Chapter 7

Outcomes of Soft and Hard Tissue Management with Biomaterials and Implant Rehabilitation

Authors
Marcos Motta, DDS, M.Sc.
Tatiana Miranda Deliberador, DDS, M.Sc., PhD.
Camila Pereira Vianna, M.Sc.
Geninho Thomé, DDS, M.Sc., PhD.

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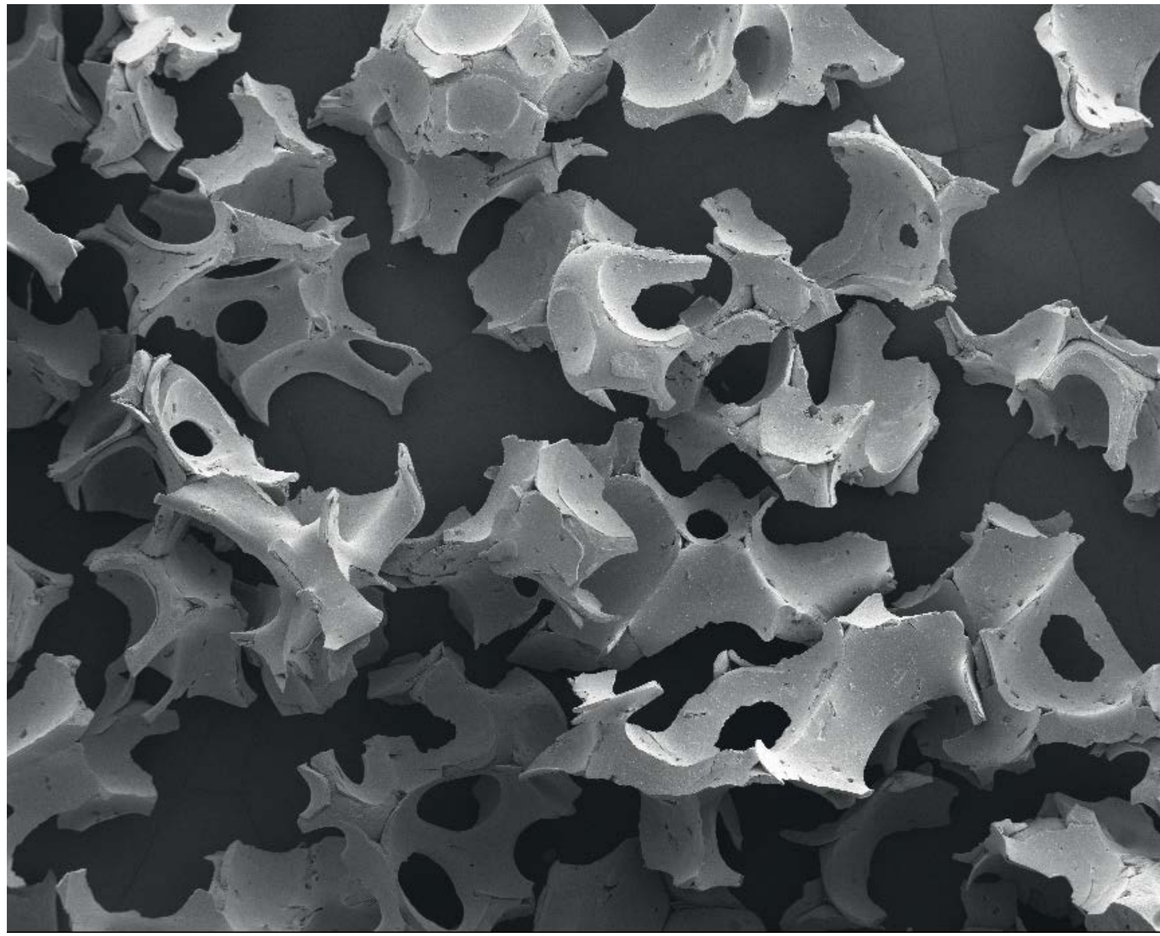
Over the past 30 years, partial or total oral rehabilitation with osseointegrated implants has become well established and is spread around the world with good long-term outcomes and survival rates ranging from 78-100%[1]. More recently, besides absence of infection, pain, mobility and radiolucency, and acceptable bone loss[2], aesthetics outcomes have become essential criteria to define the success of an implant[3].

Often, due to extensive bone resorption, after tooth loss, it is necessary to reconstruct the bone tissue and/or soft tissue before or during the installation of the dental implant. Especially when immediate implants are used, grafting procedures are needed to avoid or minimize volume loss, aiming aesthetics outcomes and for that, autogenous tissue or biomaterials are used[4].

The purpose of this chapter is to present the biomaterials options to achieve predictable soft and bone tissue repair or regeneration, as well as their indications and form of use and handling. At the end of the chapter, we will present the use of local therapy with a slow release of active oxygen to optimize the healing of soft tissues.



What are Biomaterials?

The autogenous graft is considered the gold standard method for soft or hard tissue augmentation procedures. However, due to its cost, anatomical limitations, and donor-site potential morbidity, the development of biological substitutes to restore or improve tissue function was needed, and those are called biomaterials.

The most accepted definition of biomaterials is currently the one employed by the American National Institute of Health that describes biomaterial as “any substance or combination of substances, other than drugs, synthetic or natural in origin, which can be used for any period of time, which augments or replaces partially or totally any tissue, organ or function of the body, in order to maintain or improve the quality of life of the individual”[5]. Therefore, since it not only interacts with the body but also influences the biological processes in order to repair or regenerate tissues, some factors need to be considered for its suitability[6], such as biocompatibility, biodegradability, bioactivity, antigenicity, scaffold architecture, ideal mechanical properties, and easy handling.

Biomaterials engineering has experienced steady and strong growth over its history, with many companies investing large amounts of money into the development of new products. This, with the main objective of offering to the medical and dental area, high-quality products with regard to stimulating healing with increased angiogenesis, protein adsorption, extracellular matrix deposition, adhesion, differentiation, proliferation, and growth cell and finally tissue repair or regeneration[7].

When choosing to use biomaterials, it is extremely important for the professional to know how to select the best technique and which is the best biomaterial option or the best association between biomaterials that should be used to achieve its objective, which may be tissue repair or regeneration and soft tissue augmentation.

Regarding function, biomaterials can be mechanical barriers, soft tissue substitutes or bone substitutes, and healing stimulators (Table 1), being used individually or in conjunction, according to each patient’s clinical need.

The use of biomaterials depends on clinical and surgical indications and should be planned according to clinical and imaging evaluation. We are going to present some clinical cases aiming to report the indication and the best way to use the biomaterials presented in this chapter.

TYPE OF BIOMATERIAL	ORIGIN	COMPOSITION	PRODUCT	PROPERTIES	HEALING AND INTEGRATION TIME	INDICATIONS
Mechanical Barriers	Native porcine pericardium collagen membrane	Natural three-dimensional type III collagen	Jason® Membrane	• Excellent cell attachment & proliferation • Osteopromotion • Protection against highly proliferative surrounding soft tissues • Multidirectional strength and tear resistance • Excellent surface adaptation • Very thin membrane (0.1 a 0.25 mm) • No sticking after hydration • Fast vascularization due to three-dimensional structure	Slow Degradation 6 to 9 months	• Large augmentative procedures • Fenestration and dehiscence defects • Sinus lift • Socket and ridge preservation • Alveolar ridge augmentation and reconstruction – Guided Bone Regeneration • Guided Tissue Regeneration in intraosseous defects and furcation defects
Soft Tissue Substitutes	Porcine-derived acellular dermal matrix (PADM)	Natural three-dimensional type I and III collagen	Mucoderm®	• High interconnected porosity • Scaffold for migrating and proliferating blood vessels & cells • Fast revascularization and tissue integration • Can be easily applied and fixed by sutures • Can be cut into procedure-specific shape	6 to 9 months	• Safe alternative to autologous soft tissue transplants such as subepithelial connective tissue graft (SCTG) and free gingival graft (FGG) • Soft tissue augmentation • Root coverage
Bone Substitutes	Bovine bone	Natural hydroxyapatite	Cerabone®	• Scaffolds (osteoconductive biomaterial) • Volume stability • Bone repair and regeneration • Rough surface with high porosity & interconnectivity of pores • Stimulates the proliferation of blood vessels and cells	Slow Degradation 6 to 9 months	• Sinus Lifting • Bone augmentation • Guided Bone Regeneration • Filling intraosseous defects, furcation defects, peri-implant bone defects • Socket preservation post extraction • Gap filling

Table 1: Summary of properties, origin, composition, and indications of biomaterials presented in this chapter.

TYPE OF BIOMATERIAL	ORIGIN	COMPOSITION	PRODUCT	PROPERTIES	HEALING AND INTEGRATION TIME	INDICATIONS
Healing Stimulators	Enamel matrix derivative of porcine unerupted tooth buds	Enamel matrix derivative, Propylene Glycol Alginate (PGA), water	Emdogain®	• Induces the true regeneration of a functional attachment in periodontal procedures • Improves and accelerates wound healing in oral surgical procedures: by promoting angiogenesis, modulating the production of factors related to inflammation and thanks to its anti-microbial effect toward oral pathogens	The healing stimulation process starts a few minutes after its application[3]	• Treatment of intraosseous defects to inducing the regeneration of lost periodontal tissues • Oral surgical procedures and periodontal plastic procedures to accelerated healing, minimizing discomfort for patients through less swelling, less pain and faster recovery • Periodontitis and peri-implantitis (Indicated use Emdogain® flapless) • Wound healing after implant placement • It must be applied by the professional during the procedure as directed by the manufacturer
Healing Stimulators	Synthetic product with slow oxygen release	Aqua, Alcohol, Glycerin, Silica, Sodium Saccharin, Sodium Perborate, Citric Acid, PEG-32, Sodium Gluconate, Cellulose Gum, Xanthan Gum, Lactoferrin. Oxygen source: sodium perborate is converted to sodium borate and low concentration (0.003% a 0.015%) of hydrogen peroxide (H2O2) +/- 100 mg O2/L or O2 concentration of 0,27%	Blue®m Oral Gel	• Slow release of oxygen • Bactericidal action • Increases cell metabolism • Increases rate of cell proliferation and reepithelialization • Stimulates and increases angiogenesis and formation of collagen fibers • Accelerates soft tissue healing • Support the healing of problems in the mouth	Bactericidal action immediately after application. Healing process starts one to two days after application of the product.	• Oral wounds (after extraction, after GTR, after GBR, due to chemo/radiotherapy, or traumatic injuries) • Gingivitis and mucositis • Periodontitis and peri-implantitis • Wound healing after implant placement • Wound healing after bone and soft tissue grafts (for example, on the palate after removal of epithelial and connective tissue graft) • It is recommended to apply the product 2 to 3 times a day, until complete healing

Table 1: Summary of properties, origin, composition, and indications of biomaterials presented in this chapter.

