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Esthetical Excellence Achieved After Immediate Loading Protocol and Connective Tissue Graft: A Case Report

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ABSTRACT:
The immediate loading protocol with subepithelial graft is widely used with the aim of not compromising the aesthetics, function, and comfort of the patient, as well as restoring the gingival papillary contours. The main function of this technique is to simplify the procedure, reducing the treatment time and the repair period. Objective: To describe an initial case of aesthetic excellence obtained with a single Straumann Bone Level Implant, associated with the use of subepithelial connective tissue graft to improve pink esthetics. Case report: The case involves a 54-year-old female patient with a history of extraction of tooth 24, due to an iatrogenic treatment of intra-radicular perforation. A thick gingival biotype with good quality keratinized tissue was observed. After diagnosis and treatment, an implant associated with the use and adjustment of a subepithelial connective tissue graft and a provisional crown was installed immediately. After 6 months, the provisional crown was removed, and the emergence profile with ideal gingival contour and regenerated papilla was established, allowing the final crown to be placed. The effectiveness of immediate loading is due to the simplification of the treatment, minimizing healing time, cost, treatment time, number of surgical interventions, promoting tissue preservation, and providing patient comfort. Conclusion: Immediate loading is a viable treatment option, even for single tooth implantation, in cases where there is indisputable presence of sufficient quantity and quality and does not cause soft tissue damage, thus favoring clinical results.

Key words: implant, immediate loading, immediate provisionalization, single tooth replacement, gingival biotype.

I. INTRODUCTION

Over three decades, literature has documented the high long-term success of dental implants that utilized the conventional Brånemark two-stage protocol, allowing a load-free healing period of three to six months (Choquet et al., 2001). In recent years, patient demands for immediacy and the desire to eliminate compromised aesthetics, function, discomfort, and inconvenience associated with traditional two-stage implant procedures have fostered growing clinical interest in early and immediate implant loading (Hedge et al., 2014). It is well accepted by patients due to its financial, aesthetic, and psychological benefits, being a less traumatic surgical procedure compared to conventional protocols, which reduces anxiety related to dental follow-up. (Berberi et al., 2024)

There are many advantages to the immediate loading protocol, which include reductions in the number of surgical interventions and the overall treatment time, besides considerably high survival rates, especially when high initial implant stability is achieved and the load is controlled (Vogl et al., 2019; Hedge et al., 2014). This important initial implant stability was found to be influenced by several factors, including implant geometry and length, surface morphology, splinting of implants, control of the occlusal load, quality of the bone, and absence of detrimental patient habits (Sethi & Kaus, 2017; Dayan et al., 2019).

Thus, the most biomechanically challenging application for immediate loading is the single posterior dental implant, explained by the poor bone quality of the maxillary bone additionally to the absence of splinting of the implants, which could expose it to detrimental loading affecting osseointegration (Dayan et al., 2019). Despite these challenges, recently, the systematic review by Mugri et al. (2023) highlighted that studies have shown that implants with immediate loading have high efficacy in the posterior maxillary and mandible zone. To control loads placed upon single-tooth implants and reduce micromotion at the healing bone-implant interface, various approaches have been tried (Tsuda et al., 2011; Elian et al., 2007).

One approach has been to control the load by reducing or eliminating the occlusal contact of the prosthesis supported (Schoenbaum et al., 2013).

A second approach has been to incorporate macroretentive features into the implant design to achieve primary stability (Vogl et al., 2019; Dayan et al., 2019). Thus, macrodesign plays an important role in achieving high torque values and, consequently, elevated primary implant stability (Dayan et al., 2019). In this context, the Straumann Bone Level implant was developed using the SLActive surface technology, which seems to provide an interesting acceleration during bone healing (Kang et al., 2018). This accelerated healing was confirmed up to a 60% greater bone-to-implant contact and a significantly higher unscrewing torque compared with the SLA surface after 2 and 4 weeks.

For all these advantages, the use of such implants might be considered when single implants are planned, especially in posterior maxillary regions. However, only a few studies (Proussaefs et al., 2002) have described the use of these modified surface implants in such critical cases, showing promising results.

