

# **ROOT COVERAGE BY MODIFIED CORONALLY ADVANCED TUNNEL, PALATAL CONNECTI- VE TISSUE GRAFT AND LASER PHOTOBIMO- DULATION TO IMPRO- VE TISSUE RAPAIR: A 3 YEARS CLINICAL FOLLOW-UP**

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**Abstract:** The gingival recessions are characterized by the loss of periodontal insertion with the migration of the gingival merger towards the apex, having as reference the amelo-cement junction. The most frequent causes of gingival retractions are: mechanical trauma from tooth brushing, slim periodontal phenotype, orthodontic treatment, cervical restorations, periodontal disease and occlusal trauma. The more efficient management for the resolution of the retractions is given by the periodontal surgery with the interposition of connective gingival tissue collected from other areas of the buccal cavity. One of the greatest allies in dental post-surgeries (e.g. periodontal intervention) is the laser therapy applied to stimulate and accelerate the repair process. Thus, this article aims to present a clinical trial of a 25-year-old, caucasian, female patient with gingival recession in the region of the #13 (upper right canine) with aesthetic and functional demands. The surgical treatment applied was made through the modified coronally advanced envelop flap associated to a connective tissue graft removed from the palate, with photobiomodulation with low power laser to improve tissue repair. Results were satisfying) in the immediate post surgery, having in mind not only the patient's aesthetic satisfaction, but, most importantly, the cessation of pain. Therefore, it was possible to conclude the case was successful, regarding its stability, proven by a 3 years follow-up.

**Keywords:** Modified Coronally Advanced Tunnel; Subepithelial Connective Tissue Graft; Aesthetics; Gingival Recession; Guided Tissue Regeneration, LLLT; Lasers.

## **INTRODUCTION**

The gingival recessions are characterized by the loss of periodontal insertion with the migration of the gingival merger towards the apex, having as reference the amelo-cementary junction. Prevalence in population studies in

Brazil varies between 22% for  $\geq 5\text{mm}$  to 51% for  $\geq 3\text{ mm}$  recessions<sup>1</sup>. World data identified even higher prevalence and that close to 54% of young individuals showing at least one tooth element with gingival recession and 100% of adults showing at least 1mm of buccal insertion loss in one tooth<sup>2</sup>.

The main etiological factors considered contributors for the development of gingival recessions are tooth brush mechanical trauma, the slim periodontal phenotype, orthodontic treatment, cervical restorations, periodontal disease and occlusal trauma<sup>3</sup>. Even individuals with good oral hygiene conditions may develop recession's progressions if there isn't any intervention<sup>4</sup>.

Many surgical periodontal procedures have been proposed as alternatives for the treatment of buccal insertions losses, aiming aesthetics improvement, control of dentin hypersensitivity, and mainly, changes on the periodontal phenotype, easing, in this manner, the biofilm control and preventing a new collapse of the periodontal tissues<sup>5</sup>. The scientific evidences show that, in the long term, the treatment is important to recover the root's exposed surface and to enhance the periodontal phenotype, stabilizing the gingival merger and minimalizing the recurrence of cervical recession<sup>6-7</sup>. Many dental root coverage techniques have been proposed through the years, being, so far, the coronal reposition flap techniques with connective tissue grafts and enamel matrix derivatives, considered a gold standard<sup>8-9</sup>.

To reach more predictable aesthetics results, root covering procedures which aim for the preservation of papillae have reached more consistent clinical results, when both objectives (root coverage and regeneration therapy) are aimed<sup>10</sup>. The first surgical technique using an "envelope" with adjacent papillae preservation was proposed by Ratzke (1985), which used incisions that reminded an

