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Case Report

MTG TECHNIQUE: A NOVEL MINIMALLY INVASIVE APPROACH FOR SOFT TISSUE AUGMENTATION BY MEAN A HIGH-DENSITY DERMAL MATRIX. A TECHNICAL NOTE

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ABSTRACT

In the following case report, the authors describe a case of single implant-prosthetic rehabilitation in the dilatory sector in which the high-density dermal matrix was successfully used with a specific technique (MTG) and had an excellent result in terms of increase in the peri-implant soft tissues both vertically and horizontally without the need to perform autologous tissue sampling or complex positioning of membranes (absorbable or non-absorbable).

KEYWORDS: *soft tissue augmentation, biomechanics, high consistency dermal matrix, scaffold-like structure, periodontal surgery, full-thickness flap, minimal invasiveness*

INTRODUCTION

In recent years, there has been a growing demand for aesthetic dental medicine among patients, leading to increased sensitivity in periodontics and implant prosthetics. This aspect includes the management of gum recession on natural teeth or restoration in not adequate supra crestal tissue height around dental implants. Periodontal surgery plays a crucial role in addressing periodontal defects and deficiencies, aiming to restore the health and function of periodontal tissues. Applying the connective tissue graft technique and a high-consistency dermal matrix presents an innovative approach for managing soft tissue defects and deficiencies in periodontal care (1, 2).

In this case report, the Authors present an innovative technique called Matrix Tissue Graft (MTG) for horizontal and vertical volumetric enhancement of crestal and supra-crestal soft tissues, which utilizes a high-consistency xenogenic dermal matrix (OsteoBiol® Derma 2mm, Tecnoss®, Giaveno, Italy). It differs from other techniques for tissue thickening using autologous tissue due to its reduced invasiveness and distinguishes itself from both the former and those involving the use of heterologous or synthetic tissue for two fundamental reasons: the matrix is positioned beneath a full-thickness muco-periosteal flap and in contact with the bony crest; the matrix is not secured with any fixation aid but is enveloped within the muco-periosteal flap. Periodontal surgery has witnessed significant progress in tissue augmentation and

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distraction techniques, along with the adoption of biomaterials. These developments have brought about a transformative impact on soft tissue implantation (3-6).

Soft tissue management plays a leading role in cosmetic and reconstructive surgeries, facilitating the restoration and improvement of tissue volume, contour, and function. Nonetheless, traditional approaches that rely on synthetic implants or autologous grafts can be linked to complications, restricted graft availability, or morbidity at the donor site. In place of traditional methods, the high-consistency OsteoBiol® Derma has come to the forefront, presenting the exciting potential for tissue augmentation and distraction in periodontal surgery (1, 2, 7, 8).

The high-consistency OsteoBiol® Derma exhibits numerous favorable characteristics for soft tissue implantation. Its scaffold-like structure offers a three-dimensional framework that stimulates cellular ingrowth and tissue regeneration, facilitating seamless integration with the surrounding tissues and leading to more natural and long-lasting results. Despite excellent results reported in *in vitro* and experimental studies, there is still limited availability of comprehensive multicentre clinical studies that assess its effectiveness, safety, and long-term results in tissue augmentation and distraction for soft tissue implantation in periodontal surgery (1, 2, 7-9).

The main goal of this article was to evaluate the efficacy of an innovative technique utilizing an OsteoBiol® Derma, attaining the most favorable results in soft tissue augmentation for periodontal and implant applications characterized by minimal invasiveness.

Moreover, the paper identifies potential areas for further research, providing valuable guidance for clinicians and researchers eager to utilize the high-density OsteoBiol® Derma for periodontal and implant surgical purposes.

MATERIALS AND METHODS

A 42-year-old male patient, non-smoker, with an ASA 1 classification, presented to our clinic seeking a solution for a single intercalated edentulism in the location of tooth 14. According to the patient's account, the tooth was removed about 4 years ago due to complications related to endodontic surgery. The patient needed a solution to address both the functional and aesthetic deficiencies, which involved the placement of a fixed prosthesis supported by an endo-osseous implant.

The residual alveolar ridge showed a marked transversal and vertical deficit also observable from the soft tissue morphology (Fig. 1). The consequent CBCT exam (essential for correct and safe implant planning) performed for diagnostic purposes to evaluate residual bone volumes showed a deficit comparable to that one detected by direct clinical observation of the lining soft tissues.

