excessive gingival exposure is caused by APE, an additional component is present, which is the disproportion of the height and width of clinical crowns, because they tend to be shortened, negatively affecting social parameters as attractiveness, the impression that the individual is friendly, trustworthy, intelligent and even self-confident (Malkinson *et al*., 2013).

In the present study, the sample tended to have uniform characteristics. Patients had high complaints of aesthetic impairment, they were all diagnosed with gummy smile, and classified as APE type 1B. Considering their life expectancy and the patterns of periodontium aging processes (Lamster *et al*., 2016), it was decided to plan an efficient but also very delicate tissue manipulation. Alpiste-Illueca (2012) pointed out that teeth with APE have a thicker buccal bone plate, and for this reason, the extended osteoplasty was conducted (Ribeiro *et al*., 2012) to rebuild local architecture. This maneuver contributed to reduce about 20% of the patient's gingival exposure, and softened the tension suffered from lip during smile.

Concerning the osteotomy, Mele *et al*. (2018) reported that there is no consensus on the ideal measurement to be established between the CEJ and the CB. Considering the young age of the participants, it was decided to choose 2 mm as ideal for most sites, respecting those well-known periodontal dimension (Gargiulo *et al*., 1961; Alpiste-Illueca, 2012). But surely, depending on the anatomical characteristics of the patient, it could vary, as long as the harmony of the architecture was achieved as a whole. Another point to be discussed is the final height of the flap. Also, there is no consensus on this issue (Mele *et al*., 2018), and in the present study, it was opted to keep the flap at least 1 mm coronal to the CEJ, to prevent from postoperative gingival recessions.

The choice of suture design was another focus of attention during the designing of this study. The distribution of the tension of the thread along the flap was prioritized, avoiding the concentration of forces on the papilla, and controlling the tension exerted by the labial frenulum; for this reason, the vertical mattress technique was chosen in most sites, and the horizontal mattress suture was performed in the area of the labial frenum, between the central incisors. The option for a continuous suture technique was made based not only on the efficiency of the use of surgical time and the amount of material (Fayyaz *et al*., 2018); but also, on the operator's personal preference and expertise. Thus, the procedure was streamlined, avoiding frequent stops for cutting the thread and minimizing tissue suffering. No breakage or loosening of the thread or periodontal dressing was observed up to the seventh day at the recall appointment.

By means of the analysis of the questionnaires applied to the patients, it was found that the choice of surgical technique resulted in moderate postoperative pain (4.1 ± 2.8) on the day of surgery, which continuously and significantly reduced until the third day (0.7 ± 1.2). This pattern was compatible with the previous study from Andrade *et al.* (2022), in which young adult patients with a mean age of 25.6 ± 7.6 years were also operated; whose pain score (6.5 ± 1.6) significantly reduced up to the third postoperative day (2.6 ± 1.8). In the investigation by Koppolu *et al*. (2017) patients diagnosed with type 1A APE were operated, that is, without indication of bone resection, only gingivectomy with external bevel. In such a scenario, moderate pain was found on the day of surgery (5.06 ± 0.51), which reduced to mild on the third day (1.98 ± 0.33). In the study from Ribeiro *et al*. (2014), 28 patients were operated, with a mean age of 27.5 ± 5.8 years, diagnosed with APE. The anterior maxilla was divided into two groups, one side being randomly assigned to crown augmentation surgery with gingival and bone resection with a closed flap, and the other side with the flap opened. In these latter patients, pain was assessed using the VAS, considering a range from 0 to 100, and it was considered mild (14.2 ± 24.2) immediately after surgery, and remained like this up to the second application of the questionnaire, seven days later (18.6 ± 24.5). This inconsistency, which refers to low values on the day of surgery, can be explained by the moment when the questionnaire was applied, and it may be hypothesized that intraoperative anesthesia may have masked the initial values. Finally, in the investigation by Silva *et al*. (2015), 22 patients with a mean age of 23.1 ± 2.9 years, diagnosed with APE, were treated by means of gingival and bone resection; and the questionnaire was applied seven days later, when four patients (18%) reported pain during the first postoperative week, and none reported pain in the 15-day follow-up.

As for discomfort, the intensity was considered mild on the day of surgery (2.7 ± 2.4) and tended to decrease (0.6 ± 0.8) until the third day. Additionally, there were reports of swelling (50%), bleeding (33%), internal pain in the nose (12%), and discomfort with periodontal dressing (12%). VAS scores were slightly lower than those reported by Andrade *et al.* (2022), in which the initial discomfort was severe (7.8 ± 1.6), and significantly reduced up to the third day, when it reached a moderate level (3.6 ± 1.7). In the study from Silva *et al*. (2015), the percentage of positive responses was calculated, and in the first week, swelling (64%), slight bleeding (32%, up to the third day), discomfort with the sutures (23%), numbness in the operated area (9%) and sensitive teeth (5%) were reported; and in the second week, the complaints referred to slight bleeding (9%), sensitive teeth (9%), and slight numbness (5%).

A relevant point of discussion here is the patients' self-esteem. The values found in the present study increased significantly over the experimental period, from 3.6 ± 2.4 to 9.3 ± 0.8 at 3 months, and 9.1 ± 0.6 at 18 months. In the study by Andrade *et al.* (2022), this same trend was observed, with the mean values beginning on 4.0 ± 1.5 and achieving to 9.7 ± 0.6. There is a lack of studies in the literature that focus on this analysis.

Satisfaction with the aesthetics of smile was investigated in the present study (4.1 ± 3.1 at baseline), and values increased in a statistically significant way up to third (9.5 ± 0.6) and 18th month (9.4 ± 0.5). This finding agrees with Andrade *et al.* (2022), in whose study satisfaction with aesthetics ranged from 2.3 ± 0.9 to 9.4 ± 1.1. Another assessment tool was used by Silva *et al*. (2015), the Likert scale, graduated in five levels. In their study, at baseline, the most marked option corresponded to the second level, "slightly dissatisfied" (68%), while in the 6-month postoperative period, the most present was the fourth level, "very satisfied" (41%). Cairo *et al*. (2012) performed a study in which 11 individuals (mean age of 24.9 ± 6.5 years) diagnosed with APE participated. They were treated with gingival and bone resection surgery, and six months later the patients reported satisfaction with the final outcome, registering a mean VAS

score of 86.6 (ranging from 0 to 100). By using the same scale, Ribeiro *et al*. (2014) reported an mean improvement with appearance of 86.4 ± 16.2 at seven days; and 85.0 ± 18.8 at six months after surgery.

With the correlation analysis performed in the present study, another unpublished information came out. It was observed that the patient demandingness reflects the degree of satisfaction achieved. This information is important to be considered while interpreting the results of patient-centered researches, because if the participants are not concerned about aesthetics, the results indicated by the assessment tools may have low values, not because of the ineffectiveness of the treatment, but due to the low importance given by the patient to that intervention.

Finally, as suggestion for future studies, randomized controlled trials should be carried out, by comparing different incision and suture techniques, since understanding these factors is important in tissue remodeling, and that they can affect the long term success and results stability (Domínguez *et al*., 2020). In addition, it is suggested to investigate the perception of patients regarding their quality of life before and after periodontal surgeries in the APE treatment (McGuire *et al*., 2014). Within the limits of this study, it could be concluded that surgical procedure led to an improvement in patient's satisfaction with self-esteem and with the esthetics of the smile, which was maintained up to the 18th month of follow-up. Pain and discomfort reached a mild degree in the first three postoperative days.

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