envelope in split flap, allowing the insertion of connective tissue under this envelope<sup>11</sup>. Afterwards, the envelope technique was developed in multiple recessions cases, with a delicate papillae elevation (without its breaking), to allow better tissue mobility towards the crown, appearing the term "tunnelization"<sup>12</sup>. The modified tunnelization technique, with crown directional reposition, or modified envelope, was proposed as a periodontal microsurgery technique where a separation of the periodontal tissues in the form of a mucoperiosteal envelope, with a delicate elevation of the interdental papillae, moving these tissues from the periosteum or the subjacent alveolar bone is made. For the stabilization and immobilization of the flap and/or the connective tissue graft in crown directed positions, suspensory sutures are executed to guarantee the final periodontal tissues repositioning and the root's coverage<sup>13-17</sup>. The modified envelope technique presents important advantages such as: a) greater blood supply, which favors graft nutrition and promotes repair acceleration; b) lowered post-surgical morbidity, due to the limitation on the flap's elevation<sup>18</sup>. It is understandable, yet, that the literature points to a consent about the usage of connective tissue grafts on gingival retraction cases, demonstrating positive results about root's coverage, but even more on the improvement of the periodontal phenotype obtained<sup>19</sup>.

In comparative studies related to root coverage techniques and obtained results, two systematic reviews with meta-analysis comparing clinical trials, direct and indirectly, showed that there are no differences between coronal flap repositioning technique and modified envelope technique, showing also better aesthetics results and less morbidity with the modified envelope technique associated with connective tissue grafts and enamel matrix derivatives<sup>20-21</sup>. Sculean et al.

(2016), demonstrate that modified envelope technique, with connective tissue graft and enamel matrix derivatives, was effective in obtaining the root coverage (96%) in single and multiple recessions, Miller's classes I, II and III, with significant phenotype changes ( $2.04 \pm 0.95$  to  $2.37 \pm 0.89$  in 12 months after intervention)<sup>16</sup>.

The photobiomodulation of the processes of tissue repairment with laser (LLLT - *Low-Level Laser Therapy*) is very used for therapeutical ends in dentistry, especially for diminishing the inflammatory effects in mucogingival tissue. Using different wave lengths and specific dosimetry parameters, positive results are obtained in the aid of post-surgery repair, promoting bio chemical or molecular stimulation. This modulation of the inflammatory process enhances healing, promotes angiogenesis, lowers the edema in the irradiated area and attenuates pain symptomatology, and, more importantly, accelerates the tissue's repair<sup>22-25</sup>.

The use of photobiomodulation in mucogingival surgeries is indicated to accelerate the repairing process in the beginning stages of the repairment. The results of a study in which the objective was to investigate the therapeutic effect of laser (GaAlAs, 1.5 ou 3J/cm<sup>2</sup>) in the accession and proliferation of human gingival fibroblasts, add to the hypothesis that the laser's biostimulatory effect is associated with improvement of the beginning and more sensitive phases of the repairing process<sup>24</sup>.

Some authors suggest the association of concomitant periodontal approaches to low level laser therapy in order to reach better results of root coverage<sup>22-24</sup>. In this context, a study suggested positive outcomes in the association of photobiomodulation with surgeries using the semilunar flaps to resolve gingival retractions. Confirming the initial hypothesis, statistically significant differences

related to the improvement on the values of periodontal measurements and gingival recession length, the clinical insertion level and the quantity of keratinized tissue obtained in the post-surgery<sup>25</sup>. Corroborating these results, the photobiomodulation also can be utilized to accelerate the repair of wounds in the palatal mucosa, or in any donating area after its removal, observing a superior quality in the repairment of the control group fourteen days after the gathering<sup>23</sup>. These exciting results are the reflex of the effects produced by the laser in the fibroblastic activity, as well on the it's influence over cytokines pro and antiinflammatory agents during the initial phase of the cicatricial repairment<sup>22</sup>.

Searching for scientific foundation offered by the literature, this article aim to present a clinical case of a 25 years old patient with gingival recession in the #13's region (upper right canine) with aesthetic and functional important complaints, in which was used in her treatment, the modified coronally advanced envelop flap associated to a connective tissue graft removed from the palate and, in the initial post-surgery phases, was used low power laser photobiomodulation for improvement in the tissue repair.

## CASE REPORT

A 25-year-old female caucasian patient sought treatment in a private dentistry clinic due the gingival recession in the tooth element #13 (upper right canine). According to the report, the patient had functional needs in virtue of the gingival retraction, showing difficulties in the consumption of some types of cold foods and during dental hygiene, resulting in painful sensibility as immediate consequence of stimulation. painful sensibility due stimulation. Besides, the aesthetic issue has also referred importance, because even during speech or smile, the retraction ended being exposed and embarrassing the patient.



