Clinical case letter

Esthetic management of the maxillary anterior region with multi-discipline approaches

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1. Introduction

The management of anterior implant-supported rehabilitations is always challenging. Patients have logically high expectations from the restorative treatments. In order to achieve a predictable and stable, functional and esthetic final result, both hard and soft tissue managements are often required **[1,2]**. In the case of a complete maxillary anterior region rehabilitation, there are many steps to respect and disciplines to combine in order to reach an adequate outcome. Among the key endeavors of this kind of treatments, some steps are of particular importance, such as: to prevent the alveolar ridge resorption, to augment the bone and soft tissue thickness during implant placement, to construct provisional prosthesis to model the soft tissue profile and crown/gingiva integration, and to adapt the abutment/restoration contour to further enhance the final esthetic aspect **[3-5]**.

The concept of this multi-discipline approach is frequently advocated in modern restorative dentistry **[4,5]**, but its proper application remains quite seldom. The objective of this article is to discuss and illustrate the relevance of this systematic multi-discipline approach for the treatment of the severe anterior maxilla atrophy, in order to achieve a successful, predictable and stable long-term esthetic restoration in this challenging area.

2. Materials/methods and results

The patient was referred to the department of oral surgery of the University of Naples Federico II for an upper anterior fixed partial rehabilitation. This patient was healthy, however he smoked more than 7 cigarettes/day. The upper teeth had a thin tissue biotype (<1.5mm), severe periodontitis with significant gingival recessions and severe tooth mobility. After a preliminary periodontal treatment, an implant-supported rehabilitation of the frontal region was planned (**Figures 1A to 1C**).

A prosthetic guide was fabricated based on the final prosthetic rehabilitation project, in order to guide the next surgical steps. In the first surgical stage, upper central and lateral incisors were removed and socket filling using collagen sponges was performed, to stabilize the clot and to promote wound healing. A fixed provisional bridge was then placed (**Figures 1D to 1G**). It quickly appeared that the position and strength of the median frenum was high and could compromise the next surgical steps of the treatments, by tearing on the future flaps (**Figure 1H**).

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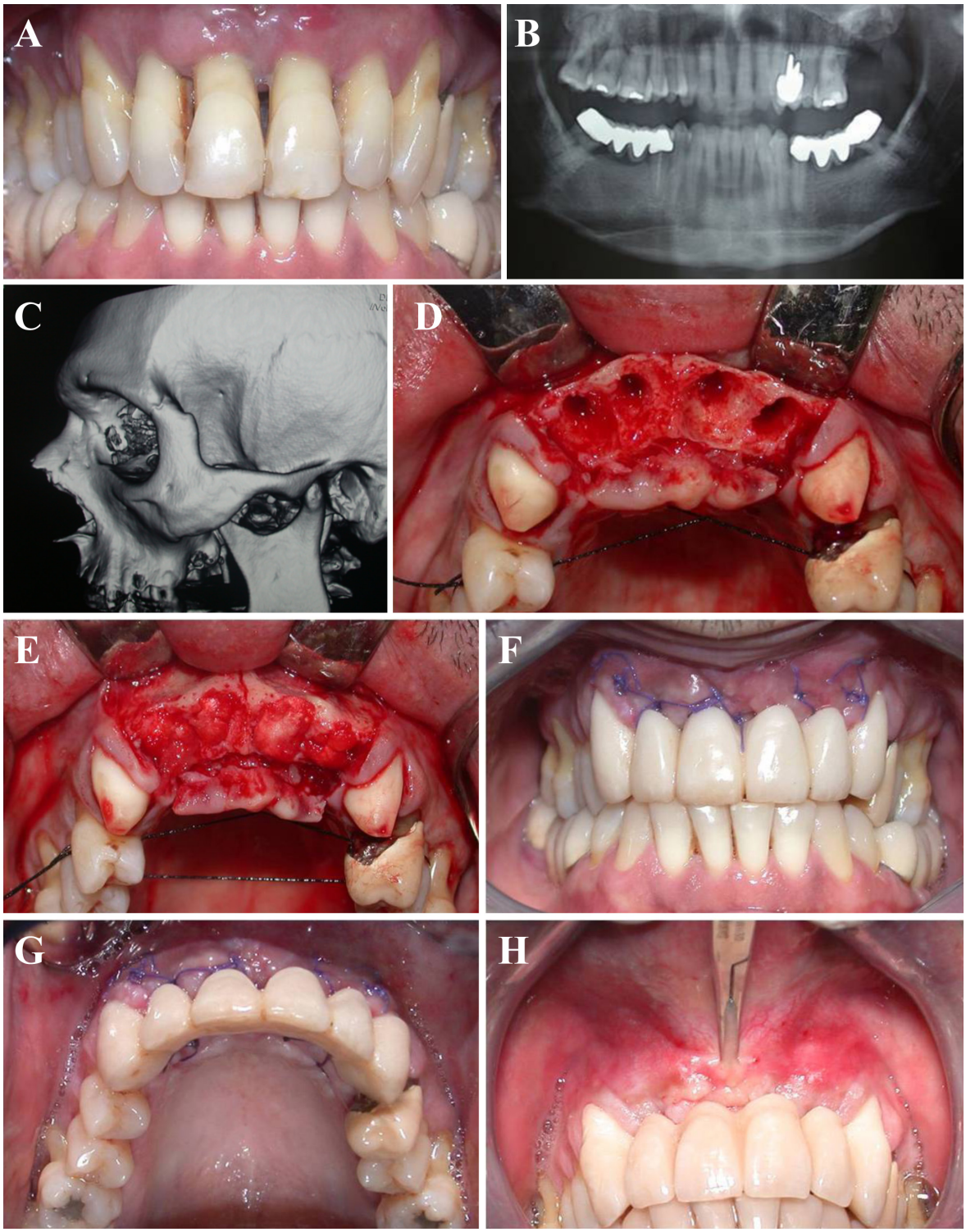