Handling Tips

Mechanical Barriers (Jason® Membrane)

1st: Select the size of membrane (15x20 mm, 20x30 mm or 30x40 mm)

2nd: Hydration, the Jason® membrane can be applied dry or rehydrated in sterile saline solution or blood.

3rd: Trimming, use a scalpel or scissors to cut to the desired shape.

4th: Placement, one side of the Jason® membrane is slightly smoother and marked with “G” at the top right corner. This side is meant to be placed towards the gingiva or soft tissue. The slightly rougher side of the Jason® membrane should face the bone. However, there is no problem if the membrane is placed the other way around.

5th: Fixation, it can easily be pinned, sutured or even screwed. But the excellent adhesion of the membrane to the bony walls makes additional fixation unnecessary in most cases.

Exposure: Should be avoided, since fast bacterial resorption significantly reduces the barrier function of the thin membrane. In case of a dehiscence, the wound usually heals without complications by formation of free granulation tissue.

Soft Tissue Substitutes (Mucoderm®)

1st: Select the size of matrix size (15x20 mm, 20x30 mm or 30x40 mm)

2nd: Hydration in sterile saline solution or blood for 5 to 20 minutes. The longer in hydration, the more malleable the matrix becomes.

3rd: Trimming, use a scalpel or scissors to cut to the desired shape.

Type of flap: Split-thickness flap or full thickness flap can be used.

4th: Fixation of the matrix in the receiving bed can be with sutures, screws or tacks

5th: Suture, suturing of Mucoderm® helps to prevent micromovements and tension-free flap closure is always recommended.

Exposure: Mucoderm® should only be left for open healing, if a revitalization from the surrounding or underlying wound bed is ensured

Bone Substitutes (Cerabone®)

1st: Select the small (0.5–1.0 mm) or large (1.0–2.0 mm) granules and the amount (0.5, 1.0, 2.0, 5.0 cc) needed according to the clinical case.

2nd: Hydration of Cerabone® in sterile saline solution or blood is not required but recommended, as it facilitates handling and application of the particles.

3rd: Application, avoid compressing a lot the particles during application. Non compacted particles leave space for blood vessel ingrowth and formation of new bone matrix.

Exposure: It should not be exposed and it is recommended to use associated with Jason® membrane

Handling Tips

Healing Stimulators (Emdogain®)

1st: Emdogain® in oral regeneration: In order to carry out the chemical conditioning of the root surface, apply the Prefgel (EDTA at 24%) on the clean surgical bed for 2 to 3 minutes. Irrigate the region 3 times with 20 ml of sterile saline solution until complete removal of the Prefgel. Apply Emdogain® to the root surface for 1 to 2 minutes with as little contact with blood as possible. The product does not need to be removed.

2nd: Emdogain® in wound healing: Apply the product after the surgical procedure is completed on the sutures and soft tissues. The product must not be removed.

Healing Stimulators (Blue®m Oral Gel)

1st: For clinician application (at the office): 1-3 applications should be made for 5 to 10 minutes each. In the last application, the product must not be removed. It should be applied daily.

2nd: For cases of Periodontitis and Periimplantitis, in phase I of treatment (conservative - non-surgical), after instrumentation (scaling and root planing or curettage), apply the product inside the periodontal or perimplant pocket with the aid of a probe or syringe with a fine needle and keep the product without removal.

3rd: For application by the patient at home: the product should be applied with a cotton swab or finger 2-3 times a day.

Clinical Case 1:

Maxillary sinus floor repositioning with xenograft bone substitute and pericardium collagen membrane followed by immediately loaded implant.

A 54-year-old female patient, in good general health, with fracture of tooth 16. Cone-beam computerized tomography revealed extensive radicular and bone resorption in the region of tooth 16, with bone height of 2.06 mm.

After the minimally invasive extraction of tooth 16, a full thickness mucoperiosteal flap with two oblique releasing incision were reflected to expose the lateral wall of the sinus. A spherical diamond drill was used to cut a bone window and then the sinus mucosa was elevated, taking care not to perforate it, allowing for bone grafting and implant placement.

The sinus was grafted with Cerabone® (1.0-2.0 mm grain size, Straumann®, Switzerland) and a 5.0x10 mm Helix GM™ implant with Acqua™ (Neodent®, Brazil) surface was installed following the appropriate drilling sequence. The final placement torque was 50 Ncm. More Cerabone® was packed around the implant and a Jason® Membrane (Straumann®, Switzerland) was placed over the lateral window to prevent mobilization. The flap was then sutured. A universal abutment was installed (20 Ncm) and then a provisional crown was cemented.

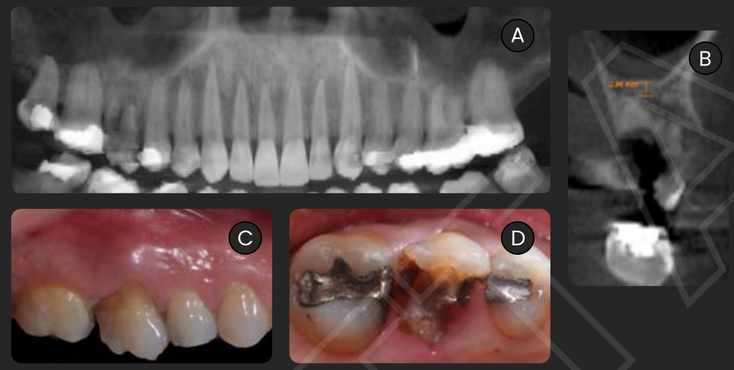


Figure 1 - A: Panoramic radiography revealing fracture of element 16; B: CBCT image of extensive radicular & bone resorption of the region; C and D: Lateral & occlusal photos of pretreatment conditions. [This case was conducted by Dr. Marcos Motta (Rio de Janeiro, Brazil)].

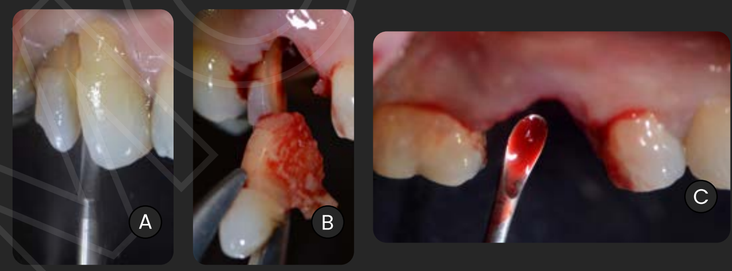


Figure 2 - A, B and C: Minimally invasive extraction of element 16.

Figure 3 - A: Lateral bone wall exposed by full-thickness flap; B: Bone window cut; C: Elevation of sinus mucosa.

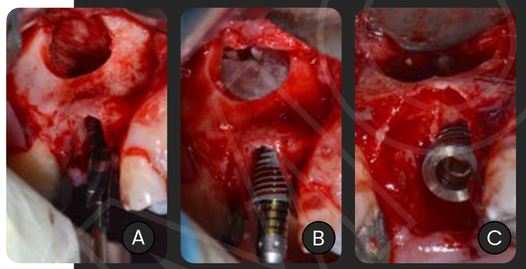


Figure 4 - A: Site perforation for Helix GM™ 5.0x10mm (Neodent®, Brazil); B: Implant placement in the grafted area; C: Its final position.

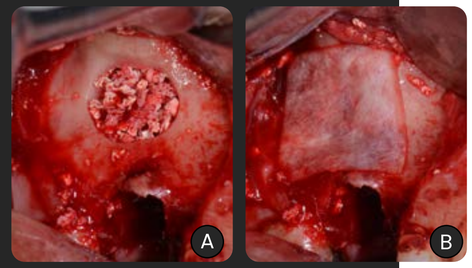


Figure 5 - A: Bone graft granules (Cerabone®, Straumann®, Switzerland) packed around the implant; B: Collagen membrane (Jason®, Straumann®, Switzerland) placed over the lateral window.

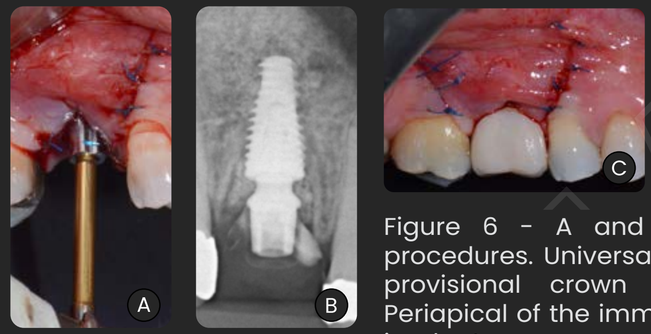


Figure 6 - A and B: Prosthetic procedures. Universal abutment and provisional crown installation; C: Periapical of the immediately loaded implant.

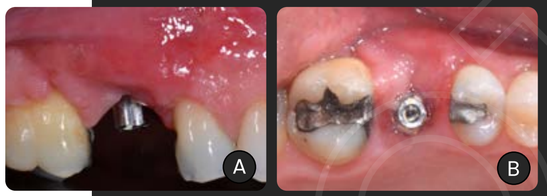


Figure 7 - A and B: Soft tissue aspect of the region seven days after surgery.

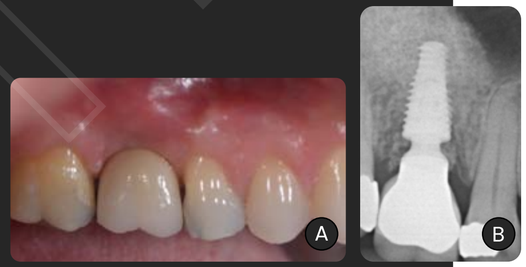


Figure 8 - A: Eight months after surgery, definitive metal-ceramic crown was installed. Lateral photo; B: Periapical radiography of definitive prosthesis installation.