During the clinical exam, the periodontal probing, it was verified a root's coverage need for 6mm recession in the tooth #13, besides a very thin gingival phenotype (Figures 1). It wasn't perceptible in other regions in this event. Equally, the patient presented great oral hygiene, without accumulation of evident plaque and with a routine of periodontal control being rigorously maintained. even though the patient was invited to make a tooth prophylaxis routine prior to the establishment of a surgical conduct.

Thus, the planning of the treatment was concluded, and defined it was to be done in four steps. 1) Accessing the #13 tooth's area with a modified envelope type of flap and the surface exposed root's surface decontamination; 2) Gathering of the gingival graft from the palate's donating area; 3) Tunnelization, positioning the connective tissues graft and stabilizing the conjunct through the graft's suture with coronal traction of the tissue; 4) Laser photobiomodulation during the first week of immediate post-surgery.

### **1<sup>ST</sup> STEP: ACCESS TO THE 13# TOOTH AREA AND DECONTAMINATION**

Anesthesia with Mepivacaine 2% with Epinephrine 1:100.000 in buccal's groove depth and in palatal next to the region of the #13 tooth after topical local anesthesia. Using specific "tunnelizing" instruments, in a kindle and gentle manner, a delicated subperiosteal access was made to obtain space for the positioning of future gingival graft, beyond the mobility of periodontal tissues for their coronal repositioning. This total flap was elevated towards the gingival mucosa region under the periosteum, looking for a divided flap, separating the muscular tissue from the epithelial and subepithelial tissues. In this manner, beyond the obtained space for the insertion of connective tissue (from

the distal of the tooth #12 until the mesial of the tooth #14), an adequate mobility for the receptor bed, allowing the migration toward the coronal direction through suspensory sutures, being one of the objectives of this report (Figure 2).

With this step being finalized, a controlled scraping was performed on the tooth #13's root surface, through the use of Piezoelectric instrument (DentSurg Pro, CVDentus, São José dos Campos, SP, Brasil), removing contaminated cement and dentin, besides possible debris and impurities from this surface, exposing dentin tissue that will favor over the adaptation of the graft, as well as the future development of fibers that will sustain the repaired tissue. Regarding that, the procedure was to expose the dentin tubes through the use of EDTA in a 24% concentration (Straumann® PrefGel®, Basel, Switzerland) for 5 minutes with abundant washing of the bed after the waiting time. Therefore, it was applied to the enamel matrix derivative – Amelogenina 0,15mL (Straumann® Endogain®, Basel, Switzerland), in order to stimulate the receptor bed allowing the increase in the success index about the graft's accession.

### **2<sup>ND</sup>: COLLECT OF GINGIVAL GRAFT FROM THE HARD PALATE DONATING AREA**

For the gingival tissue collect, the approached area was in the hard palate region between teeth #23 and #26, with great offer of gingival volume, as well as good usage of subepithelial lamina dura, adequate to the case's objective. For this purpose, the harvesting connective tissue linear technique was selected, where with a 15C blade (Aesculap B. Braum®, Melsungen, Germany) a linear incision was made between those teeth, perpendicularly and within 4 to 5mm depth. In a delicate manner, with the blade parallel

to the teeth and gently positioned under the epithelial margin, in order to keep it, a dissection of the connective tissue was made in the desired length. After this step, with 2 incisions on the extremities of the tissue to be collected and one in the apex margin, a rectangle of connective tissue was removed and transplanted to the area to be covered (Figure 3).

### **3<sup>RD</sup> STEP: STABILIZATION AND SUTURE OF THE GRAFT WITH CORONAL TRACTION OF THE TISSUE**

Through delicate suture strings (Resorba®, Resotex® 5.0, Nuremberg, Germany) the connective tissue was placed in the receiving area, in order to maintain it exactly in the gingival margin (amelo-cement junction) of the tooth 13#, with the possibility of a 20% exposure of the tissue, aiming to obliterate the root's exposed portion. Two fixation sutures were made in the extremities of the grafted tissue, maintaining it well placed and stable over the buccal-cervical surface of the tooth 13#, just under the envelope incision previously created. With two more suspensory sutures, it was possible to pull the native gingival tissue towards the cervical direction, in order to seal completely the recession area. Thus, the clinical surgical objectives for the root's coverage were reached, specially on the complete sealing of the affected area (Figure 4).