Figure 1. First steps. (A, B) Preoperative view and panoramic X-Ray showing the horizontal alveolar bone loss due to the periodontal disease. **(C)** The preoperative CT scanner revealed the maxillary bone atrophy. **(D, E)** During the first surgical step, teeth were removed, the fresh sockets were filled with synthetic collagen and covered with a full thickness flap. **(F, G)** A temporary resin bridge between the canines was placed to model the future rehabilitation. **(H)** After 4 weeks of healing, it was confirmed that a frenectomy was needed before the bone augmentation procedure, to avoid the flap retraction after the next surgery.

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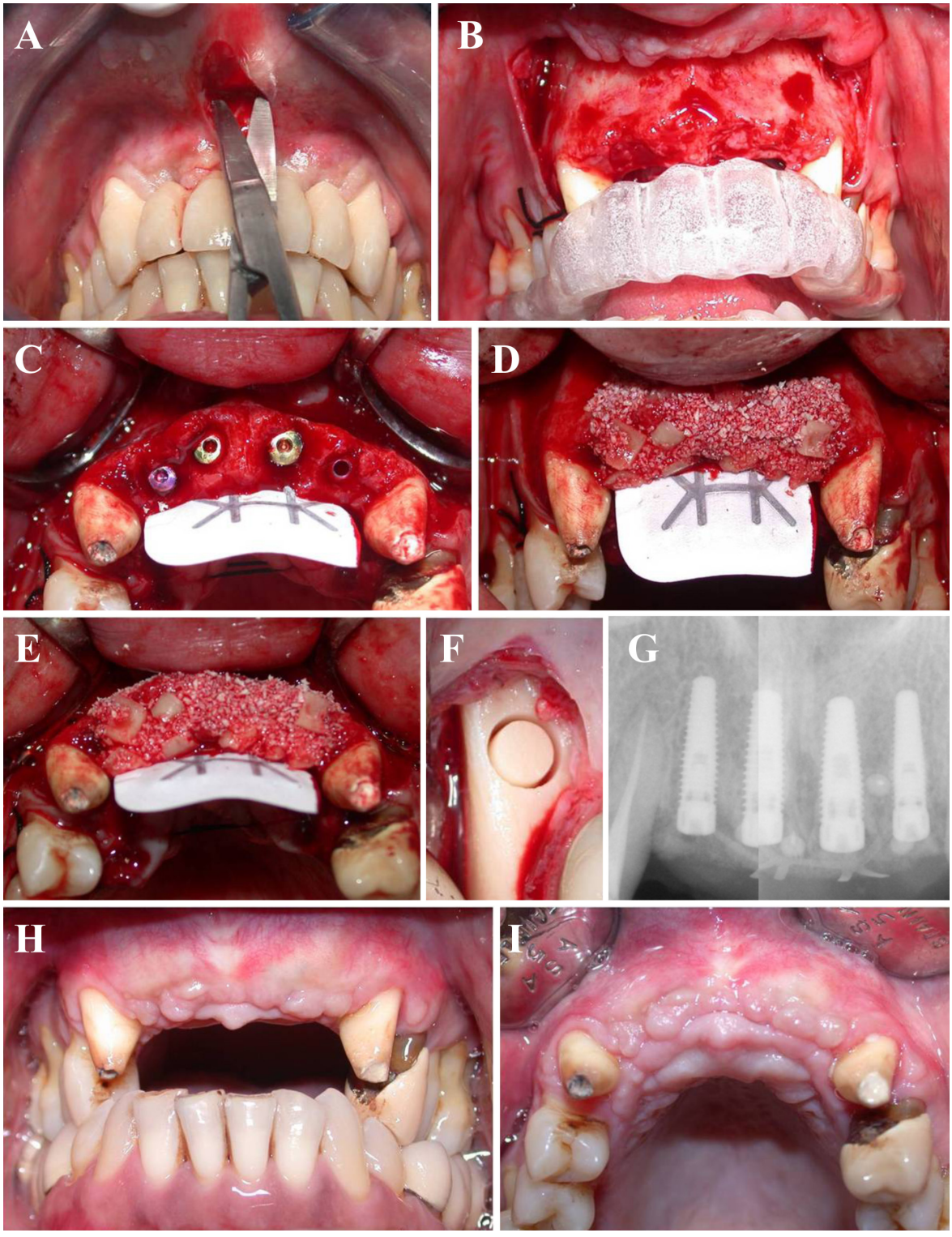