Fig. 1. *Pre-surgery patient's oral situation.* ***A****): Direct view showing lack of vertical keratinized tissue* ***B****): Occlusal view showing lack of thickness of keratinized tissue.*

Therefore, in addition to the CBCT exam, we performed an intraoral scan using a 3-shape trio scanner and included the patient in the control group for treatment with an OsteoBiol® Derma for soft tissue augmentation to improve the thickness of both peri-implant and supra-crestal soft tissues.

The overlap between the bone volumes of the CBCT and the soft tissues detected by the intraoral optical scan showed a thickness of the supra-crestal soft tissues of 1.8 mm; these data were subsequently confirmed by the direct intraoperative surgical control performed. The residual bone volumes were sufficient and suitable for a standard-sized implant insertion without further procedures. Hence the patient was offered a double treatment involving the insertion of an endo-osseous implant and the simultaneous thickening of the crestal and supra-crestal soft tissues, which were instead deficient for a suitable prosthetic rehabilitation from a functional and aesthetic point of view.

Once the informed consent was obtained and signed by the patient for the proposed treatment, he was provided with the hygiene and dietary instructions to follow before, during, and after the implant-prosthetic treatments. Moreover, the main periodontal indices were marked after the professional oral hygiene session. Once the absence of clinical signs attributable to periodontal disease was detected, the patient was prescribed antibiotic therapy using amoxicillin + clavulanic acid tablets of 1g to be taken every 12 hours (2 in a day) starting from the day before the operation and to be

taken for a further 5 days with the same frequency. Therapy with chlorhexidine 0,12% mouthwash was also administered once a day, to be performed 1 day before the operation and followed for a further 2 days.

The surgery involved the administration of loco-regional anesthesia with articaine 4% infiltration (adrenaline 1:100.000). Then, a full-thickness mucoperiosteal surgical flap was elevated using a 15c blade. The main incision extended from the center of the ridge, dividing the keratinized mucosa present into two equal portions, lingual and vestibular. The flap was then perfected through full-thickness medial and distal relief incisions from the primary ones with a divergent trend and without affecting the papillae of the adjacent elements reaching the muco-gingival line.

The osteotomy preparation with progressive drills was performed, and the implant was inserted with an implant micro-motor recording a peak torque of 55 N/cm2 (cone in 3p Devices Torino®). A trans-mucosal healing screw with a diameter of 3.8 mm was then positioned on the implant. The vestibular detachment of the full-thickness flap between the two relief incisions was stretched gently with anatomical forceps to check sufficient space for the matrix and make it suitable in terms of length and width for the consequent covering and stability.

The OsteoBiol® Derma 2 mm was separately stored in the greatest possible sterility, adequately shaped, and then positioned without any fixation aids. The flap was then sutured using a 4/0 PTFE thread and a 16 mm taper cut needle with simple detached stitches without placing other protective structures such as membranes or others (Fig. 2). No immediate prosthetic loading was performed.