In the donating area, two hemostasis maneuvers were made, along abundant washing with saline solution. Sutures by the technique "x-square", also with delicate suture strings (Resorba®, Resotex® 5.0, Nuremberg, Germany), were done in order to contain possible bleeding and to approximate the edges.

Post-surgery medications were prescribed for pain control, inflammation and for the

possibility of infection, orally: amoxiciline 500mg (1 pill every 8 hours for 7 days) dexamethasone 4mg (1 pill every 12 hours for 3 days) and ketorolac tromethamine 10mg (1 pill every 8 hours for 3 days) The patient was instructed to respect some post-surgery care regarding alimentation, hygiene control and suspension of physical activities, in order to avoid harm to the procedure performed. Topical hygiene with chlorhexidine gluconate 0,12% in a gentle manner, over the wound with cotton is to be performed, avoiding trauma to the grafted area. After 21 days the sutures were removed. The area was adequate, no signs of infection or inflammation and with good hygiene applied over the wound. Also, a periodically control was made over the gingival margin of the tooth 13# (each six months until complete 3 years). (Figure 5 and 6).

### **4<sup>TH</sup> STEP: PHOTOBIOMODULATION WITH LOW-LEVEL LASER**

To enhance the periodontal repairment in the immediate post-surgery, such as the receptor as well to the donating areas, low level laser therapy was applied in two buccal points and two palatine points of the tooth 13#, respecting the following parameters: LLLT - Diode GaAlAs, in the red wave length of 660nm, potency of 100mW, applying 1Joule per point, for 3 sessions with a 48-hour interval between them. These applications dispense the usage of local or topical anesthesia or any invasive management (Figure 7)

## **DISCUSSION**

It is known that the prevalence in Brazilian population studies varies between 22% for recessions  $\geq 5\text{mm}$  and 51% for recessions  $\geq 3\text{mm}$ <sup>1</sup>. In addition the referred clinical case in this article fits the scope of more accentuated retractions, in which, according to periodontal probing, the patient presents

a 6 millimeter gingival recession There are many etiological causes for gingival recessions. The most common are mechanical trauma from tooth brushing, thin phenotype, orthodontic treatment, presence of cervical restorations, periodontal disease and occlusal trauma<sup>3</sup>. This patient had previously passed through orthodontic treatment, being affected chronically by awake bruxism. The patient presents a good hygiene pattern, being rigorous in the appointments for professional prophylactic control, having rare episodes of located gingival inflammatory processes. Regardless, the gingival phenotype the patient presented was thin and poorly keratinized, factor added to other etiological causes previously cited, which may have favored the isolated gingival recession of the element #13. The upper canine teeth are main factors of many occlusal processes, specially to lateralization, in which the masticatory charge required in these places is truly great, it being another factor to be entailed in the unitary recession.

The literature presents some techniques for the root coverage, showing a great success rate with long term follow-ups well established<sup>20</sup>. Among techniques, coronal repositioning of the flap, associated with connective graft and enamel matrix derivatives, are considered gold standard<sup>8-9</sup>. The chosen technique for the achievement of this clinical case was the modified envelope with the association of a sub epithelial connective graft harvest from the hard palate. Among important advantages of this technique, we can highlight the possibility of maintenance of a better blood flux in the surgical site. This characteristic is fundamental to favor the nutrition of the graft and, consequently, promotion of acceleration of the repairment. Besides that, a reduction on the post-surgical morbidity due the limitation on the flap's elevation<sup>18</sup>, this patient being young and with

