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CLINICAL ARTICLE

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The beyond the gap filling approach: Modeling facial and interproximal tissues and improving esthetics for anterior flapless immediate implant placement

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Abstract

Objective: Maintenance of adequate interproximal tissue height between an implant and a natural tooth or between adjacent implants represents an esthetic challenge in implant dentistry. The aim of this case report is to describe a modified technique referred to as the beyond the gap filling (BGF) approach designed to improve the horizontal and vertical components of the facial aspect and particularly the height of interproximal bone peaks around immediately placed implants into fresh extraction sockets.

Clinical Considerations: Four patients (five teeth) requiring anterior tooth extraction were treated with the BGF approach that included: (a) minimally traumatic tooth extraction; (b) immediate implant placement without flap elevation; (c) installation of a narrow profile healing abutment to protect the implant during grafting; (d) grafting with a construct with 90% bovine bone granules and 10% porcine collagen packed coronally to the facial and interproximal bone walls above the level of the bone crest; and (e) delivery of an immediate restoration.

Conclusions: The current report suggests that the level/height of the interproximal bone crests between an implant and a natural tooth or between two adjacent implants can be improved by the BGF approach and, consequently, papilla height can be maintained in cases with a high risk of papilla height collapse and, consequently, esthetic outcomes can be maximized.

Clinical Significance: The BGF is a simple technique to be used by clinicians to prevent significant papilla collapse in anterior immediate implants and consequently achieve maximum esthetic outcomes in implant dentistry.

KEYWORDS

anterior implants, bone graft, facial gap, immediate implant, implant esthetics, inter-implant papilla

1 | INTRODUCTION

The growing interest in preventing undesirable clinical esthetic changes when natural teeth are replaced by titanium implants reflects the most elementary pillars of current implant dentistry standards: (a) the achievement of successful osseointegration of the dental implant[1]; (b) the maintenance of healthy peri-implant tissues[2,3]; (c) the establishment of an harmonious relationship between the implant-supported restoration and the adjacent teeth; (d) the accomplishment of stable occlusal contacts[4,5]; and (e) the restoring, improvement or

maintenance of the patients esthetic condition (i.e., patient satisfaction).[6–8]

Following tooth extraction different successive biological events occur as a response to the combined effects of local inflammation generated by trauma produced during the extraction procedures, the end of occlusal forces transmission to the periodontium resulting in lack of physiological need of those structures (e.g., bundle bone).[9–15] These effects promote a modification of the homoeostasis and structural characteristics of the alveolar bone, resulting in dimensional alveolar bone resorption characterized by partial horizontal and vertical reduction of the alveolar ridge, mostly perceived at the buccal bone crest. The amount of bone remodeling (i.e., extension and degree) is variable and may be influenced by the patient's individual local conditions (i.e., periodontal tissues' conditions, periodontal anatomy) and other systemic factors (i.e., smoking, diabetes), but the entire marginal buccal bone wall can be lost following tooth extraction.[11,14,15]

In order to counteract the amount of alveolar ridge resorption naturally occurring after tooth extraction, alveolar ridge preservation (ARP) procedures have been used prior to or simultaneously with implant placement.[15,16] As recently outlined by the XV European Workshop in Periodontology on Bone Regeneration systematic review, these treatment modalities have demonstrated more noticeable outcomes in terms of minimizing horizontal bone resorption, than on vertical mid-buccal and mid-lingual bone changes.[15] Moreover, extraction sockets grafted with either xenogenic or allogenic bone substitutes, covered by a collagen membrane/socket seal materials, presented the greater effects in terms of minimizing alveolar ridge reduction.

In 2012, a procedure called the "dual zone therapeutic concept" was proposed to decrease soft and hard tissues contour alterations related to immediate implant placement and provisional restoration in anterior extraction sockets.[17] This treatment approach is based on the use of a flapless and minimally traumatic tooth extraction, immediate implant placement, grafting the gap between the implant and the buccal bone wall and installation of a provisional restoration to seal the extraction socket.[16] Differently from conventional buccal gap grafting, where only the gap between the implant and extraction socket (bone zone) is filled with a bone grafting material, the authors proposed that this bone graft should be also packed into the tissue zone (i.e., the soft tissue coronal to the implant-abutment interface) to the height of the facial free gingival margin.[17] Consequently, this filling maneuver might be able to prevent clinically relevant vertical facial bone changes, as well as improve peri-implant soft tissues thickness (i.e., tissue zone).[17]

To date all the published ARP procedures as well as the dual zone therapeutic concept have primarily focused on minimizing ridge alterations on the buccal/facial aspects. In fact, there is only one case report in the literature that has proposed a technique called "proximal socket shield" that addresses papilla preservation on interproximal implant sites.[18] Based on the concept of the socket shield technique, that proposed the maintenance of the buccal/facial fragment of the root,[19] the proximal socket shield described the maintenance of root fragments distal and mesial to the immediate implant.