Figure 2. Multiple surgical steps. (A) Four weeks after the teeth extractions, a frenectomy was performed. **(B, C)** Four weeks after the frenectomy, a full-thickness gingival flap was raised, the alveolar ridge was prepared and 4 implants were placed according to the prosthetic guide. **(D, E, F)** The bone augmentation procedure was performed using a 50/50 mix of autologous bone (from ramus in F) and xenograft material. **(G, H, I)** After 6 months, the retroalveolar X-Rays **(G)** showed a stable aspect of the implant and bone volumes, and the gingival tissues were healed and matured **(H, I)**.

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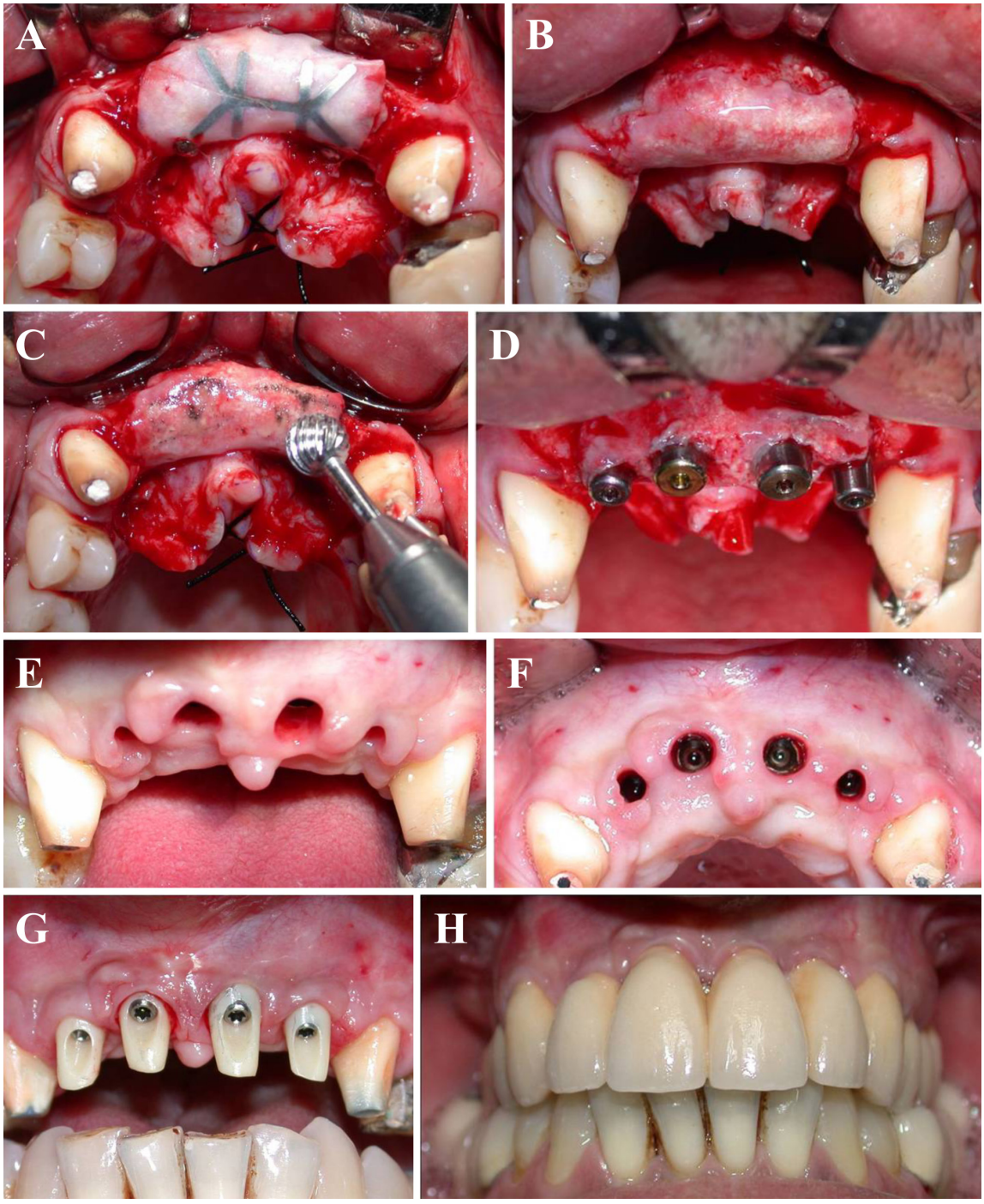

Figure 3. Final surgical and prosthetic steps. (A, B) Six months after the previous surgery, the non resorbable membrane was removed and the regenerated bone could be observed. **(C, D)** With a ball bur, the fixture shoulders were exposed and the bone peak modeled. **(E, F)** After 4 months with a provisional prosthesis, the gingival tissue was healed and mature enough to start the final implant-supported restoration. **(G, H)** Zirconia abutments were placed to prepare the marginal fit. A zirconia/ceramic bridge was finally connected.

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After 4 weeks a frenectomy was performed (**Figure 2A**). After 8 weeks from tooth extractions, a full thickness flap was raised and four implants (Nobel Biocare, Gothenburg, Sweden; 2 implants 4.3 x 13 and 2 implants 3.5 x 