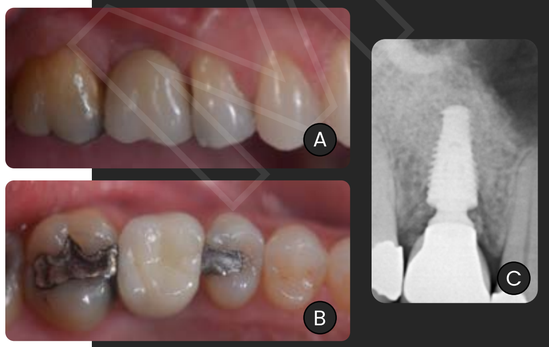


Figure 9 - A and B: 18 months follow-up visit. Lateral and occlusal photo of region 16; C: Periapical radiography [This case was conducted by Dr. Marcos Motta (Rio de Janeiro, Brazil)].

Clinical Case 2:

Oral rehabilitation with narrow implants and reconstruction of hard and soft tissues with xenograft bone substitute and collagen membrane (porcine-derived acellular dermal matrix).

In this clinical case, we present the oral rehabilitation with Neodent® Guided Surgery (NGS), reconstruction of hard and soft tissues, and immediate loading in the anteroinferior region of a 37-year-old female patient, in good general health. The patient's choice was reported that she wanted to have individual dental implants. Therefore, the treatment plan was to use 4 narrow implants (Helix Narrow, Neodent®, Brazil) due to the reduced mesiodistal space and thin bone thickness. For bone gain and soft tissue augmentation, the choice of biomaterials was Cerabone® and Mucoderm® (Straumann®, Switzerland).

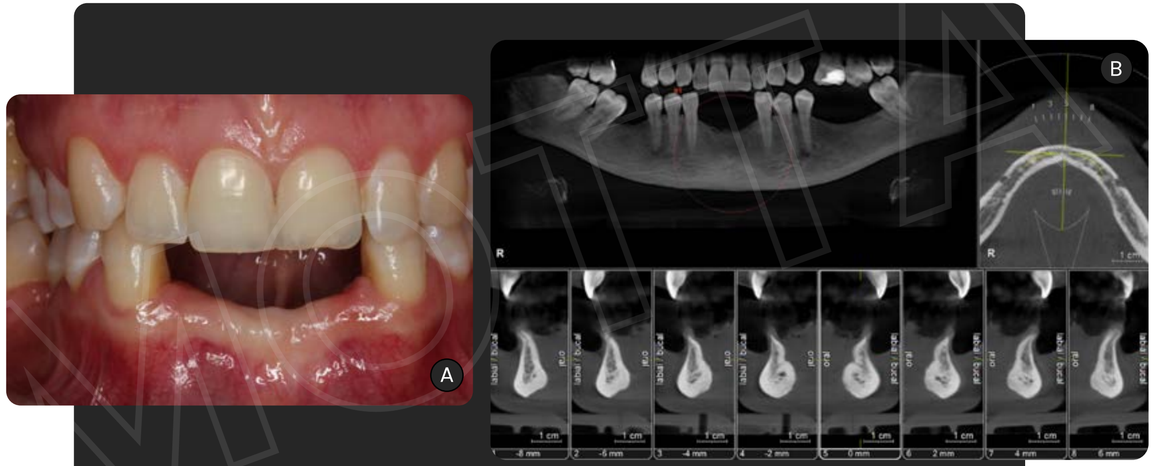


Figure 10 - A: Clinical image; B: Initial tomographic exam showing thin bone thickness in the antero-inferior region [This case was conducted by Dr. Geninho Thome (Curitiba, Brazil)].

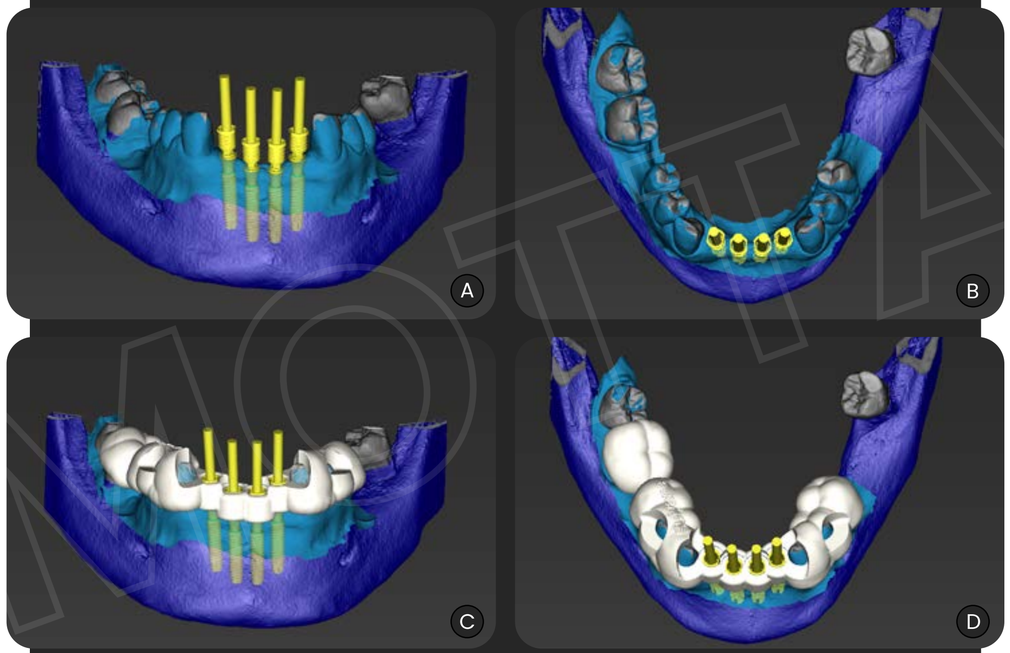


Figure 11 - A and B: Virtual planning with Straumann® coDiagnostiX™ Software. This software offers a diverse library of dental implants, in this case, the Neodent® Helix Narrow was selected; C and D: The surgical guide was made (C and D).

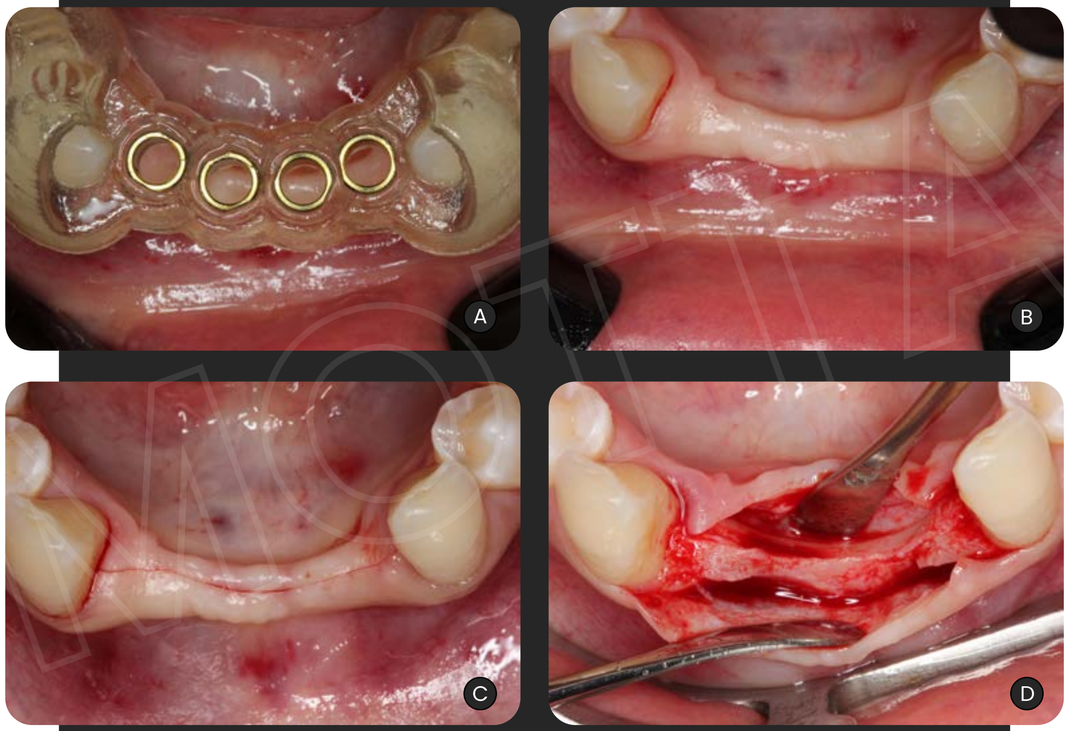


Figure 12 - A: One of the key points of guided surgery is the perfect adaptation of surgical guide, which is mainly visualized by the windows created in the adjacent teeth; B: In occlusal view of the antero-inferior region, an adequate band of keratinized gingiva over the bone crest and thin tissue thickness in the buccal region are observed; C: It was made an intra sulcular incision in adjacent teeth with incision over the bone crest; D: Followed by full thickness flap. Note the thin bone thickness.