a great aesthetic demand, along a minimum post-surgical discomfort. Contemporary literature also identifies a tendency on the use of connective grafts associated with surgical periodontal procedures for repositioning the margin for root coverage<sup>19</sup>. Following this philosophy, a sub-epithelial connective tissue graft harvest from hard palate was performed, with linear technique, widely used for this purpose. Through a linear incision, 2 to 3mm far from the cervical limit in the palatine face, the more superficial sub epithelial connective tissue (lamina propria) preserving the integrate gingival epithelium, closing the operator wound by first intention, through sutures type "x-square". The case was followed monthly in the first year, with photographic register of the maintenance of the gingival margin until the 3<sup>th</sup> year post-surgical, during which it was verified an adequate aesthetic, a present and asymptomatic function from the symptomatology point of view, but mostly, a stabilization of the grafted tissue with gingival health and satisfying color. The gingival probing demonstrated a stable, not painful, not bleeding gingival sulcus.

Photobiomodulation through low intensity laser therapy is a technology that can be utilized to favor the tissue repairment in the preliminaries phases of the post-surgical in periodontal surgeries. According to current literature, the photobiomodulation acts facilitating the adhesion and proliferation of human gingival fibroblasts, supporting the hypothesis that the biostimulating effect of the laser may be associated with benefits in the early and more sensitive stages of the repairment process<sup>24</sup>. This phenomenon brings as immediate consequence a important potential in the facilitation of the cicatricial process of traumatic or provoked wound, in a way to enhance the capacity of repairment in these sites. In the presented clinical case, the photobiomodulation had fundamental role

in the velocity and quality of the repairment, such as in the surgical buccal gingival wound of the tooth 13#, as in the palatine gingival tissue donating site. Maybe, the quality of the cicatricial act and, mainly, the absence of pain, edema and bruising on the treated sites, are results of a technically well done surgery, of a well-calculated medicine prescription and post-surgical recommendations rigorously followed. But, one can wonder about the possibility of a supporting effect from the photobiomodulation protocol if well prescribed and with precise points of application, being these factors providential for the success in short or long terms in the presented clinical case. It is considered that the association of all these factors allowed a minimum post-surgical phase, without meaningful discomfort or bigger complaints, as well to few reports on bleeding or infections. Besides, it was noticeable that progression of all periodontal post graft factors were more expressive in a positive way, than in conventional situations where this protocol is not utilized.

## **CONCLUSION**

Satisfying results were obtained in the immediate post-surgery stage, regarding the patient's satisfaction with the aesthetic result and with the functional improvement, since the pain symptomatology ceased. It is possible that the successful resolution of the case be attributed to the combination of photobiomodulation, technical excellence and the use of high quality materials and biomaterials. The case was considered successful, as its stability was clinically proved through a 3-year follow-up.