13)**[6]** were placed (**Figures 2B and 2C)**. At the time of implant placement, a bone augmentation using a mixture of 50% of demineralized xenograft (Bio-Oss, Geistlich AG, Wolhusen, Switzerland) and 50% of autogenous bone graft (harvested from ramus) was placed to assure an over-sized bone augmentation. A non-resorbable ePTFE (expanded-polytetrafluorethylene) titanium reinforced membrane (Gore-Tex, WL Gore and Associates, Inc., Newark, USA) was used to cover the grafts. The flap was then coronally shifted and sutured (**Figures 2D to 2F**).

After 6 months, the retroalveolar radiographs confirmed a stable bone and implant integration, and the gingival tissue appeared healed and mature **(Figures 2G to 2I).** A surgical re-entry was then performed. The non-resorbable membrane was removed (**Figures 3A and 3B)**. In order to access to the implant heads, a ball bur was used to eliminate the excess bone and to design a natural bone contour with some inter-implant bone peaks (**Figure 3C)**. Healing caps (6mm long) were then placed and the full thickness flap sutured (**Figure 3D)**. After 10 days, an implant-supported provisional restoration was constructed to model the soft tissue healing and to create esthetic inter-implant papillae. Four months after the provisional phase (**Figures 3E and 3F)**, the final restoration was fabricated and connected. A thick gingival tissue biotype with an esthetic aspect was obtained (**Figures 3G to 3H**). During the 3-year follow-up, the final aspect was stable.