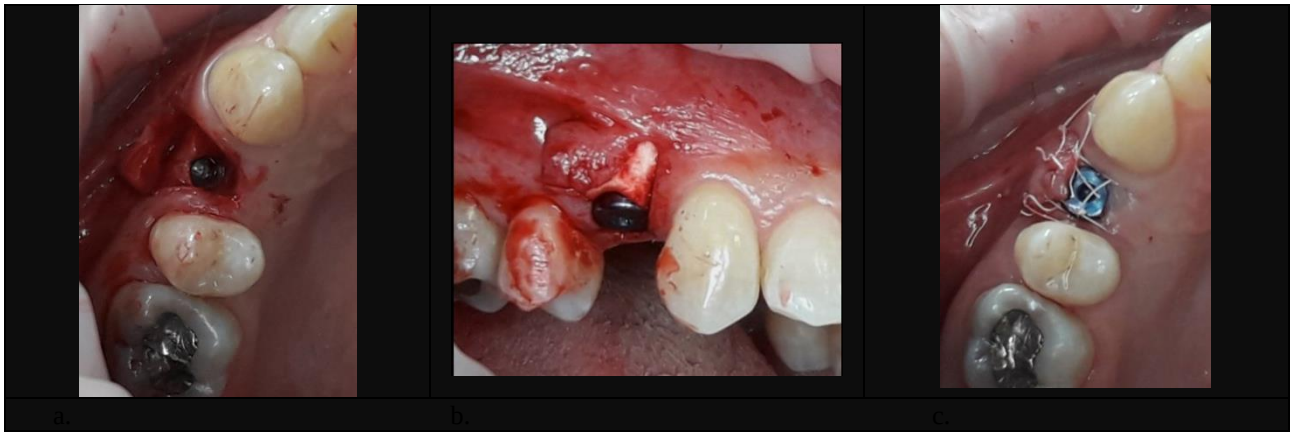

Fig. 2. ***A****): implant placement with the specific design of the flap;* ***B****): addition of OsteoBiol® Derma 2 mm without fixation aids;* ***C****): end of surgery with trans-mucosal healing, stitches, and primary closure.*

Once the tissues had fully matured, approximately after 3 months of healing time, we proceeded to create a temporary prosthesis for the implant. This temporary prosthesis utilized a PMMA temporary abutment for a single screw-retained prosthesis. Approximately 30 days later, we took an optical impression to reevaluate and gather precise measurements, and this information was used to fabricate the final prosthetic product. The definitive prosthesis was then placed 15 days after the optical impression was taken.

Almost complete maturation of the tissues with stabilization and tissue increase (both horizontal and vertical) is evident at the 6-month follow-up and 1-year follow-up with a definitive crown (Fig. 3-6). A further scan clinical control is expected in 2 years. The scans obtained will be compared using image superimposition software (Fig. 7, 8).

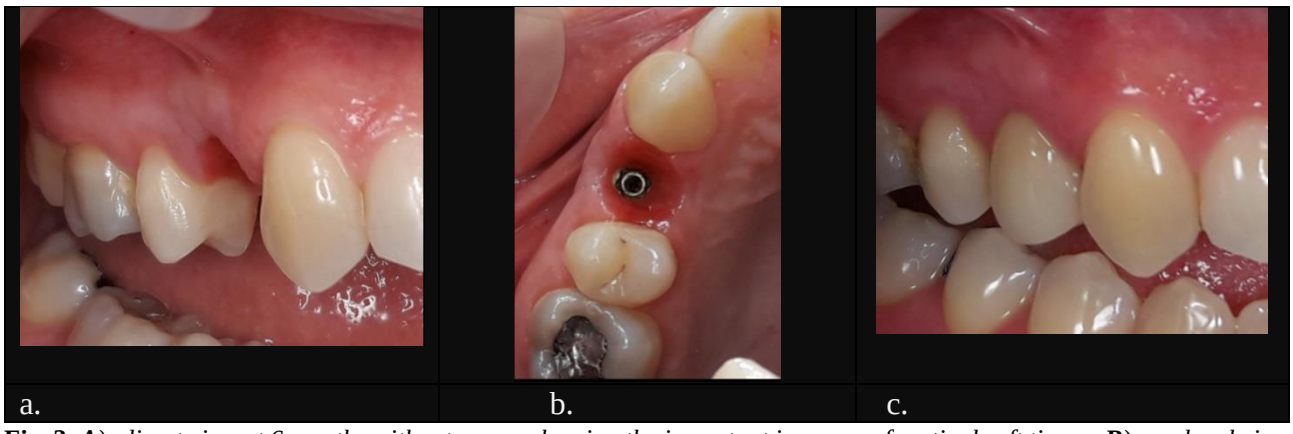

Fig. 3. ***A****): direct view at 6 months without crown showing the important increase of vertical soft tissue;* ***B****): occlusal view of implant's head with increase of thickness of soft tissue at 6 months;* ***C****): direct view at 12 months with the definitive crown.*