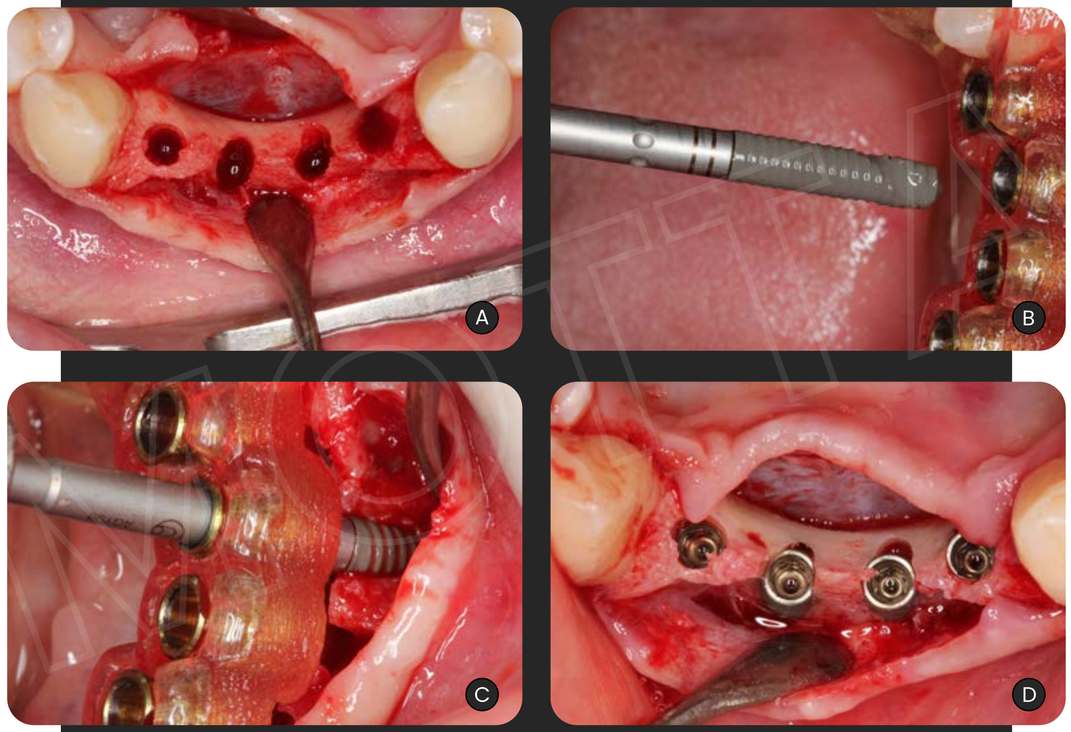


Figure 13 - A: Surgical instrumentation was performed in accordance with the manufacturer's guidelines for Neodent® Guided Surgery for Neodent® Helix Narrow Implants (Neodent®, Brazil). Occlusal view after perforations. Note that in both central perforations there was bone dehiscence; B and C: Narrow implants being installed; D: All 4 narrow implants placed with final torque over 32 Ncm.

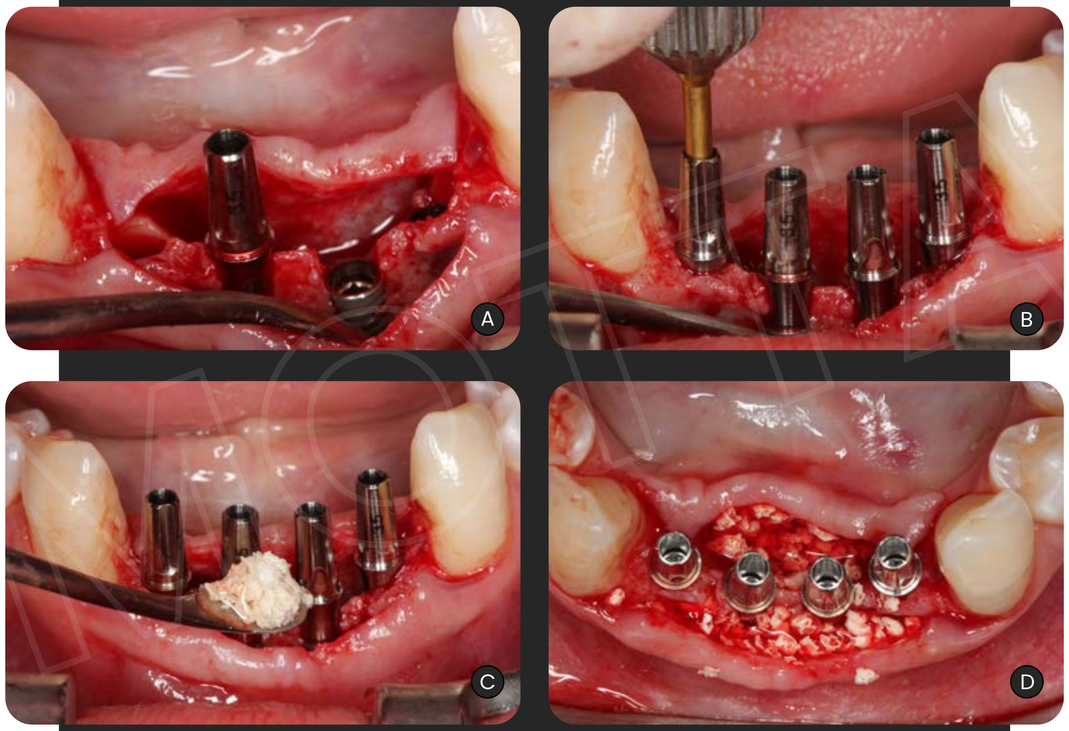


Figure 14 - A: 3.5 mm collar high abutments were selected; B: for the 4 implants; C: and the larger granules of bone graft (Cerabone®, Straumann®, Switzerland); D: was grafted in the buccal and lingual area.

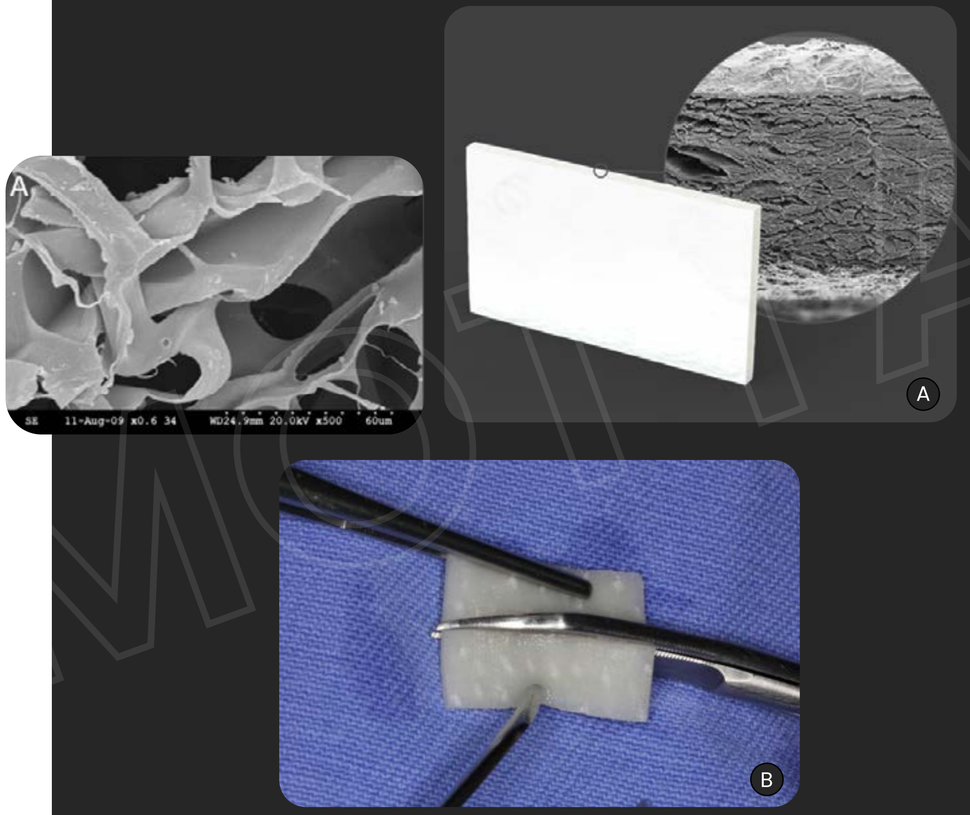


Figure 15 - A: In order to achieve tissue augmentation, the 20x30 mm three-dimensional[8]; B: collagen membrane (Mucoderm®, Straumann®, Switzerland) was chosen. The matrix was hydrated for 15 minutes and cut in half horizontally to be inserted into the surgical bed.

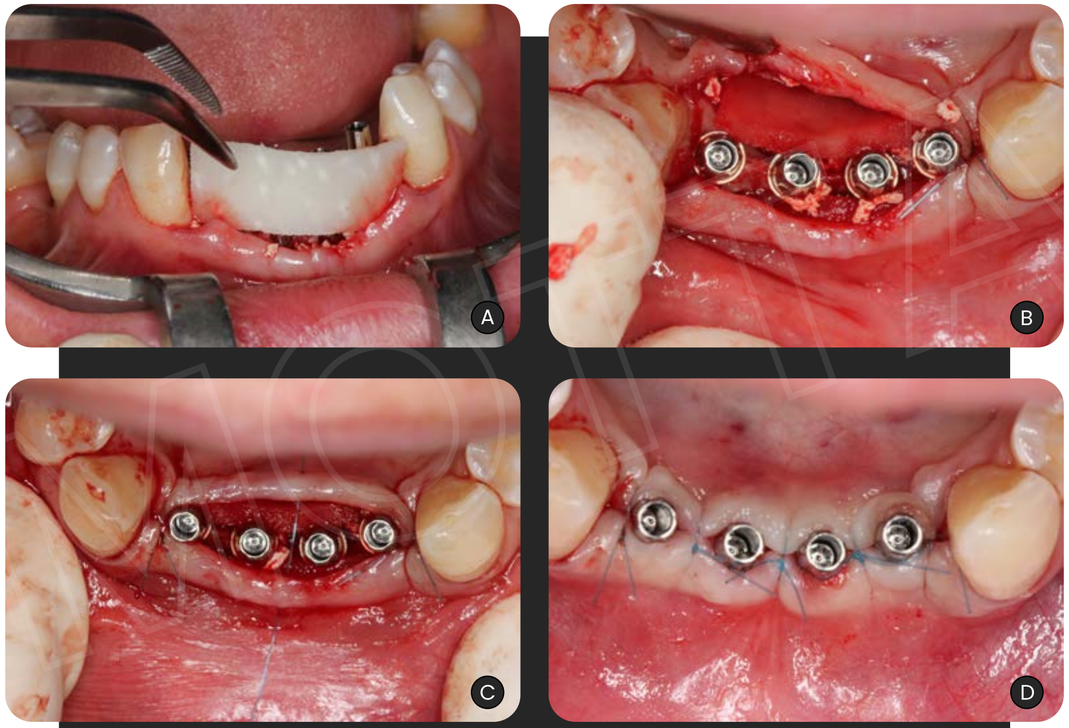


Figure 16 - A: The collagen matrix (Mucoderm®, Straumann®, Switzerland) inserted between the bone graft and the flap, both by buccally; B: and lingually; C and D: There was no suture in the matrix, only simple sutures, with polyamide nylon 5.0, for complete closure of the flap.