Limited data also suggest that the immediate restoration of implants might facilitate and stabilize gingival architecture more than a staged approach (Yoshino et al., 2014; Chung et al., 2011). It is common to observe the collapse of the gingival and bone support in posterior regions of the maxilla after premolar extraction, for instance. In such cases, the concept of immediate implant loading associated with gingival surgical procedures to improve aesthetic results in such areas with poor bone quality could be an alternative (Karthikeyan et al., 2016; Lee et al., 2016; Kaushik et al., 2014).

Thus, the present case reports the aesthetic excellence obtained with a unitary Straumann Bone Level Implant, associated with the use of subepithelial connective tissue graft to improve pink aesthetics.

II. CASE REPORT

A 54-year-old, healthy female presented with a missing maxillary left first premolar and visible soft tissue loss on the buccal plate. According to the patient's report, the tooth had to be removed due to extension and intermittent endodontic lesions resulting from an intra-radicular perforation that occurred during iatrogenic endodontic treatment. During the clinical and radiographic exam, a healthy periodontal and periapical condition was observed in the adjacent teeth with 7mm of mesiodistal space between them. The gingival biotype was thick with keratinized tissue of good quality, although flattened gingival architecture was presented (Figure 1A). Model casts and photographs were also performed to document the patient's current condition. According to the planning, the most appropriate treatment would be the placement of the Straumann Bone Level implant (Straumann, Basel, Switzerland), immediate loading with a 1-piece, screw-retained acrylic resin crown, in addition to a subepithelial connective tissue graft. The main reason for this choice was to preserve marginal bone level and contribute to gingival level stability and increased soft tissue contour.

In preparation for treatment, a preliminary impression was performed, and a master cast was obtained. In this cast, a diagnostic wax-up of the premolar was accomplished allowing for the manufacturing of a surgical guide (Figure 1B), as well as the placing of an implant replica in the planned position. A provisional abutment (Temporary Abutment, Straumann, Basel, Switzerland) was installed over the implant replica, and a provisional crown was fabricated (Figure 1C and 1D).

For the surgery, local anesthesia with 4% articaine (1:100,00 epinephrine) (Ubistesin Forte, 3M/ESPE, Sumaré, Brazil) was administered, and a full-thickness flap was raised. The surgical guide was used during bone preparation as guidance to implant position and inclination (Figure 2A). The bone site was prepared under copious saline irrigation using the sequential burs of the implant system. The Straumann Bone Level implant (Straumann, Basel, Switzerland) with 10 mm of length and 4.1 mm wide was placed using 32 Ncm torque (Figure 2B). The platform of the implant was placed 2mm apically to the cementoenamel junction of the left canine. The provisional abutment (Temporary Abutment, Straumann, Basel, Switzerland) was adjusted with diamond burs and tested in position (Figure 2C). The provisional restoration was tested and adjusted over the provisional abutment (Figure 2D). Following, the provisional restoration was relined intraorally with direct composite resin (Z100, A2 shade, 3M ESPE Dental Products, St Paul, MN, USA) placed in the gap between the provisional restoration and the abutment followed by an initial light curing of 20 seconds. The final polymerization was accomplished extraorally, and the length and shape of the provisional restoration-abutment complex were refined using flow composite (Filtek Z350 Flow, A2 shade, 3M ESPE Dental Products, St Paul, MN, USA), light curing for 30 seconds (Figure 2E).

A subepithelial connective tissue graft was extracted from the palatal region 2 mm below and between the upper right premolar and molar (Figure 3A and B), and the donor site was sutured. Following, the graft tissue was adjusted and sutured in the buccal region on the implant site (Figure 3C) aiming to improve soft tissue deficiency. In the present case, that soft tissue graft was sufficient to restore the harmony and contour of the labial plate. Bone grafting was not required because a good thickness of the buccal bone plate was present and no gap was observed between the bone and implant. The provisional restoration was then fastened on the implant with a titanium screw using a torque of 35 Ncm, and the flap was sutured (Figure 3D). The palatal access hole was closed with the same flow composite, and occlusion was checked. Any centric and eccentric contacts were eliminated.

Postoperatively, the patient received a prescription of Amoxicillin/Clavulanate potassium 1 mg per day for 5 days and nonsteroidal analgesic Nimesulide 100mg twice a day for 5 days. A 0.2% Chlorhexidine rinse was prescribed three times a day for 2 weeks. The sutures were removed after 7 days (Figure 3E).