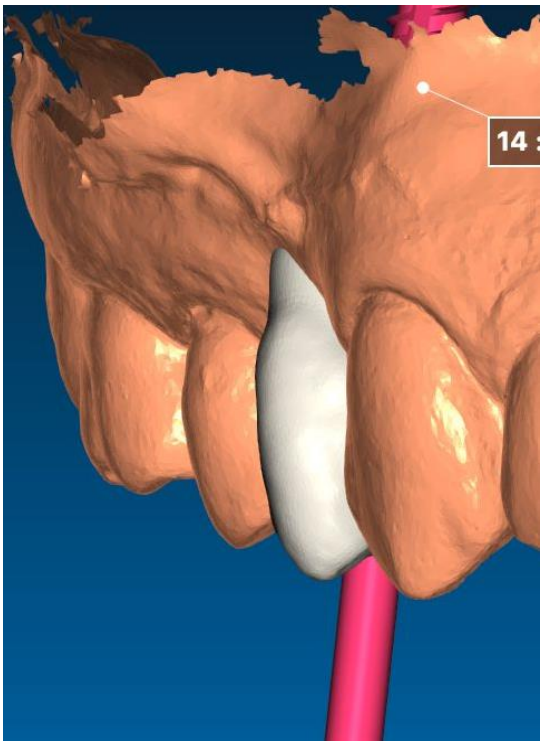

Fig. 4. *Digital planning of screw-retained implant-supported prosthesis.*

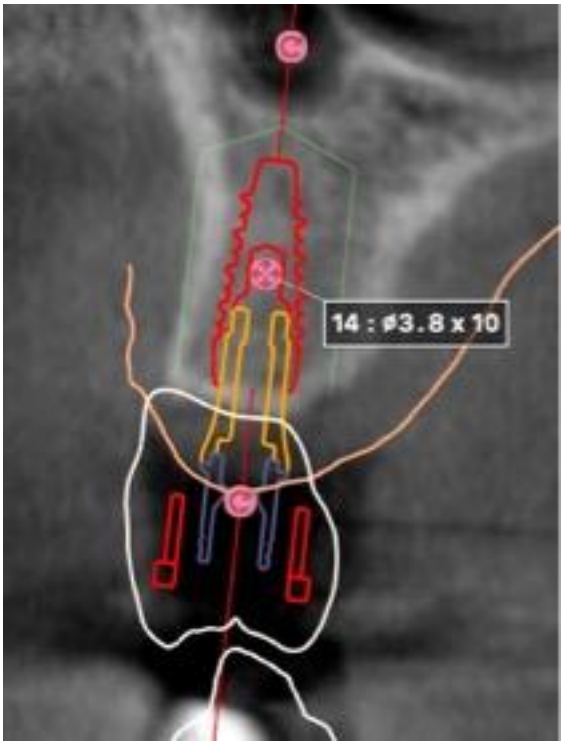

Fig. 5. *Digital surgical and prosthesis planning with superimposed file .stl*

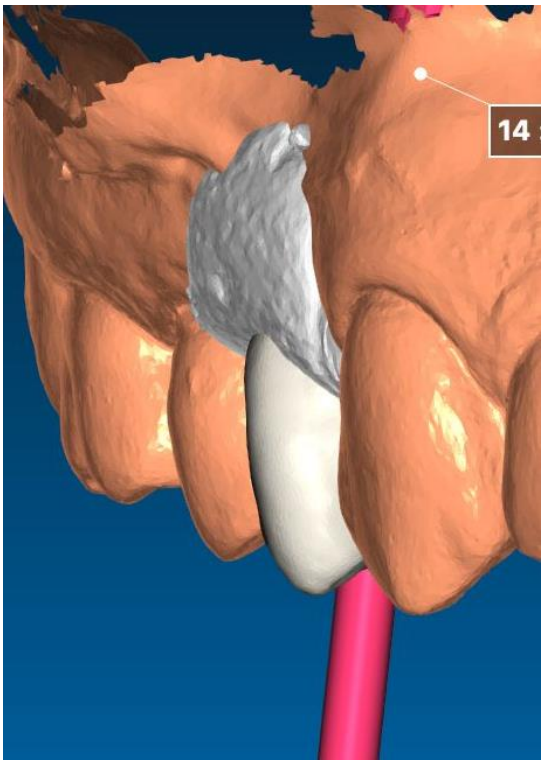

Fig. 6. *Digital planning of screw-retained supported prosthesis and super of scanned mtg graft in Stl file.*