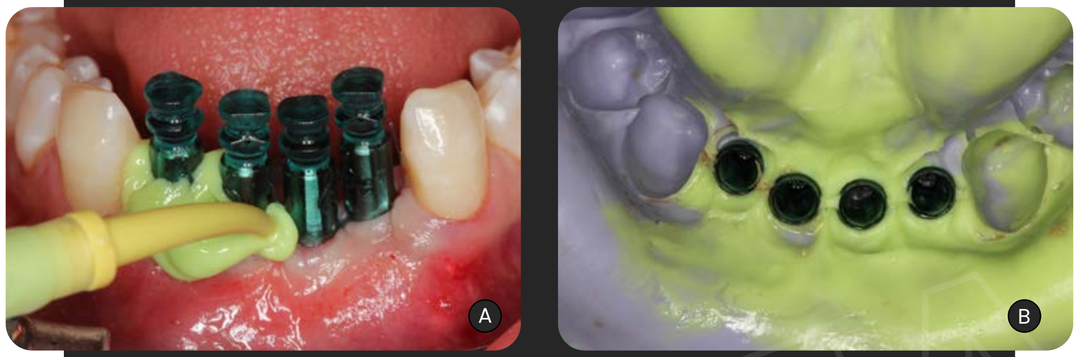
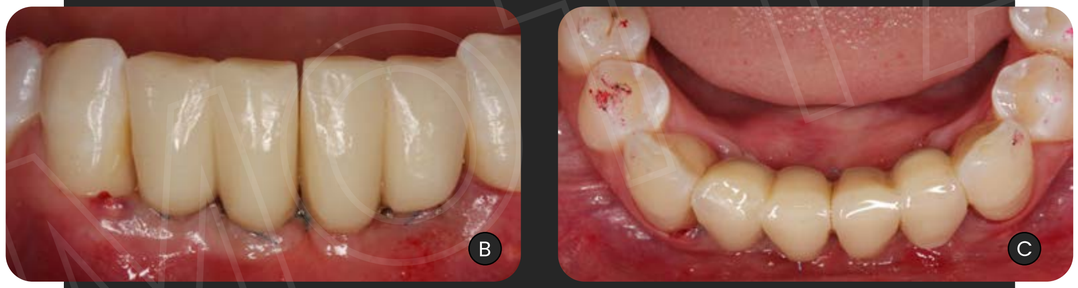


Figure 17 - A and B: The molding was made with light and heavy silicone.



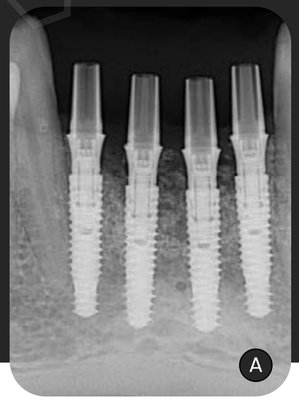


Figure 18 - A: Periapical x-ray of the immediate postoperative. B and C: The provisional prostheses were installed with proper adjustment of the occlusion.

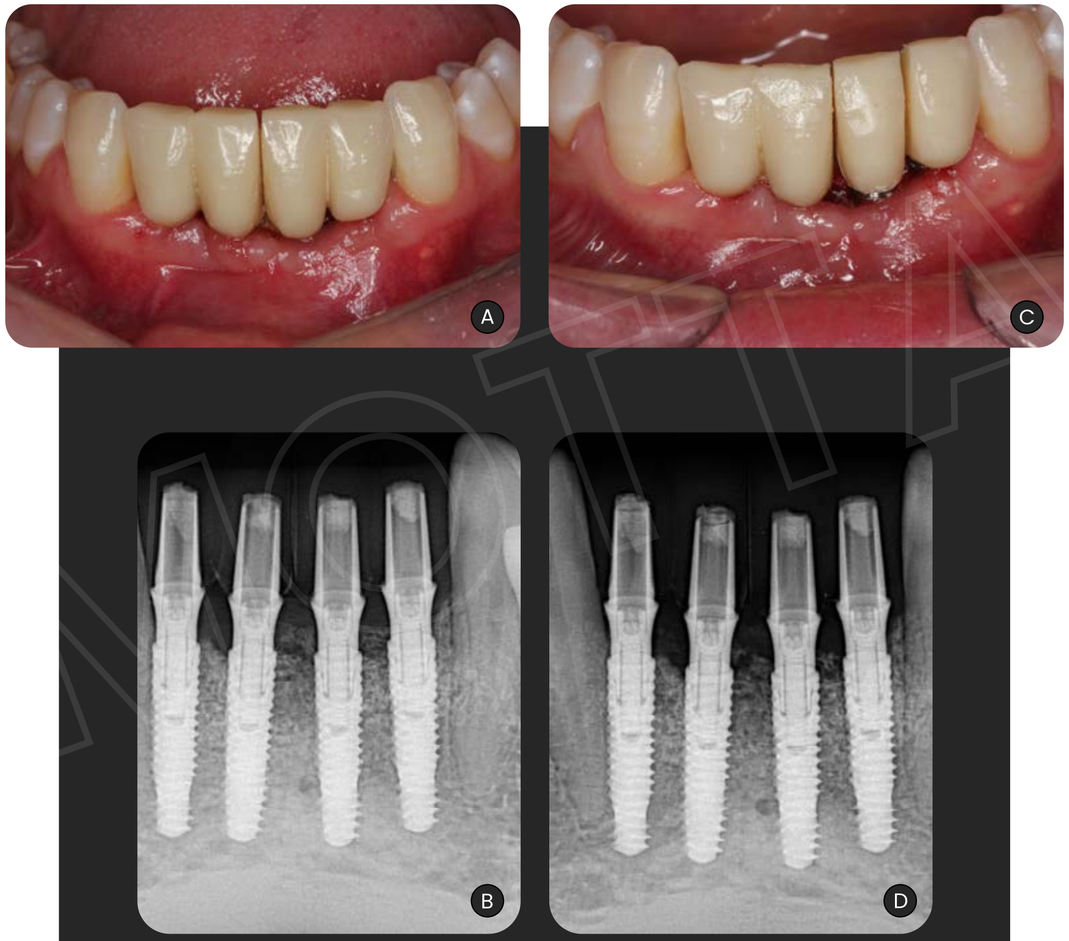


Figure 19 - A and B: Clinical and radiographic follow-up for 1; C and D: and 2 months.

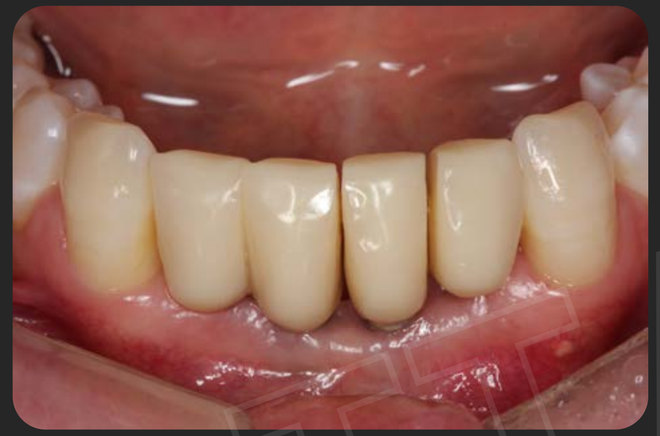


Figure 20 - Clinical follow-up for 10 months. Note the augmentation of soft tissue in buccal area.

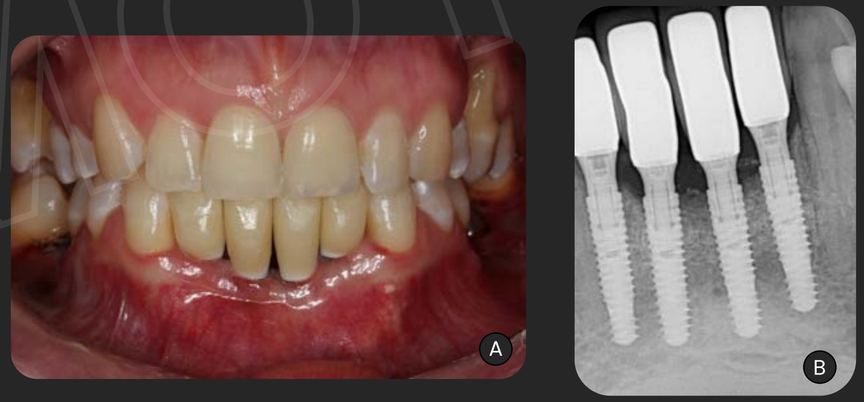


Figure 21 - Clinical (A) and radiographic (B) follow-up for 13 months, with the metal-free ceramic prostheses that were made by the CAD/CAM system [This case was conducted by Dr. Geninho Thome (Curitiba, Brazil)].

Clinical Tips for Narrow Areas

Adequate bone volume and interdental space are requirements for standard diameter implants[8]. Thus, implant supported rehabilitation in atrophic ridges with reduced bone width or regions with limited mesiodistal space, especially in the esthetic zone, could be challenging[9]. Although augmentation procedures, orthodontic treatment and teeth interproximal adjustments can be applied in these situations, they are time-consuming and costly[10]. As an alternative, narrow-diameter implants are a straightforward treatment option, presenting survival rates ranging from 93.8% to 100%. Some authors have suggested that osseointegration of narrow implants could be compromised due to reduced bone-implant contact area. However, several studies have reported that narrow implants have shown similar clinical and radiographic outcomes to regular implants, satisfying patients' functional and esthetics aspects[11,12,13].

The Helix GM™ Narrow implant is an innovative solution, designed to offer confidence in the rehabilitation challenging cases, with limited spaces.The implant with 2.9mm of diameter is produced using the most commercially pure and mechanically strong titanium grade 4 (Ti Gr 4) – maintaining Helix hybrid implant design – with heights of 10, 12 and 14 mm. Its design allows the achievement of good primary stability, which in combination with the Neodent® Acqua™ hydrophilic surface, allows predictability in immediate loading application.

Specific drills are used for freehand and guided surgery, combined in a single surgical cassette, providing versatility in case planning, and dismissing the need for the bone tap.