The provisional restoration was left in place for six months to allow time for osseointegration and maturation of the peri-implant gingival complex. Six months after the implant placement, the customized provisional restoration was removed, and the emergence profile with an ideal gingival contour and regenerated papilla was established (Figure 3F). This period of healing is crucial to achieve the maturity and stability of the peri-implant mucosa prior to the final impression and ceramic restoration, especially in aesthetic areas.

For the final impression, an indirect custom implant impression coping technique was used to precisely replicate the final gingival architecture (Figure 4A). The emergency profile achieved was duplicated and transferred to the transfer abutment (Figure 4B) by using the indirect contour technique (Figure 4C). For this purpose, the implant's replica was fastened on the provisional restoration, and the set was copied by means of dense impression silicone (System Zetaplus, Zhermack, Labordental, Sao Paulo, Brazil). Then, the provisional crown was replaced by the transfer abutment, and polymethyl-methacrylate acrylic resin (Red Duralay, Reliance, Dental Mfg. Co. Worth, IL, USA) was disposed in the gap, transferring the emergence profile. After finishing and polishing the acrylic resin, the transfer was adjusted intraorally (Figure 4D).

A plastic stock tray and silicone impression material (Express XT VPS, 3M ESPE, Sumaré, Brazil) were used for the impression with the open tray technique. An impression of the mandibular arch was also performed, and both definite casts were fabricated from type IV dental stone and mounted in a semiadjustable articulator and in maximal intercuspal position. The customized abutment (Gold Abutment Straumann, Basel, Switzerland) was selected (Figure 4E), and lithium disilicate porcelain (Figure 4F) was applied using stratification technique for the definitive restoration. The restoration was tried-in (Figure 5A), and the proximal contacts and occlusion adjustments were performed. After the delivery of the definitive restoration (Figure 5B), the buccal aspect of the definitive restoration was perfectly integrated into the patient's dentition, and the gingival papillae looked normal, enhancing the optimal aesthetic result (Figure 6).

III. DISCUSSION

The implant placement and immediate temporary restoration are beneficial because they provide the opportunity to develop and support the surrounding peri-implant tissues from the time of surgery (Schoenbaum et al., 2013). For this patient, a tapered implant was used to replace the first left upper premolar, as well as having minimal alterations in the marginal bone level, presenting excellent longevity (Kang et al., 2018). In addition, placement of concomitant soft tissue grafting with immediate implant may contribute to gingival level stability and increased soft tissue contour (Lee et al., 2016).

The implant placement with immediate temporary crown aims to simplify the treatment, minimizing the healing time, cost, treatment time, number of surgical interventions, promoting tissue preservation, and giving the patient more comfort (Hegde et al., 2014; Mugri et al, 2023). In the immediate loading technique, bone neoformation is stimulated around the implant, being faster than in the two-step procedure (Hegde et al., 2014). Studies demonstrate that alveolar bone loss is more critical in the first year after dental extraction, especially in the first 3 months, with a reduction of about 30% of the alveolar ridge (Morjaria et al., 2012).

An important aspect of treatment success is primary stability. Some studies show that approximately 25 Ncm of torque is enough (Sethi & Kaul, 2017), while others demonstrate that 45 Ncm is the basic requirement for the immediate implantation of load implants (Vogl et al., 2019). In the present case, a torque of 32 Ncm was used, suggesting safe application of immediate loading as long as there is smooth occlusal contact. Primary stability, moreover, can be increased by the use of tapered implants, as well as individualized surgical protocols, as used in the case (Dayan et al., 2019). Tapered implants are advantageous, requiring less space in the apical region, offering better primary stability for immediate implants into alveolar sockets, and better distribution of compressive forces due to its similarity to the natural anatomy of the tooth root (Udomsawat et al., 2018; Kim et al., 2021). In addition, patients who underwent tapered implant surgery in the posterior region of the jaws when compared to cylindrical implants had less significant pain severity in the first 24 hours after surgery (Samieirad et al., 2019).