This case report describes a modification of the dual zone therapeutic concept (i.e., the Beyond the Gap Filling Approach) at three immediate implant sites (two patients), where a construct with 90% bovine bone granules and 10% porcine collagen was modeled and placed in extraction sites with a two-fold objective:

1. To fill the gap between the implant and the bone wall (bone zone) as well as the tissue zone both on the facial and the interproximal aspects; and
2. To improve the horizontal and vertical components of facial bone defects/dehiscence and to improve/maintain the interproximal bone peaks and prevent loss of papilla height, in cases with a high risk of papilla height collapse and, consequently, maximizing esthetic outcomes.

2 | BEYOND THE GAP FILLING APPROACH METHOD/OVERVIEW

In general terms, following local anesthesia, the BGF approach is based on:

1. A minimally traumatic tooth extraction performed in order to maintain the complete integrity of the socket walls and to not risk loss of papilla height.
2. Immediate implant placement without the elevation of a full-thickness flap (the 'flapless" technique may be used for both sockets with and without buccal bone dehiscence/defects). Implant diameter selection is based on the socket dimensions (diameter and length), making sure that a facial gap of 3 mm remains to be grafted.
3. Installation of a narrow profile healing abutment to protect the implant during grafting.
4. The gap formed between the implant surface and the surrounding bone wall is completely filled with a construct with 90% bovine bone granules and 10% porcine collagen (Bio-Oss Collagen, Geistlich Biomaterials®). Once the bone substitute reaches the entrance of the extraction socket, it is gently packed coronally to the buccal and interproximal bone walls, making sure to pack the bone substitute above the level on the bone crest (facial and interproximal). The primary concept of the BGF approach is that, by placing the graft particles in the tissue zone interproximally, the interproximal papilla vertical level is better maintained during the natural healing of the site following extraction and implant placement.
5. Removal of healing abutment, fabrication and installation of immediate provisional restoration or a custom healing abutment (in case implant primary stability is not adequate for an immediate provisional restoration) that seals the entrance of extraction socket and does not promote compression to the surrounding soft tissues. In order to achieve this goal, the provisional restoration or custom healing abutment must be concave and have a narrow profile subgingivally.
6. Wound healing period of at least 6 months.

After delivery of the final crowns the patients were enrolled in a maintenance program (every 4 months) to monitor the clinical

conditions and stability of the peri-implant tissues as well as the behavior of the interproximal bone (evaluated by radiographs and cone-beam computed tomography [CBCT]). During the maintenance appointments, probing depths (PD) and bleeding on probing (BOP) were recorded, oral hygiene was reinforced, the patients received a supra gingival and intrasulcular mechanical debridement with ultrasonic and hand instruments, and the teeth were polished. The implant sites were carefully instrumented with plastic inserts for ultrasonic devices and flossed. Patient compliance and a good maintenance program are important for a successful outcome of this protocol. Bellow, short- and long-term clinical and radiographic outcomes of four cases are presented in which the BGF approach was associated with anterior flapless immediate implant placement.

3 | CASE REPORTS

3.1 | Patient 1

Patient 1 was a 50-year-old systemically healthy, smoking woman (5–10 cigarettes/day), who presented with a root fracture on tooth #9, periodontal probing depth of 7 mm at the distal aspect of #9 and a thick gingival phenotype (Figures 1–3). Figure 4 shows the CBCT indicating the presence of favorable alveolar housing for immediate implant placement, and the presence of inteproximal bone loss between teeth #9 and #10, which carries a high risk of distal papilla loss after extraction, regardless of implant placement. Therefore, it was opted to use a flapless approach to prevent further disturbance to the distal papilla and to maintain the current papillary height. Following tooth extraction, a BLT SLActive Roxolid implant (Straumann®, diameter 4.1 mm, length 12 mm was selected in order to leave a facial gap of 3 mm) was installed and the BGF approach was implemented (Figures 5–7). Adequate implant primary stability was obtained (40 N cm of insertion torque) for an immediate chairside restoration. A 2 mm gingival height titanium abutment was selected for the fabrication of an immediate, screw-retained composite resin restoration (Figures 8 and 9). The restoration was polished and contoured with extreme care to prevent plaque retention and compression of the graft and soft tissues. Post-operative medications were prescribed as follows: Amoxicillin 500 mg (3 times daily for 10 days), Ibuprofen 600 mg (4 times daily in case of pain), and 0.12% chlorhexidine gluconate rinses (2 times daily for 1 week). The patient was told to avoid biting on the implant-retained restoration for the first month, and to avoid strenuous physical activity for the first 4 days after the procedure. Since the esthetic appearance of the immediate composite restoration (a permanent restorative material) was favorable and the patient requested to not have it removed, it was opted to leave the composite restoration instead of replacing it by a ceramic crown. Uneventful healing occurred and clinical, radiographic and CBCT follow-ups up to 4 years showed stable peri-implant tissue levels (Figure 10). Clinical parameters were as follows: probing depths (PD): within normal limits around the implant and adjacent teeth without bleeding on probing (BOP). A PD of 3 mm without BOP was present on the distal aspect of the implant. Peri-implant tissues were devoid of clinical signs of inflammation at all follow-up appointments.