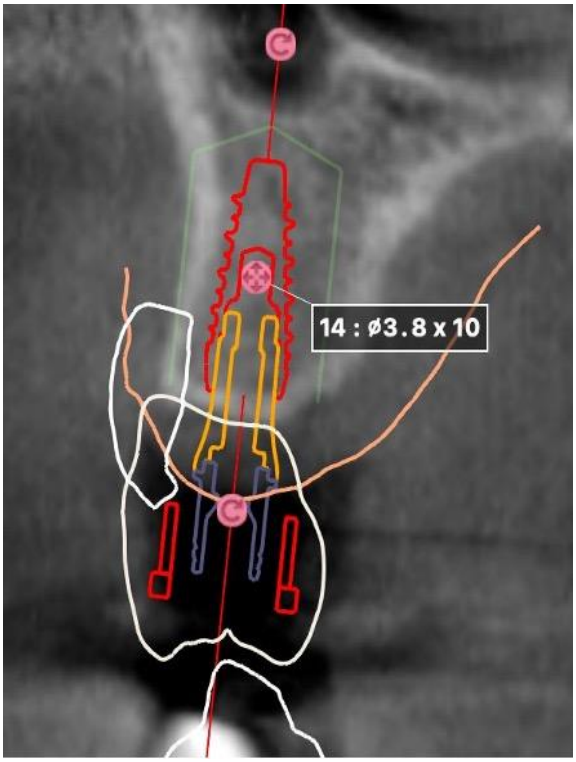

Fig. 7. *Cross section of the screw-retained implant. Implant-supported prosthesis planning imposition with superimposition of a double Stl. File (soft-tissue profile and derma graft upgraded from a Stl file Library).*

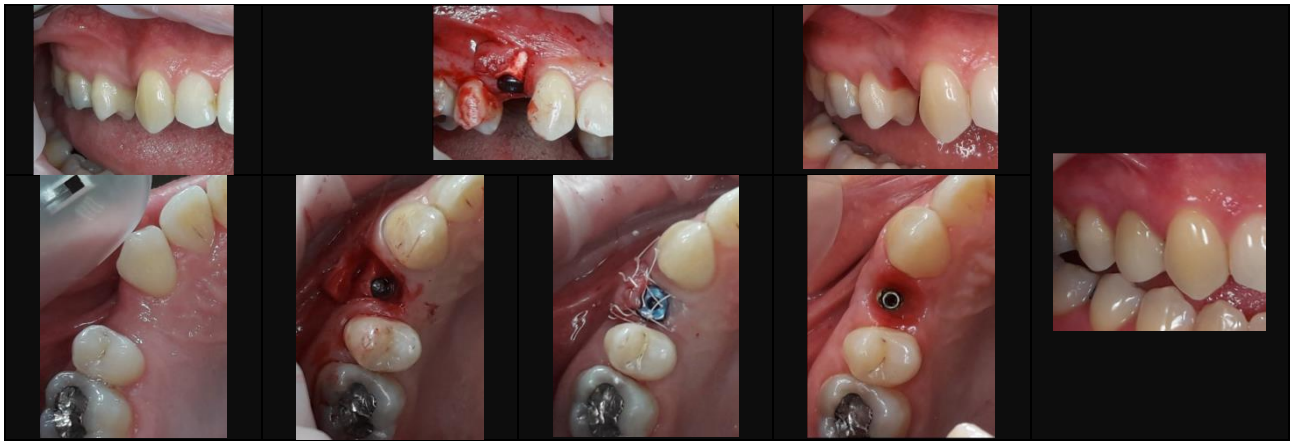

Fig. 8. *Summary of a composite of the technical note.*

DISCUSSION

MTG is a technique for enhancing the horizontal and vertical expansion of crestal and supra-crestal soft tissues. It involves the utilization of an OsteoBiol® Derma with a high level of consistency. It stands apart from conventional methods used for tissue thickening with autologous connective tissue due to its reduced invasiveness, eliminating the need for tissue sampling. Moreover, it differs from procedures that employ heterologous or synthetic tissue for two crucial reasons:

1. Reduced invasiveness: the matrix is positioned under a full-thickness periosteal mucus flap and in direct contact with the bone crest on one side and with the periosteal of the flap itself on the other;
2. Distinctive approach: the matrix is not stabilized with any fixation aid but placed in the correct position after careful preparation of the flap (10-14).

In this way, the morbidity of complex, multiple operations is significantly reduced, sampling is unnecessary, and all the additional inherent positioning and stabilization issues of membranes are avoided.