A subepithelial connective tissue graft is considered to be a reliable and predictable procedure that provides a satisfactory aesthetic result, making it an advantageous alternative for gingival realignment after implant placement (Karthikeyan et al., 2016; Lee et al., 2016). This restorative modality is used for soft tissue volume adjustments in terms of ridge preservation procedures, soft tissue ridge augmentation, or papilla reconstruction (Kaushik et al., 2014). The main advantages of the subepithelial connective tissue graft are that it is cheap, versatile, and easily available; provides successful results; is less invasive than other autogenous harvesting techniques; and has a shorter healing period, causing less patient discomfort (Karthikeyan et al., 2016).

In this case, a subepithelial connective tissue graft was used to cover the deficient gingiva in the buccal region, to maintain the natural contours of the gingiva and papillae, with the aid of the suture and the provisional abutment, which supported the emergence profile of the gingiva. Papilla preservation and stability are very necessary in esthetic areas in the case of immediate implant with soft tissue deficiency (Waki & Kan, 2016). This type of graft has greater soft-tissue volume and a low chance of necrosis, compared to free gingival graft (Kirmani et al., 2018).

Studies demonstrate the increase of soft tissue around dental implants using subepithelial connective tissue graft from the lateral palate or tuberosity area, as a better tendency in volume gain and keratinized tissue gain (Rojo et al., 2018). The connective tissue graft after immediate implant placement is capable of preserving the integrity of peri-implant tissue, as well as improving pink esthetics (Bakkali et al., 2021). Peri-implant keratinized gingiva is advantageous for local health, and adequate thickness of the keratinized gingiva contributes to positive esthetic results (Lee et al., 2016).

The natural appearance of the provisional crown and the stability of thegingival architecture in the aesthetic zone are important steps towards achieving excellent results (Tsuda et al., 2011). In addition, the contour of the provisional restoration may promote soft tissue healing around the implants (Proussaefs et al., 2002). The study by Rai et al. (2020) highlighted that the interval between the provisional and definitive restoration aids in the remodeling of the gingival architecture. This requires careful planning with regard to provisioning, as it is necessary to develop interproximal contact areas that support the papillae and appropriate facial cervical anatomy that ensures a passive relationship between the gingival and the restoration in order to maintain the gingival architecture prior to placement of the definitive crown (Tsuda et al., 2011).

Studies have demonstrated a closer relationship between papilla deficit and contact point height in relation to height crestal bone between implant and adjacent tooth. The lower the contact point of the restoration margin in relation to alveolar crest, the greater the correlation with complete papilla formation, but the higher contact point, the greater an association with papilla deficit (Kniha et al., 2017). The vertical distance from the crestal bone level to the base of the interproximal contact point varies from 2 mm to 11 mm in single-tooth implants (Jung et al., 2018). After tooth extraction, the interproximal papilla generally collapses due to loss of tooth support, and the degree of collapse depends on the thickness of the mucosa. The level of the periimplant papilla is dependent on the bone level associated with the adjacent tooth (Choquet et al., 2001).

The aesthetic and functional risks of inadequate mucosal architecture due to uncontrolled pressure application can be reduced by immediate implant crown with modulation of the emergency profile (Wittneben et al., 2016). The best approach to sculpt peri-implant soft tissue is an appropriately contoured provisional prosthesis (Hiochwald, 1991). The difficulty persists as regards the precise transfer of soft tissue to the mold and consequently the duplication of the emergency profile of the provisional prosthesis to the final prosthesis (Elian et al., 2007). In the present case, the emergency profile achieved by the indirect custom print impression copying technique was duplicated and transferred to the transfer abutment using the indirect contour technique. For this, the implant copy was fastened in the provisional restoration, and the set was replicated by means of dense printing silicone. After that, the transfer abutment replaced the temporary crown, and polymethyl methacrylate acrylic resin was placed in the gap, transferring the emergency profile.

Gingival facial recession is a common finding in implant restorations, and approximately 1 mm of tissue loss can be expected up to 12 months after definitive prosthesis placement (Yoshino et al., 2014). The conversion of the facial gingival biotype through the use of a subepithelial connective tissue graft at the time of implant placement is beneficial and minimizes recession of the facial gingival tissue, since there is preservation of soft tissue levels, making the gingival tissue more resistant to recession (Chung et al., 2011; Zuiderveld et al., 2024). In addition, areas with soft tissue deficiency, the use of subepithelial connective tissue graft may increase tissue height and thickness, thus favoring aesthetic outcomes (Waki & Kan, 2016), as observed in the present clinical case.