3.2 | Patient 2

Patient 2 was a 49-year-old systemically healthy, nonsmoking woman who presented a facial fistula associated with root fracture at tooth

FIGURE 2 Close-up of the interproximal papilla between #9 and #10, showing a small black triangle

FIGURE 1 Frontal picture showing a thick gingival phenotype and adequate levels of the gingival margin on teeth #8 and #9

FIGURE 3 A 7 mm pocket was present at the distal aspect of tooth #9

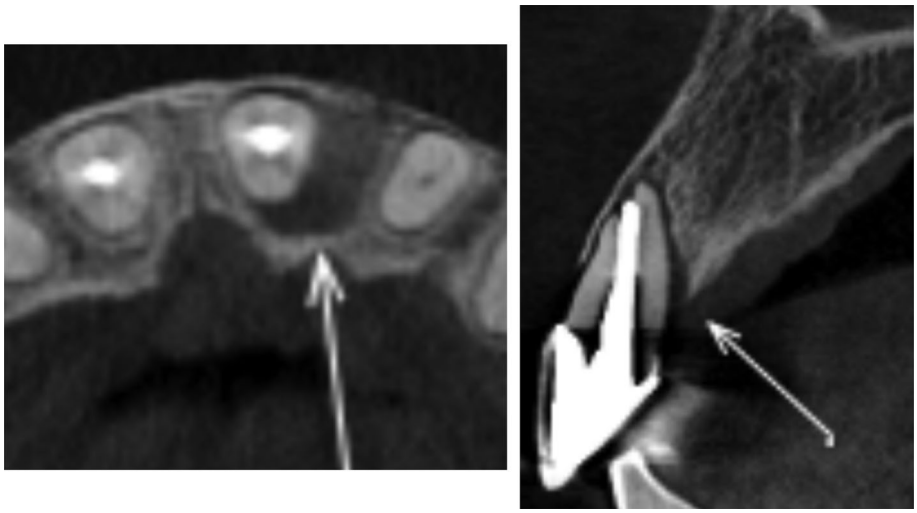

FIGURE 4 CBCT axial view (left) showing radiolucent area on the distal/palatal aspects of tooth #9. CBCT sagittal view (right) showing a bone defect at the palatal aspect of tooth #9. Note the presence of a thin facial bone/dehiscence

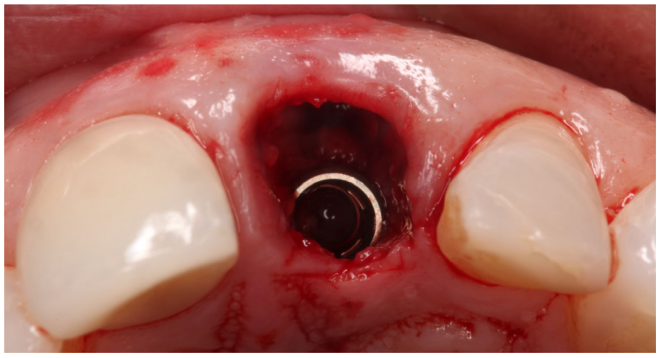

FIGURE 5 Immediate flapless implant placement. The implant was placed in the palatal aspect of the socket, in the appropriate restorative position

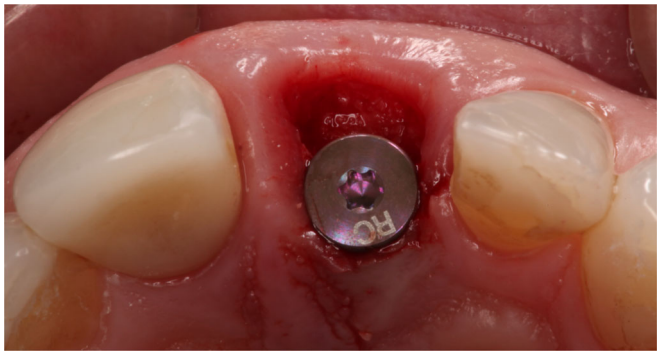

FIGURE 6 A narrow healing abutment was placed to prevent graft material to fall into the inner aspect of the implant, then the gap was filled facially and interproximally beyond the horizontal and vertical components of the bone crest/defect (bone and soft tissue zones). The bone substitute (Bio-Oss Collagen®) was gently packed around the narrow profile healing abutment to build a framework which alongside the emergence profile of the temporary restoration will support the soft tissue during the healing phase