3. Discussion

Achieving an esthetic aspect for implant-supported rehabilitation in the maxillary anterior area is an important requirement to consider a treatment as a success in this region **[7]**. However the treatment is never a “one-shot” treatment, but is always a therapeutic construction associating several surgical and prosthodontic steps.

To ensure a proper treatment outcome, a multi-discipline as well as step-by-step approach is essential **[8]**. In this reported case, all the steps were performed under the guidance of the final restoration template. The therapeutic strategy was ruled by the final objective. This prosthesis-guided multi-staged approach assured not only the esthetic success, but also forced us to follow all the necessary steps to change the gingival tissue biotype from thin to thick. This is an important result, since it is a key to maintain a long-term esthetic success **[9]**.

After tooth extraction/avulsion, most of the bone loss occurs in the first 3 months. The buccal plate resorption is greater (2 times more) than the lingual one **[10]**. Such dramatic changes of the bone profile are probably caused by the loss of periodontal vessels, and the thin and compact bone architecture of the buccal plate. These changes lead to the reduction of the bucco-lingual width, then to the bone height loss **[10]**. The severity of the bone resorption may pose problems for clinicians: it creates an esthetic concern during the design of an implant-supported restoration or a conventional prosthesis; and it makes implant placement challenging due to the lack of adequate bone support. Several techniques have been proposed to try to reduce the post-extractive bone resorption **[10,11]**. In the reported case, the compromised teeth were removed, and post-extraction sockets were filled with collagen sponges and then covered with a full thickness flap to minimize potential bone resorption **[10,11]**. The choice of this collagen sponges is debatable, as many materials are available for this indication and no clear recommendations exist on this matter. The

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advantage of this sponge filling is that it does not disturb the natural process of healing of the alveoli. As the alveolar sockets had their 4 walls, the use of a more compact bone material was not required. The full thickness flap was coronally advanced to assure an adequate soft tissue coverage of the site. This strategy provides some additional benefit for the following surgical step, as more soft tissue was available during the implantation and bone augmentation procedure and during the final step of soft tissue modeling with provisional prosthesis.

The frenum was quite strong and high on the alveolar ridge. Frenectomy was needed and planned before to start the implant and grafting surgery, in order to improve the flap mobility, to ensure a tension-free flap coverage of the grafted area and to reduce the postoperative flap retraction after surgery **[12,13]**. On the longer term, the elimination of the frenum was needed in order to avoid any stress on the peri-implant bone and soft tissues. The frenum insertions can often the source of gingival and bone dehiscences and then implant contaminations, leading to unesthetic aspects and even to peri-implantitis with potential loss of the implants **[14]**.

At the second stage of implant surgery (implant uncovering), it was observed that implants were deeply submerged under the vertically augmented bone. During the re-entry surgery, the excess bone over the implants was eliminated and the bone profile was modeled to create inter-implant bone peaks, to support the future healthy papillae between the implants **[12,15]**. This strategy can help to prevent papillae disappearance and hence it reduces the unesthetic problem known as “black triangle disease” **[12]**. In the following step, the soft tissue was modeled by the pressures of the provisional restoration. Using the ovate pontic concept allows clinicians to mold the soft tissues, and the gingival peri-implant contour can be somehow designed. Su et al. showed that by changing the abutment or crown contour, soft tissue can be molded in a different dimension that fits the needs of a final prosthesis **[3]**.

The change of the tissue biotype (from thin to thick) is another factor that contributes to the good results noted in this case. The thick tissue helps to maintain the soft tissue dimension, allows to manage an esthetic inter-dental triangle, hence ensures the long-term implant esthetic result **[9]**. This change of biotype remains a quite ultimate and difficult objective to reach and control in this kind of treatments. However, this change of biotype is only possible when the environment is globally treated, what implies to reach a natural and functional bone volume and a proper soft tissue reorganization at the end of the treatment.

Finally, this article focused on a general modern philosophy of implant dentistry, and the potential therapeutic options are in fact endless to reach the same final objectives. This is particularly true with the development of new technologies, materials and techniques to simplify and improve the clinical results, for example the use of platelet concentrates **[4,5]** or improved implant design or surfaces **[6]**.

As a conclusion, the use of a multi-discipline and multi-step approach is often the ideal way to a stable esthetic and functional outcome. This approach is now a key philosophy of modern implant dentistry, and should be always kept in mind by all clinicians.

Disclosure of interests

The authors have no conflict of interest to report.

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