IV. CONCLUSION

Several aspects combined, such as the connective tissue graft, the correct positioning of the implant, the macro and micro designs, the use of immediate loading protocols, and metal-free restorations, result in a harmonious relationship between soft and hard tissues, accomplishing a predictable prognosis and aesthetic excellence.

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Figure Legends

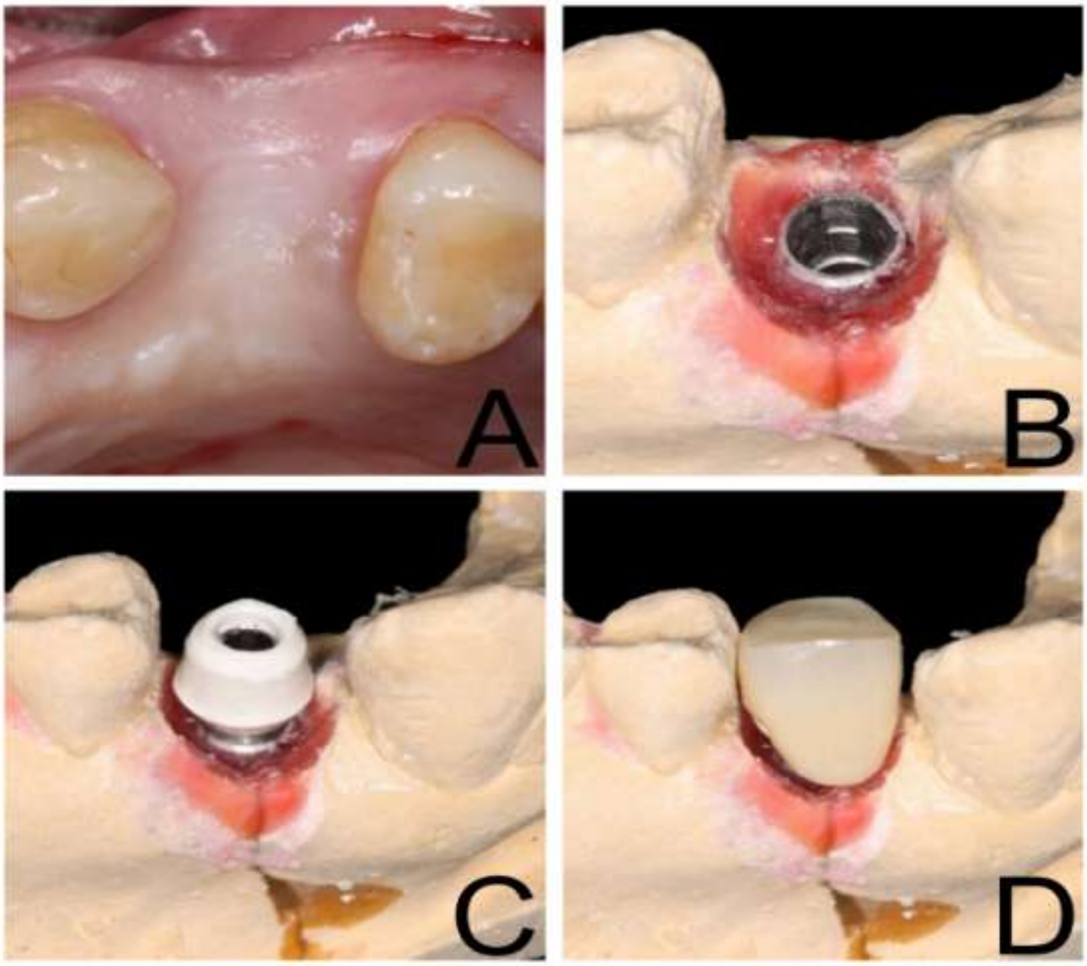

Figure 1: A) A thick gingival biotype with good quality keratinized tissue, presenting a flattened gingival architecture. B) Cast model presenting the pre-molar diagnostic waxing with implant's replica in the planned position to the surgical guide. C) Provisional abutment personalized and D) Provisional crown fabricated on the replica of the implant.