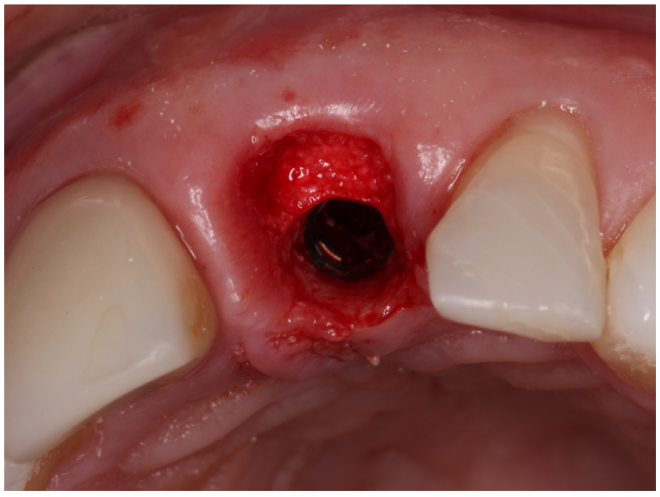

FIGURE 7 The healing abutment was removed and the graft material can be clearly seen coronal to the bone crest, both at the facial and interproximal aspects

#8 (Figure 11). The gingival phenotype was considered intermediate/thick and connective tissue grafting was not deemed necessary at the initial evaluation. CBCT showed favorable alveolar housing for immediate implant placement despite a buccal bone wall defect at tooth #8 (Figure 11). The patient was medicated with Amoxicillin 500 mg 3 days prior to tooth extraction. Following tooth extraction, a BLT SLActive Roxolid implant (Straumann®, diameter 4.1 mm, length 12 mm was selected in order to leave a facial gap of 3 mm) was placed and the BGF was performed (Figure 12). Good implant primary stability was obtained (45 N cm of insertion torque). A screw-retained provisional restoration was fabricated on a 2 mm gingival height titanium abutment and delivered. Post-operative medications and instructions were the same as those described for patient 1. Healing was uneventful for 6 months and the tissues around the implant on site #8 and tooth #9 were esthetically satisfactory and healthy (Figure 13). However, after 08 months, a root fracture was diagnosed at tooth #9, thus this tooth was extracted and the same treatment protocol was implemented (placement of a Straumann® BLT SLActive Roxolid implant, diameter 4.1 mm, length 12 mm was selected in order to leave a buccal gap of 3 mm, and BGF approach was performed). The insertion torque of the implant was over 40 N cm and a screw-

FIGURE 8 A 2 mm gingival height abutment was used to build the immediate composite restoration that was delivered immediately after the BTG procedure

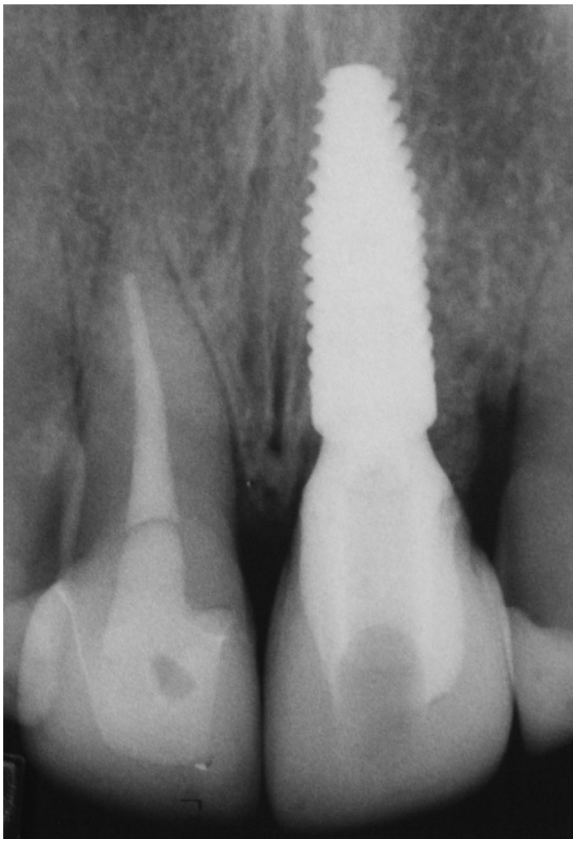

FIGURE 9 Immediate post-operative periapical radiograph showing the presence of bone graft particles coronal to the implant platform on the distal aspect of the implant supporting the distal papilla