A screw-retained 16° Morse taper connection was designed to ensure a tight fit, for a stable abutment connection, with optimal sealing and strong mechanical resistance. The comprehensive prosthetic portfolio provides optimization of esthetic outcomes, allowing rehabilitation using cemented and screwed crowns, bridges, as well as overdentures, using conventional or digital workflows.

Clinical Case 3:

Helping soft tissue healing after flap dehiscence with slow oxygen release.

The patient, a 52-year-old female, systemically healthy, sought dental treatment to perform oral rehabilitation with a dental implant in the region of the tooth 11. We will show the use of oral gel (Blue®m, Netherlands) for helping soft tissue healing after flap dehiscence.

Oxygen plays an essential role in each stage of the wound healing process. It helps to increases host resistance to infection, stimulates the formation of collagen fibers and increase angiogenesis[9]. Thus, in recent years, new therapeutic approaches, based on Topical Oxygen Therapy (TOT), have been developed to support oral wound healing.

Focusing on the powerful benefits oxygen possesses within the healing process, the TOT products contain high concentrations of oxygen, in part derived from honey and others derived from sodium perborate. The active oxygen is released slowly when in contact with the wound[10] and those products are indicated as auxiliary therapy in healing .

The oral gel used in this case has a greater release of active oxygen, releasing 5 times more oxygen than other products (fluoride free toothpaste, mouthwash, toothpaste with calcium fluoride, oral gel, oxygen fluid, oral foam and mouth spray), and for this reason, its main indication is to use as auxiliary therapy in healing.

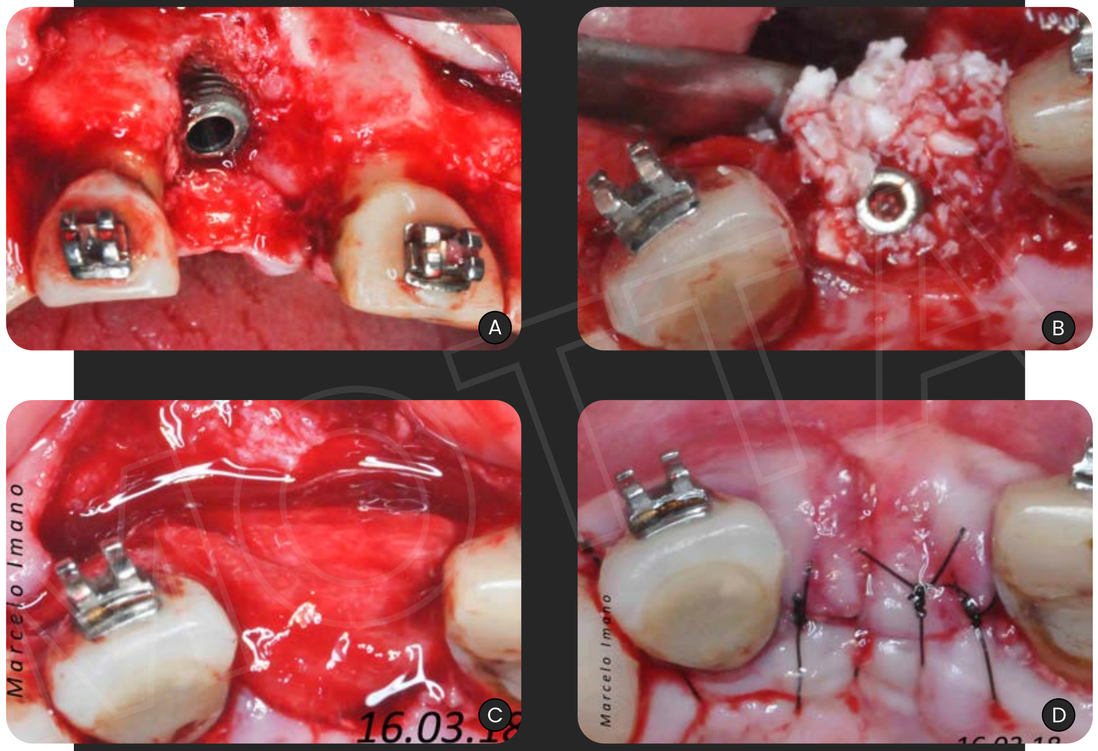


Figure 22 - A: This first figure shows the implant placement (#11) with exposed threads; B: placement of bovine bone graft; C: and collagen membrane; D: performing the Guided Bone Regeneration (GBR) technique followed by suturing the flap [This case was conducted by Dr. Marcelo Imano (Curitiba, Brazil)].

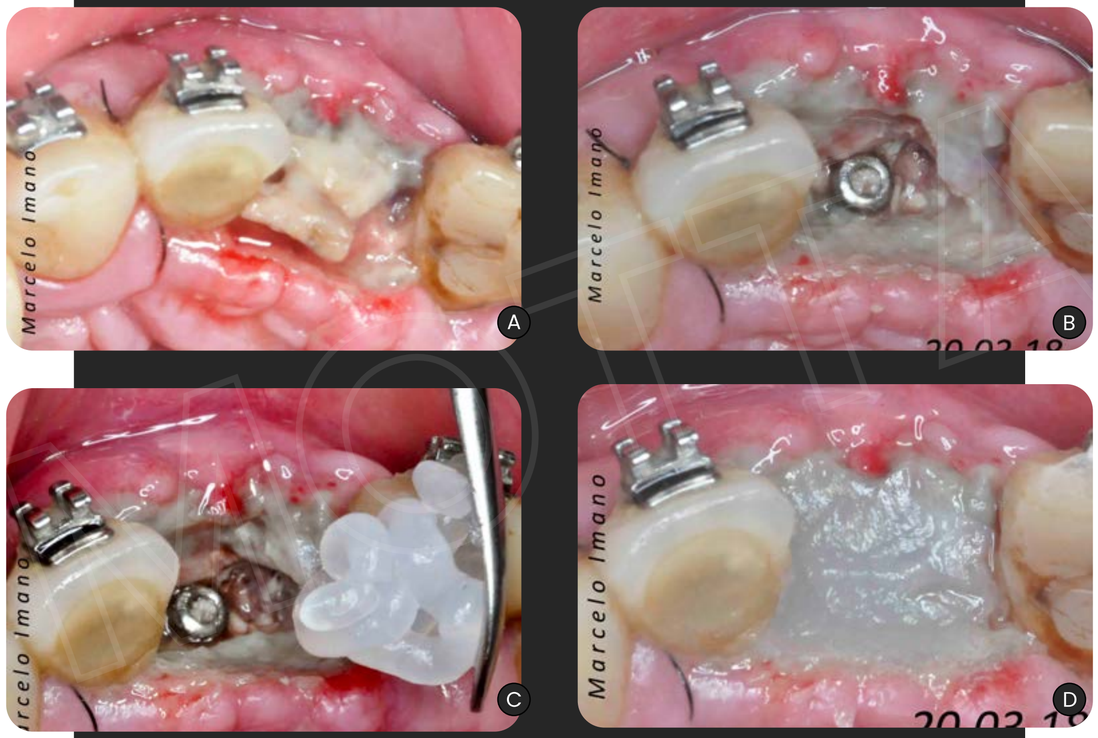


Figure 23 - A: Four days after the surgical procedure, the flap dehiscence occurred due to tension in the suture, with exposure of the membrane and the biomaterial; B: The patient reported pain and discomfort at the site, as well as strong odor. The remaining exposed biomaterials and the necrotic tissue were removed; C: which is very important to be done before applying the gel. In contact with water or tissue fluid, sodium perborate (oxygen source) is converted into sodium borate and H_2O_2, and small quantities hydrogen peroxide are released very gradually. This slow oxygen release, stimulates cell migration, angiogenesis and collagen fiber formation. The oral gel (Blue®m, Netherlands) was applied; D: which remained in the defect for 10 minutes. After 10 minutes, the gel was removed with saline solution and two more applications were performed in the same way. In the 3rd application, the gel was not removed and only analgesic medication was prescribed.

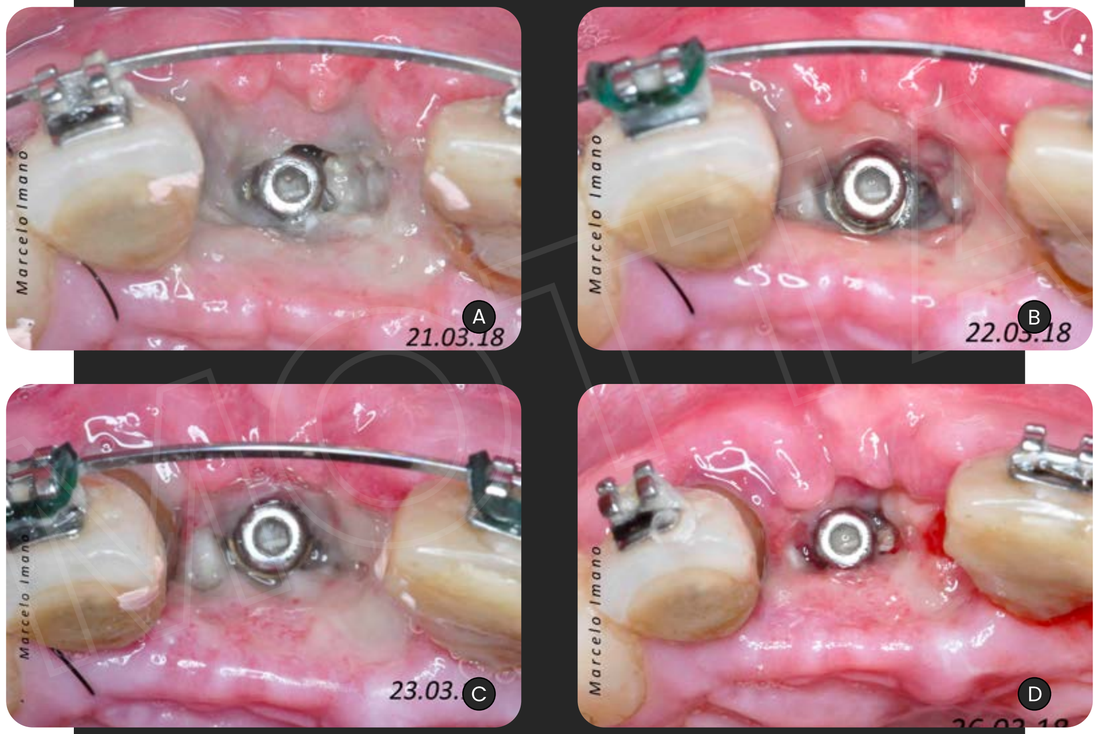


Figure 24 - A: The patient was requested to return to the office aften. After the 1st application of the oral gel (1st patient visit), it was already possible to observe an improvement in the tissue status; B: At each patient´s visit, the oral gel was applied 3 times, leaving the product to act for 10 minutes for each application, and in the last one, the gel was not removed. After the 2nd oral gel application, the formation of living tissue has already begun - granulation tissue was observed; C: and the patient has no more pain complain. After the 3rd application (3rd patient visit), there was a reduction of the necrotic tissue with healthy tissue formation and the beginning of wound closure; D: After the 4th application (4th patient visit - 6 days after flap dehiscence), it was observed continuous improvement in wound healing and wound closure by second intention.