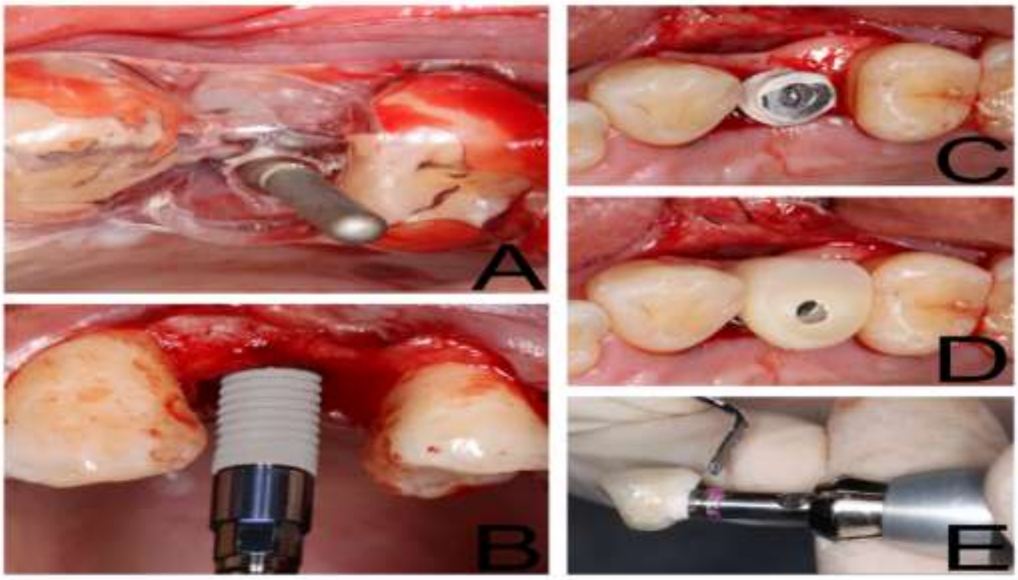

Figure 2: A) Preparation of the surgical site guided by the surgical guide for the three-dimensional position and inclination of the implant. B) Placement of the Straumann Bone Level implant, 10 mm long and 4.1 mm wide, using 32 Ncm of torque. C) Testing the temporary abutment in position, adjusted with diamond drills. D) Testing and adjusting the provisional restoration over the temporary abutment. E) Completion of final polymerization extraorally and refinement of the length and shape of the provisional-pillar-restorative complex using flow composite, photopolymerizable for 30 seconds.