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## FIGURES

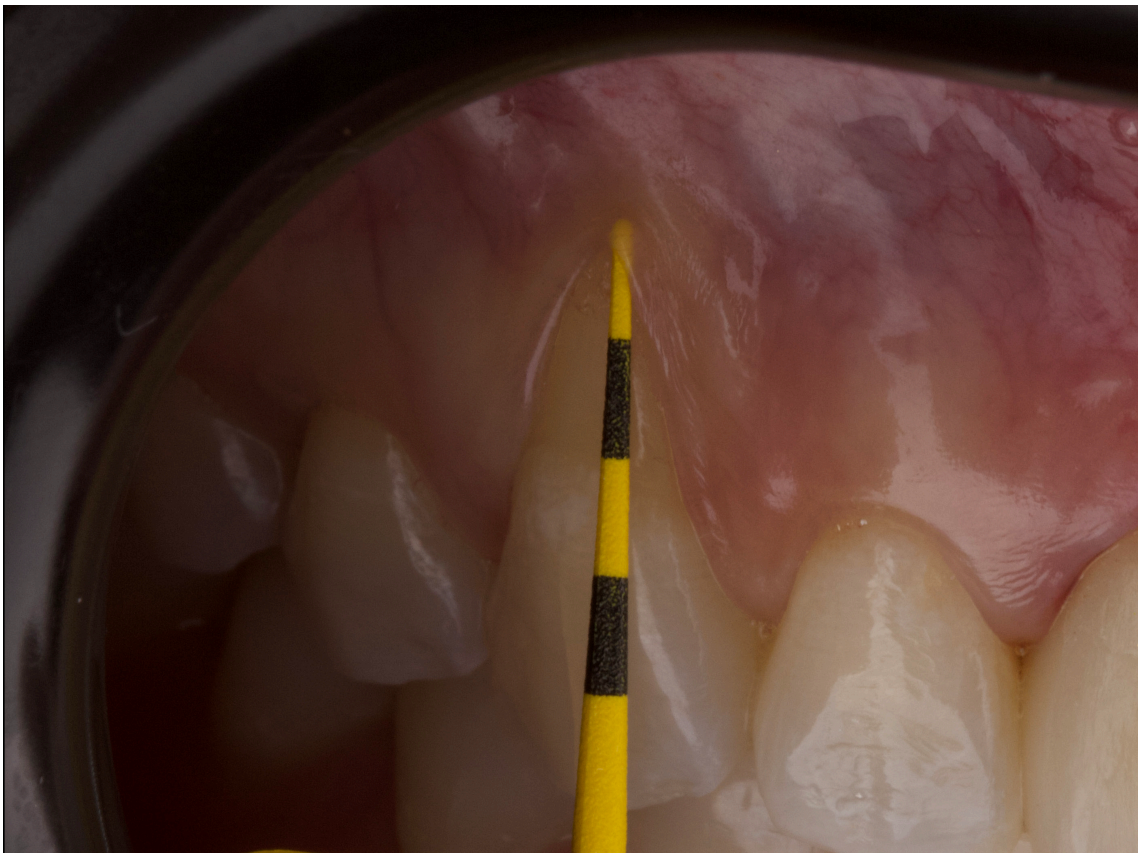


Figure 1: Initial photo of the clinical case showing the tooth gingival recession (13#). It can be noted an approximate 6mm attachment loss.





Figure 2: The retraction location access. A) use of delicate tunnelers to obtain a subperiosteal space in order to accommodate the connective graft; B) piezosurgery technique to root preparation dental surface; C) EDTA and amelogenin application in order to enhance the graft adhesion.

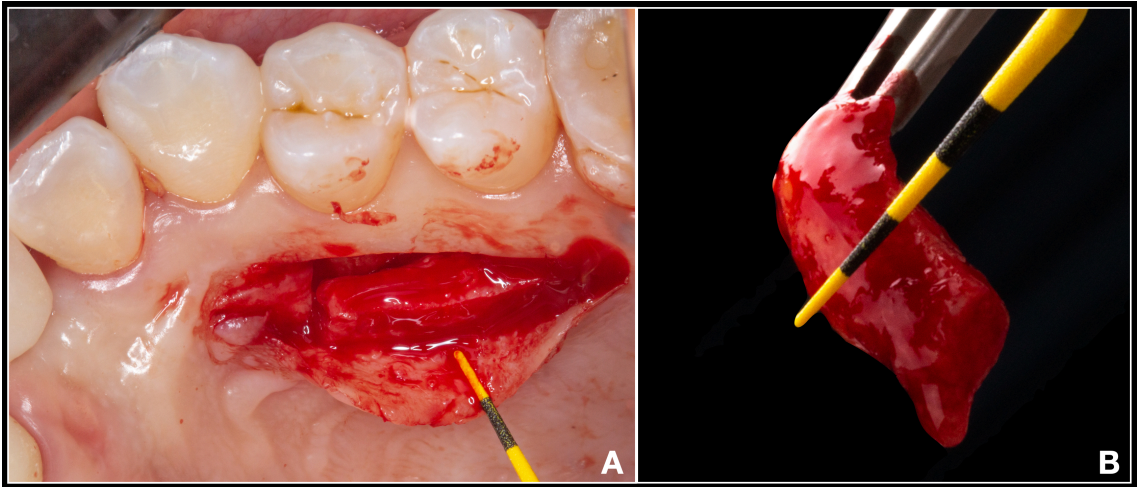


Figure 3: Palatal access for connective gingival graft collection of donor area. A) The linear technique was used to approach the region for tissue removal; B) exposure of the graft by evaluating height and width.