retained provisional restoration was also fabricated on a 2 mm gingival height titanium abutment and delivered (Figure 14). Post-operative instructions and medications were the same as described above. As the maximum papilla height between adjacent implants is shorter than that between an implant and a natural tooth, the BGF approach has the potential to minimize papilla loss and maximize esthetics. Six months following implant placement on #9, two (02) zirconia customized abutments were fabricated (Straumann® Variobase hybrid abutments) and final screw-retained ceramic restorations were delivered (the restorations were cemented onto the zirconia abutments extraorally). The buccal mucosa of implant on #8 site (where the fistula was located pre-operatively) had a reddish coloration and looked different from the adjacent mucosa. This could be the result of healing of the fistula resulting in a different vascularity on the site. However, there was no inflammation of the peri-implant mucosa as depicted in Figure 15, the transition zones of both implants on sites #8 and #9 were healthy and had a similar appearance, and BOP was not present at any follow-up appointment. A comparison between a periapical radiograph taken 6 months after implant placement on site of #9 and 14 months after implant placement on site #8 and another periapical radiograph at 4 years follow-up showed that the bone crests/bone graft particles coronal to the interproximal bone crests beneath the papillae at both mesial and distal aspects of the implants as well as between the implants decreased in height (compared to the level of the implant platforms) (Figure 16). This change happened after the initial abutments were changed to the customized zirconia abutments (see discussion for possible explanation). Clinical, radiographic and CBCT follow-ups up

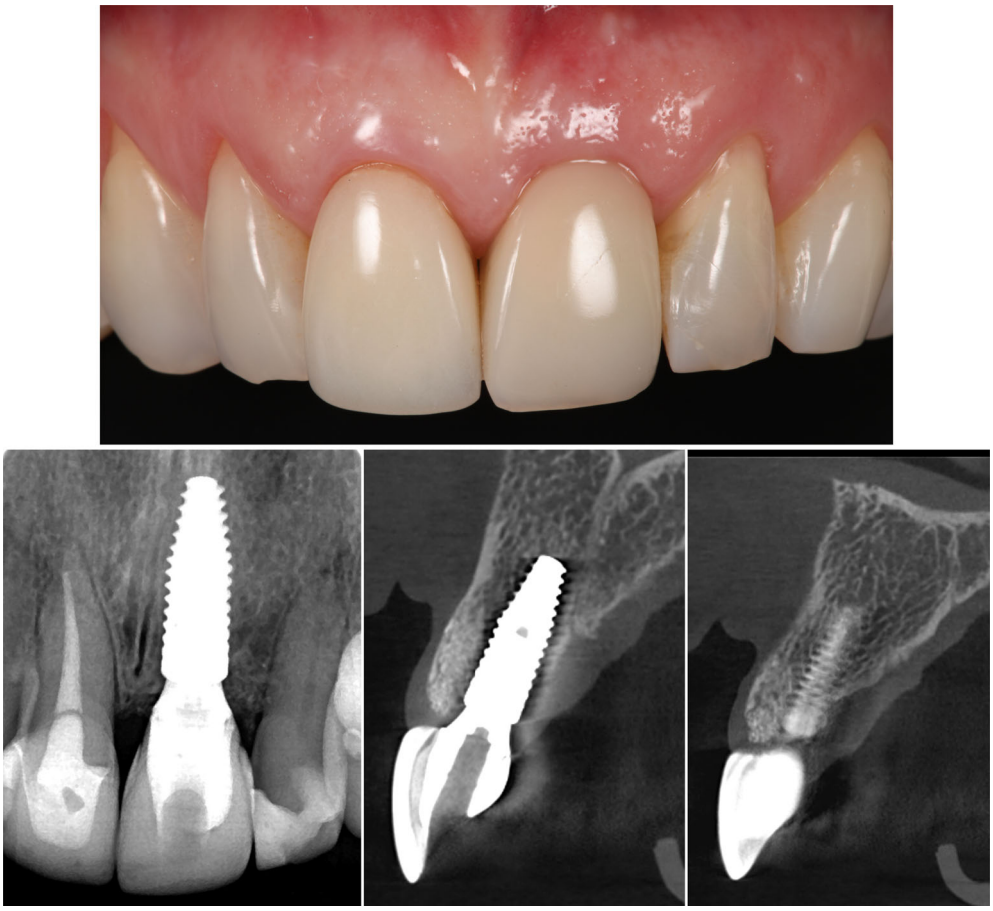

FIGURE 10 Facial view at 4-year follow-up appointment showing stability of the marginal peri-implant mucosa and stability of the distal papilla, where a significant periodontal defect was present preoperatively. Periapical radiograph and CBCT images at 4-year follow-up showing stability of the interproximal bone levels and evidence of residual bone graft particles on the distal aspect of the implant coronal to the implant platform. CBCT sagittal view shows a thick buccal bone and the presence of the residual bone particles. These residual particles on the straight facial (middle figure) and distal (right figure) aspects are important to maintain the facial/interproximal tissue levels

to 4 years show stable peri-implant tissues, as well as the bone substitute particles clearly seen over the interproximal bone crest between the dental implants #8 and #9 (Figure 17). Probing depths around both implants were within normal limits without BOP at follow-up appointments.