The OsteoBiol® Derma is characterized by a high consistency, which allows stable volumetric maintenance throughout the first surgical phase of soft tissue healing generated by the trauma of implant insertion. The thickening of the peri-implant soft tissues with site-specific biotype variation is the current focus in implant-prosthetic regeneration for medium and long-term maintenance and success. Normally, this thickening is performed with connective or epithelial-connective grafts, which still represent the gold standard but require a donor site, greater invasiveness and number of operations, and more excellent skills of the operating surgeon due to increased procedural difficulties (15). The application of the OsteoBiol® Dermatakes place immediately after implant positioning (taking into account both the prosthetic optimal orientation and the biology of tissues involved) precisely at 4 mm more apical than the free margin of the flap to prevent the demonstrated para-physiological peri-implant resorption in case the thickness of the soft tissues is 2 mm or less (16-20).

The significant distinction between a connective tissue graft and a dermal matrix graft is that, if executed correctly, the autologous graft quickly contributes to supra-crestal vascularization. In contrast, the dermal matrix becomes involved in vascularization only after full integration, typically around 4-5 months after placement. Hence, we cannot prevent the natural peri-implant bone resorption, which should be anticipated and proactively managed, as previously explained, by "sinking" the graft apically by 4 mm.

If the thickness exceeds 3 mm, the implant can be positioned in a juxta-crestal position. Another difference is that OsteoBiol® Derma is positioned below a full-thickness flap. If the inter-implant distance exceeds 10 mm, a trapezoidal flap can be used, thus obtaining the preservation of the papillae. If the distance is less than 10 mm, it is better also to involve the papillae of the adjacent entities within the flap, known as a "hockey stick" shape, trying in any case to preserve the lingual/palatal aspect of these papillae. The flap relief incisions must extend in the coronal-apical direction up to the muco-gingival line. In contrast, the crest incision will preserve the keratinized gingiva by dividing it into two portions: one lingual/palatal and one vestibular. The matrix must have a proper size so that it can be easily accommodated within this flap to stabilize it equally without any means of fixation.

The stability of the matrix is ensured not only by the flap but also by the employed sutures, which are applied with straightforward detached stitches. In specific situations where the muco-gingival line is situated more apically and the drains are in proximity, detached stitches can also be used on the mesial and distal drains to further secure the matrix.

The matrix can be positioned over the implant itself (overturned occlusally) in the case of a submerged fixture over a healing screw. The OsteoBiol® Derma can be shaped to be managed for trans-mucosal requirements creating two portions that "embrace" the healing screw medially and distally.

The sutures are removed in 14 days; the patient must be adequately informed about the behavior to maintain (especially when chewing food, reducing its consistency, or semi-liquid). Within 28-35 days, there is a complete epithelialization of any portions, even those left exposed (which defines another considerable advantage compared to the traditional matrix/membranes whose occurrences often mean complete failure of the entire operation). After 4 months, there is an integration of the matrix. In the meantime, you can still proceed with the temporary prosthesis phases starting from the second month.

The development of this technique was codified using STL superimposition. Through the application of dedicated software, we were able to superimpose intra-oral scans taken before and after treatment at intervals of 6 months, 12 months, and 2-3 years. This analysis revealed a consistent maintenance of tissue volume, accompanied by a favorable increase in tissue thickness and site-specific biotype after applying the matrix.

CONCLUSIONS

While it is essential to acknowledge that findings from a single case may not hold statistical significance, it remains valuable to emphasize the numerous benefits associated with using this material in conjunction with this technique for augmenting soft tissues, both horizontally and vertically.

The intrinsic simplicity of this procedure, primarily attributed to the absence of membranes or other structures required for protection, stabilization, and coverage, makes it more accessible and manageable even for less experienced surgeons compared to traditional techniques.

The MTG technique using high-consistency OsteoBiol® Derma 2mm has proven effective in thickening the specific peri-implant tissue biotype, increasing patient comfort, and recreating an implant emergence profile more suitable to the subsequently positioned prosthetic crown. In general terms, it can be deduced how survival and successful implant rate can be increased by stabilizing the surrounding tissues (quantity and quality) and reducing unwanted problems such as mucositis or peri-implantitis. Furthermore, this technique offers superior aesthetic results, allowing for a more accurate mimicry of ideal soft tissue, resulting in an improved overall appearance. Considering all the indications mentioned above, it can be argued that this procedure is more biologically sustainable and economically efficient for daily prosthetic implant rehabilitations.

The authors are hopeful that this initial endeavour can serve as an inspiration to many other colleagues and encourage a more comprehensive exploration of the material and technique. Even though it has shown remarkable effectiveness in just one case, there is potential for broader research and application in the field.

Conflict of interest statement
All the authors declare no conflict of interest.

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