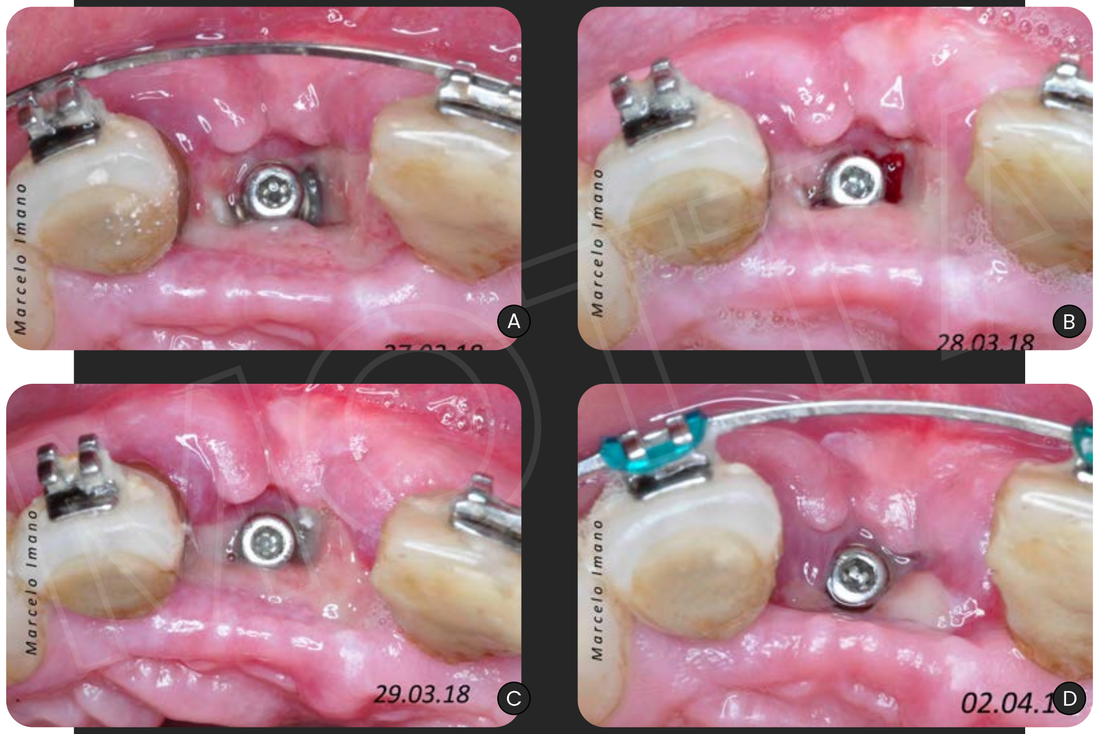


Figure 25 - A: In the figure is possible to observe the wound healing after the 5th application (5th patient visit - 7 days after the flap dehiscence). An excellent clinical improvement was observed, with the presence of epithelialized tissue and continuous wound closure; B: The daily clinical improvement was observed: after the 6th application; C: as well as after the 7th application; D: and the 8th application - 12 days after flap dehiscence.

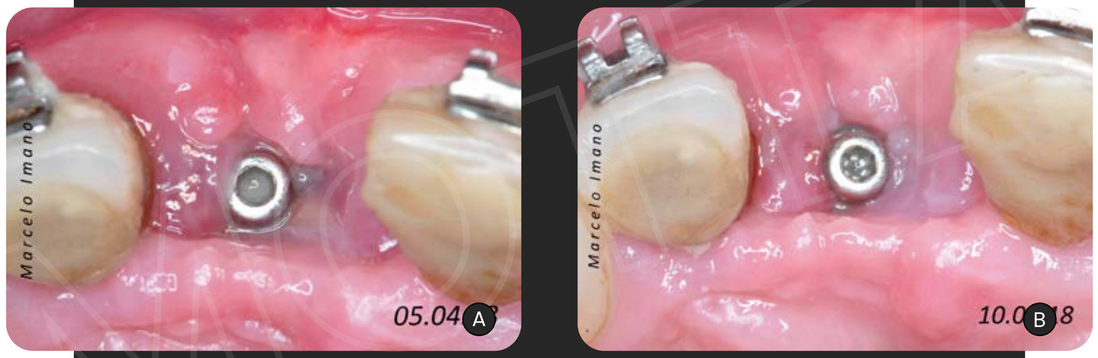


Figure 26. A: Fifteen days after the flap dehiscence, it is possible to observe the fully epithelialized wound, with almost complete closure; B: At 20 days after, the wound is completely healed. It is important to emphasize that no type of suture was performed or antibiotic therapy, just the use of oral gel almost every day on the post-operative visits.

The application of oral gel (Blue®m, Netherlands) can be done by the professional at the office or by the patient at home. When done by a professional, it is recommended to apply it once a day, ideally. The professional can choose to apply the product, leaving it to act for 5 to 10 minutes, irrigate with saline solution and apply the product again and dismiss the patient from the consultation with the gel in the wound. If the oral wound is larger, the application can be made as described in this clinical case.

If the oral gel is applied by the patient at home, it is recommended by the manufacturer to apply it 2-3 times a day. The patient can apply it with a cotton swab or with the finger, always with great care and leaving a thick layer of gel on the wound.

Clinical Case 4:

Helping soft tissue healing with slow oxygen release.

The patient, a 47-year-old female, systemically healthy, sought dental treatment because she had a fracture in tooth 14. The minimally traumatic extraction was performed and an immediate implant was placed in the region of tooth 14. The gap was filled with a bovine bone graft. At the same surgical time, the crown lengthening surgery was performed on tooth 15. Four days after surgery, the patient returned, reporting pain, and, on clinical examination, healing by second intention was observed. We will show the use of oral gel (Blue®m, Netherlands) for helping soft tissue healing (Figures 27 to 30).

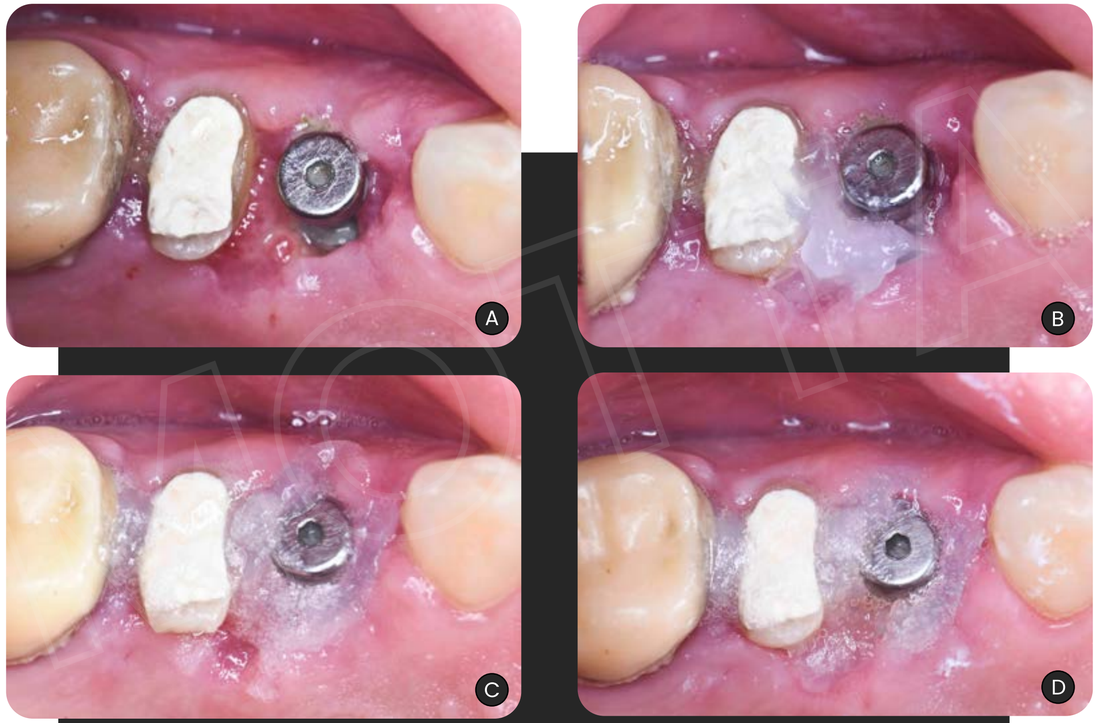


Figure 27 - A: The figure shows the surgical region 4 days after the surgical procedure, when the sutures were remove; B: The region was cleaned with a cotton ball with the mouthwash (Blue®m, Netherlands) and second intention healing was observed. The oral gel was applied; C: but the application must be done to the full extent of the defect, with a thick layer; D: After 10 to 15 seconds of the gel application, it is already possible to observe the release of oxygen. The small bubbles show the its release. One of the advantages of this products is the controlled and slow release of oxygen in the wound. The oral gel is applied three times (10 minutes each) and the last application, the gel was not removed from the wound and the patient was released.