3.3 | Patient 3

Patient 3 was a 38-year-old systemically healthy, nonsmoking male. The patient was referred from the restorative dentist after a tooth fracture was identified on tooth #8. The tooth was temporarily splinted to the adjacent teeth by his dentist with composite resin (Figure 18). The periapical radiograph shows a bone defect on the mesial aspect of tooth #8, which indicated that papilla height loss would happen after tooth extraction creating a significant esthetic issue. Immediate implant placement and grafting was performed as described above. A BLT SLActive Roxolid implant (Straumann®, diameter 4.1 mm, length 14 mm) was placed and the BGF approach was done. Figure 18 shows the pre- and post-operative clinical presentations and the pre- and post-operative peri-apical radiographs. As shown by the images, papilla height was satisfactorily maintained at the mesial aspect of tooth #8 despite the partial pre-operative absence of the interproximal bone crest and the bone defect mesial to tooth #8. The peri-apical radiograph taken 18 months after implant placement shows the presence of bone graft particles coronal to the implant platform supporting the papilla. Probing depths around the implant were within normal limits without BOP at follow-up appointments.

3.4 | Patient 4

Patient 4 was a 45-year-old systemically healthy, nonsmoking male. The patient had a history or trauma and endodontic treatment of tooth #9. The patient complained of "a different feeling" around the tooth. Clinical examination revealed the absence of a periodontal pocket, and sensitivity to percussion. A CBCT was taken and a significant bone defect distal to tooth #9 and mesial to tooth #10 was identified (Figure 19). Tooth #10 tested vital. The bone defect also involved part of the facial bone between teeth #9 and #10. The risk of complete papilla collapse distal to tooth #9 and an esthetically compromised outcome was very high. Therefore, immediate implant placement and the BTG approach were performed as described above. A BLT SLActive Roxolid implant (Straumann®, diameter 3.3 mm, length 12 mm) was placed and the BGF approach was done. Figure 19 shows the pre- and post-operative clinical presentations and the pre- and post-operative CBCT images. As shown by the