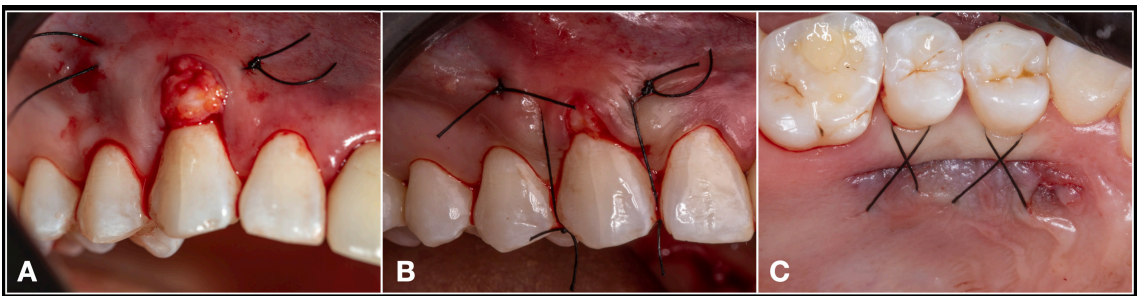


Figure 4: Suturing and graft adequacy at the recipient site. A) positioning of the gingival connective graft in the buccal-cervical position of tooth #13 with stabilizing sutures; B) making suspensory sutures in order to position the gingival margin in the desired location; C) type “x” sutures for coaptation of the edges in the palatal donor area.

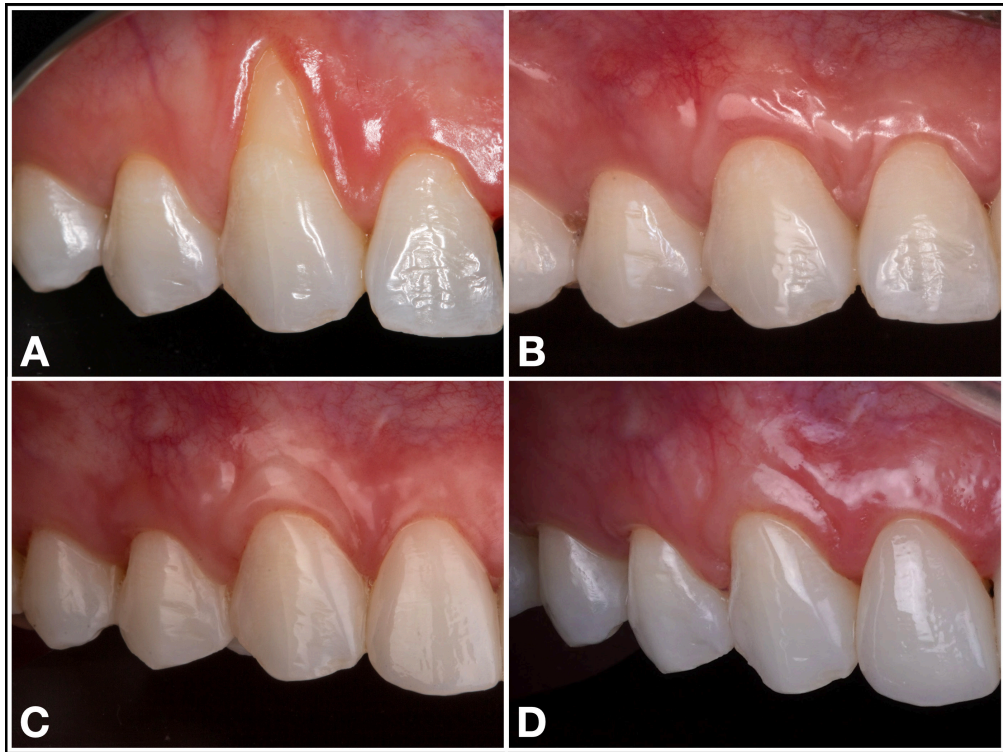


Figure 5: Photographic control of the clinical case: A) initial photo; B) 30 days after surgery; C) 1 year follow-up; D) 3 years follow-up. Observe the quality of the gingival tissue obtained and maintenance in this long-term follow-up. Gingival health is established and the gingival margin in the planned position.



Figure 6: Clinical case final evaluation performed showing long-term maintenance of the gingival margin - 3 years follow-up.