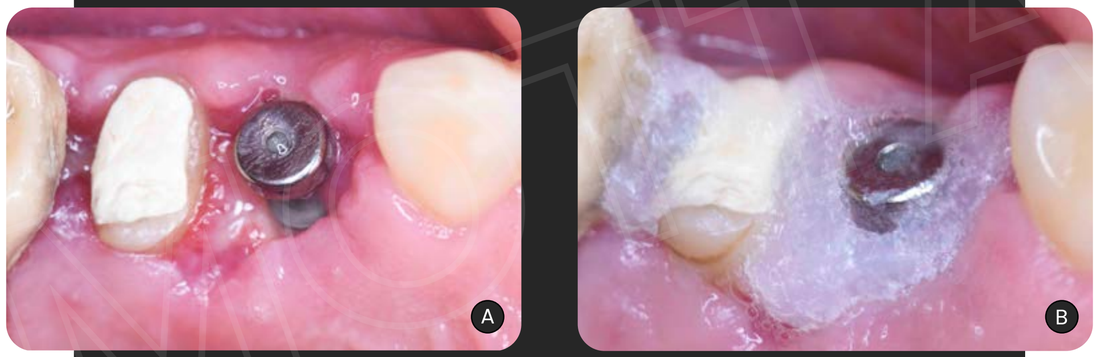


Figure 28 - A: On the day after, the patient return for a second follow-up visit without any pain. With just one oral gel application, it is noted an improvement on the tissue status, apparently with less inflammation; B: During this visit, it was applied the oral gel for the 2nd time, three applications of 10 minutes each. In the last application, the gel was not removed from the wound and the patient was released.

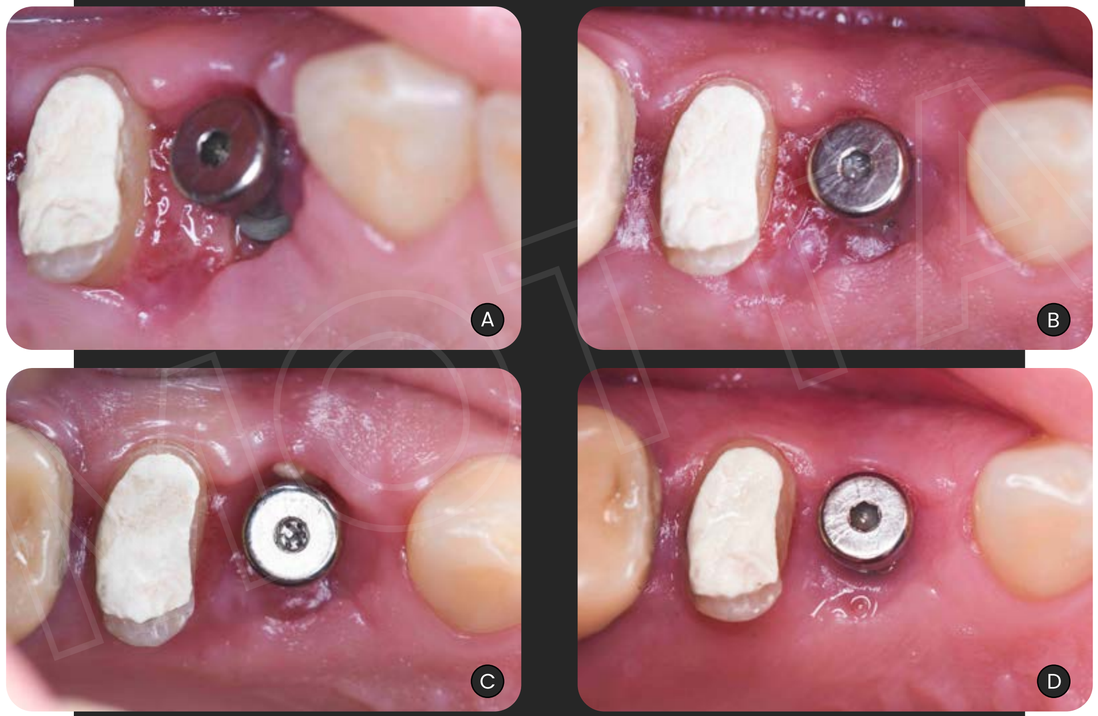


Figure 29 - A: Third follow-up visit, on the day after the previous one. After two oral gel applications in consecutive days, it was observed the healing process with the formation of granulation tissue; B: At this visit, the 3rd oral gel application was made as the previous one. The 4th follow-up visit was 5 days after (8 days after the 1st visit). It was possible to observe the complete wound closure with epithelialized tissue, after only 3 applications; C: On this day, the oral gel was applied again, 3 times of 10 minutes each. Among the post-operative follow-ups, the patient was instructed to perform careful oral hygiene and rinse every 8 hours with the mouthwash. In the fifth follow-up visti, 10 days from the 1st one, it was observed an significant improvement in wound healing; D: At this visit, the application was made once more, in the same way as the previous times. After 60 days of follow-up, the tissues were completely healed and with normal clinical appearance, including the formation of keratinized tissue.

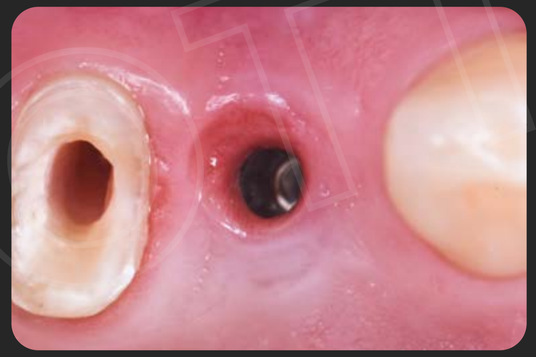


Figure 30 - Five months follow-up visit, ready to initiate the prosthetic rehabilitation [This case was conducted by Dr. Marcelo Imano (Curitiba, Brazil)].

As in the previous clinical case, the option was to apply the oral gel at the office, to carry out a photographic record of the case. However, the patient can perform the application at home, being recommended 2 to 3 daily applications.

Oral gel has also been used with excellent clinical outcomes in the periodontal treatment and peri-implant pockets. The product must be applied inside the pockets, with the aid of a syringe and fine needle, after scaling and root planning and/or curettage of the granulation tissue has been performed. Furthermore, the oral gel can be used as a product for chemical decontamination of the root, the surface of the dental implant or after removal of a periapical lesion.

Just as oxygen stimulates angiogenesis and collagen fiber formation, the local application of Emdogain® (Straumann®, Switzerland) immediately after the surgical or periodontal procedure has also shown promising clinical results11 in terms of stimulating healing[12] and increasing dimension of the keratinized tissue[13].

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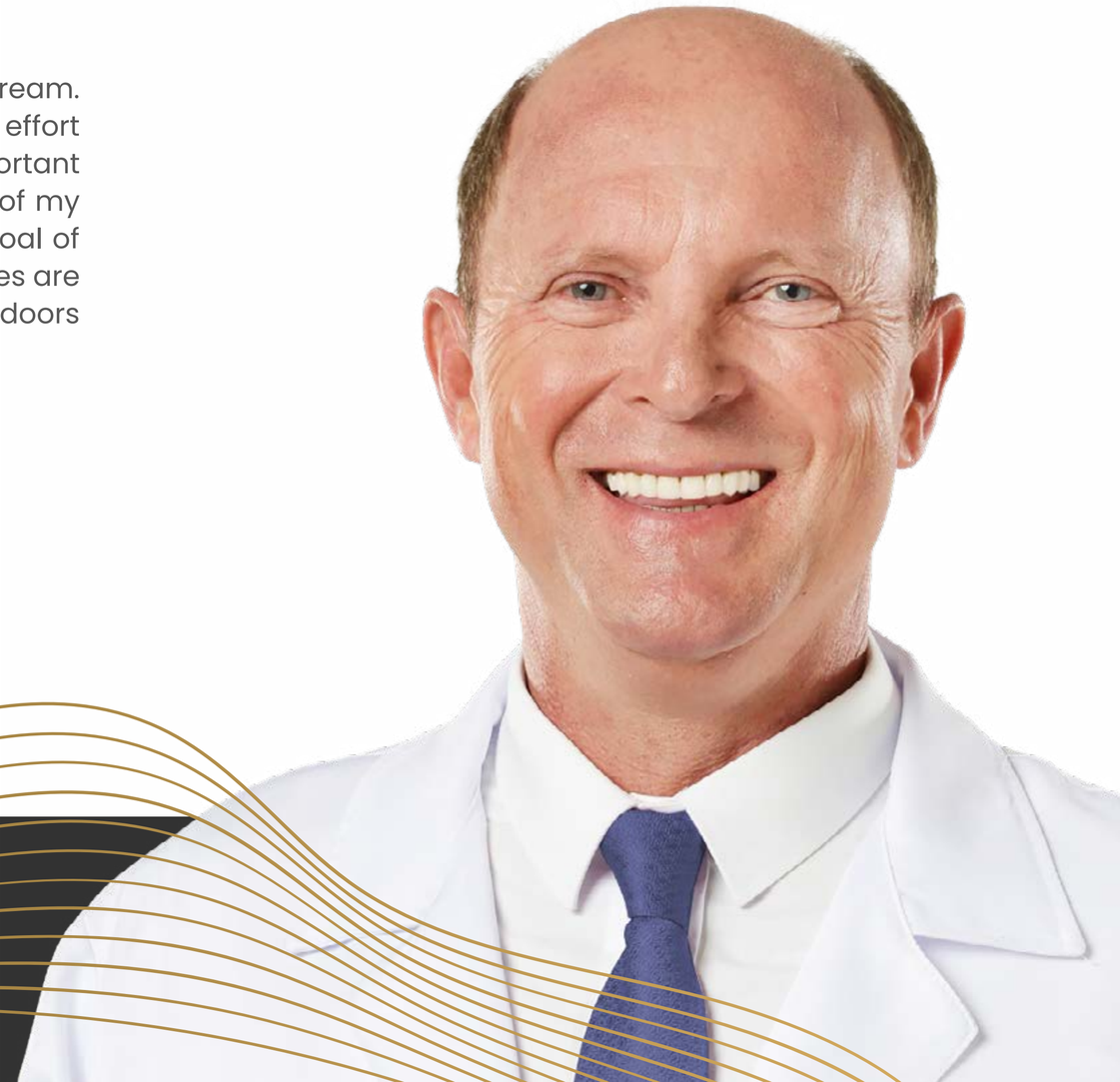
Geninho Thomé, DDS, M.Sc., PhD.



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