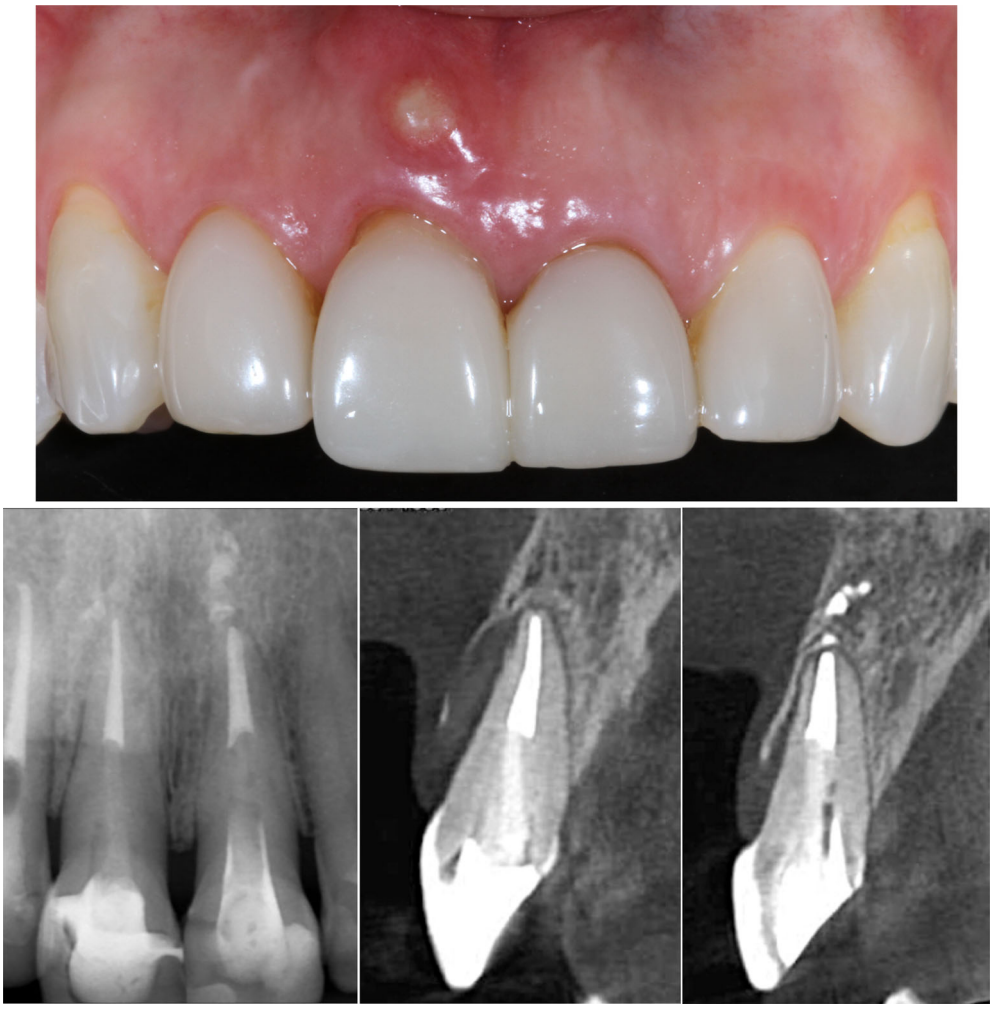

FIGURE 11 Frontal picture showing a sinus tract on the facial aspect of tooth #8. Periapical radiograph showing extravasation of endodontic filling material on teeth #8 and #9 (left) and CBCT sagittal views of teeth #8 (center) and #9 (right), respectively, showing a facial bone defect on #8 with partial loss of facial bone wall, and a thin/partially lost facial bone wall on #9 with extravasated filling material on the apical aspect

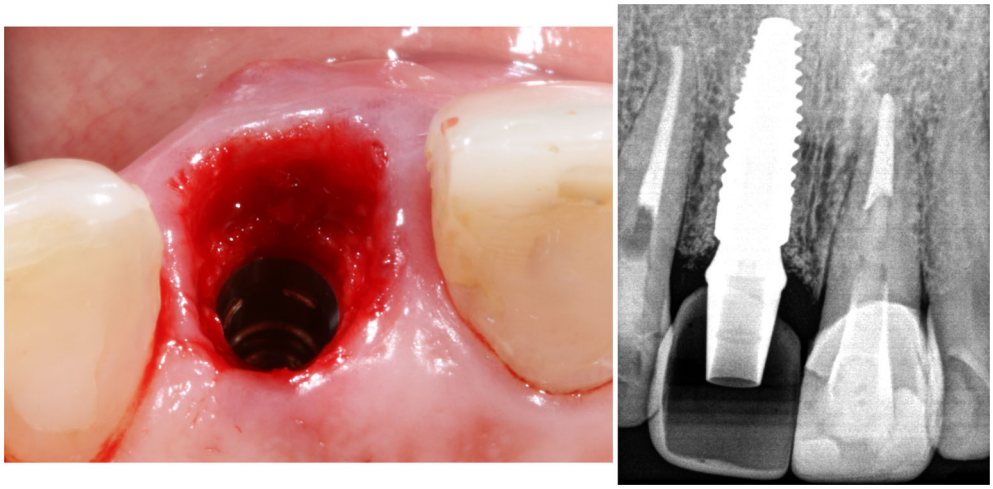

FIGURE 12 Immediate flapless implant placement on site #8 showing the graft material coronal to the buccal bone crest on both facial and interproximal aspects. The protocol for grafting was the same described for Case1. Periapical radiograph showing the graft particles coronal to the interproximal bone crest on the mesial and distal aspects of the implant with the 2 mm gingival height abutment and the immediate provisional restoration in place

6-year post-op images, papilla height was satisfactorily maintained at the distal aspect of tooth #9 despite the significant pre-operative bone defect. The pos-operative CBCT images show bone graft particles distal to the implant and above the implant platform, filling the bone defect and supporting the papilla.

4 | DISCUSSION

The present case report was focused on describing the potential use of a modified dual zone therapeutic concept approach (i.e., the beyond the gap filling [BGF] approach) performed simultaneously to

FIGURE 13 Clinical aspect after 6 months of tissue conditioning with the provisionals on implant on site #8 and on tooth #9

even in cases with a high risk of papilla height collapse and, consequently, maximizing esthetic outcomes.