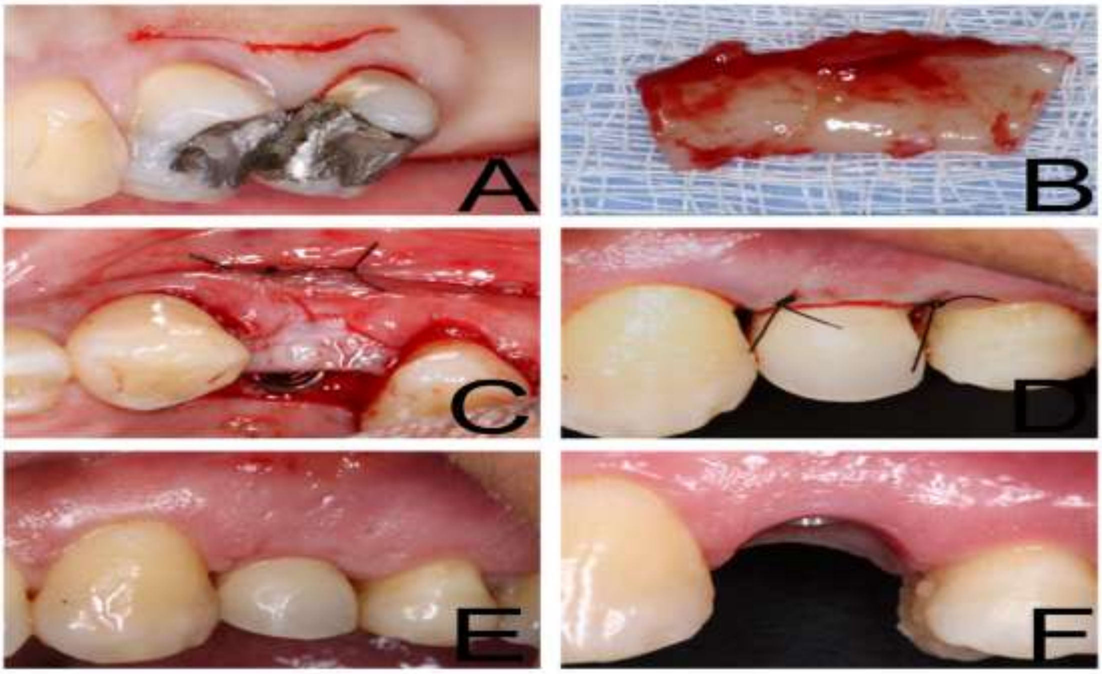

Figure 3: A and B) Extraction of subepithelial connective tissue graft from the palatal region, between the upper right premolar and molar. C) Adjustment and suturing of the graft tissue at the buccal region at the implant site. D) Fixation of the provisional restoration in the implant with a titanium screw, using a torque of 35 Ncm, and flap suture. E) Removal of the suture after 7 days postoperatively. F) Removal of the personalized temporary restoration six months after implant placement, presenting the emergency profile with an ideal gingival contour and establishment of the regenerated papilla.

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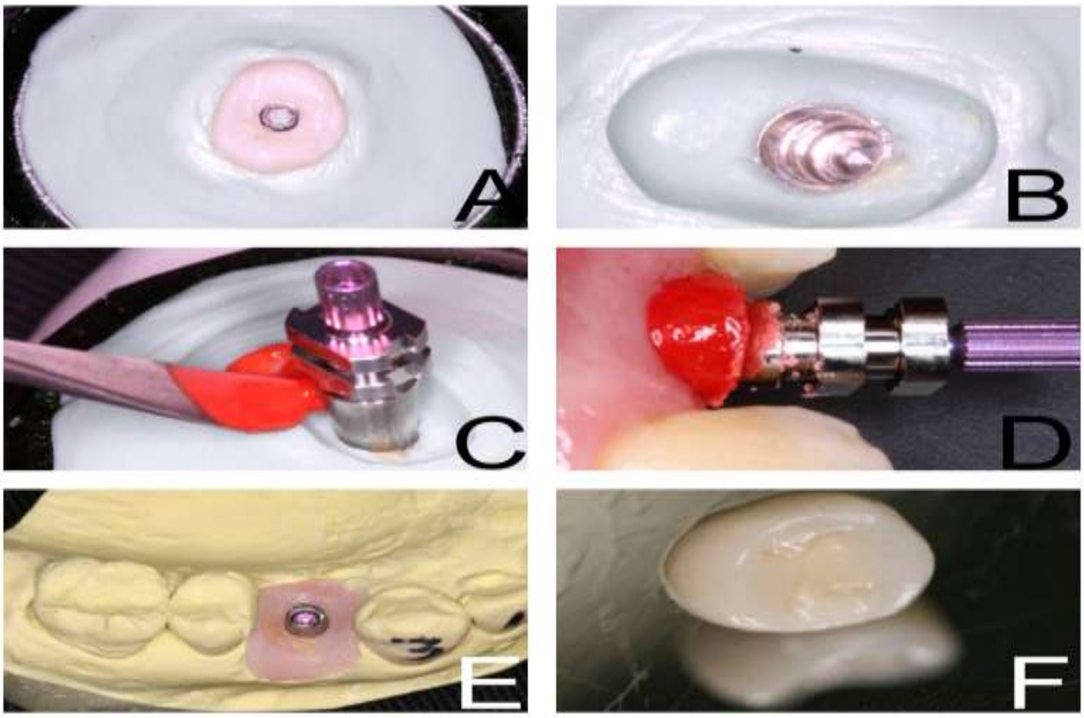

Figure 4: A) Use of the indirect custom impression coping technique to accurately replicate the final gingival architecture. B and C) Duplication of the emergency profile, which was transferred to the transfer abutment using the indirect contour technique. D) Replacement of the provisional crown by the transfer abutment and polymethylmethacrylate acrylic resin, adjusted intraorally, obtaining the emergency profile. E and F) Selection of the personalized abutment in the definitive model and lithium disilicate porcelain.

Figure 5: A) Trying to restoration. B) Delivery of the definitive restoration.

Figure 6: Integrating the patient's oral aspect of the final restoration into the patient's dentition.