It has been shown that the different types of bone filling materials currently used for ARP or in the buccal/facial gap of an immediate implant (i.e., allogenous, xenogenous and alloplastic) are mainly delivered/used in the format of graft particles. These are usually moisten with the patient's blood or saline and then gently packed into the bone gap formed between the implant surface and the buccal bone wall. However, the stabilization of such bone substitute granules is dependent of the gap's anatomical characteristics, a condition that may preclude their use 'beyond' the alveolar bone crest limits/height. It may be argued that the positive findings demonstrated by the BGF

FIGURE 14 Eight months after the implant was placed on site of #8, a fracture was diagnosed on tooth #9. Tooth #9 was extracted and the same approach was utilized for immediate flapless implant placement, grafting (BGF approach), and immediate provisional restoration as described for tooth #8

FIGURE 15 Frontal (left) and occlusal (right) views of the transition zone (emergence profile) developed by the provisional restorations. As explained in the description of the case, the darker coloration of the mucosa facial to the implant on site #8 was likely to be the result of the healing of the fistula and as shown by the pictures, the peri-implant mucosa was healthy

immediate implant placement and provisional restoration/custom healing abutment of maxillary anterior teeth. Both the short- and long-term clinical and radiographic results suggest that the BGF approach can improve the level/height of the interproximal bone crests between an implant and a natural tooth or between two implants, and significantly minimize or prevent loss of papilla height

approach may be partially linked to the "block-like" graft physical properties delivered by the xenogenous biomaterial used in the five implant sites. It has been claimed by the biomaterial manufacturer that handling properties of this bone substitute are improved through the addition of collagen. This assumption seems to be true as the mechanical characteristics (i.e., easy handling, cutting, adjustment to the shape

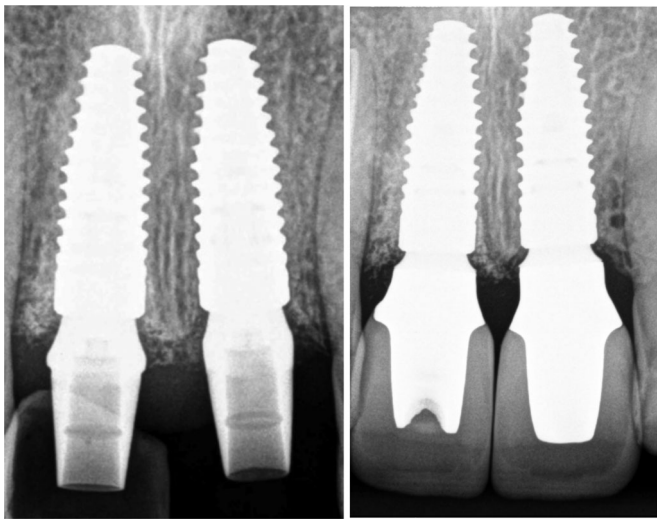

FIGURE 16 Periapical radiograph taken 6 months (left) after implant placement on site of #9 and 14 months after implant placement on site #8. Bone graft particles are seen coronal to the interproximal bone crests beneath the papillae at both mesial and distal aspects of the implants as well as between the implants. Periapical radiograph at 4 years follow-up (right) showing the maintenance of the residual graft particles coronal to the bone crests, however, if compared to the radiograph on the left, the bone particles/bone crest decreased in height (compared to the level of the implant platforms on both the left and right radiographs) after changing the abutments (see discussion for possible explanation)

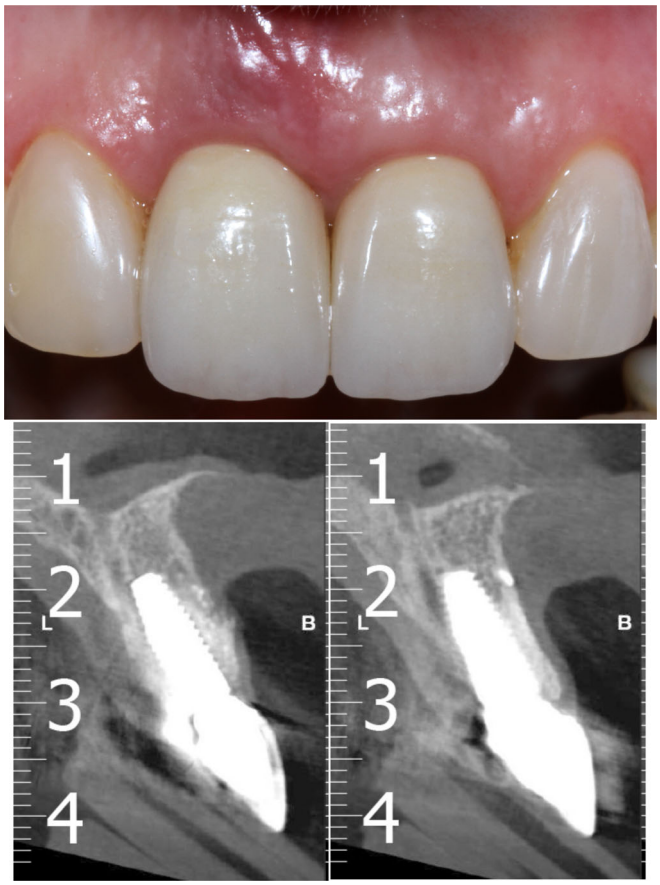

FIGURE 17 Final aspect of the ceramic restorations (4 years) and CBCT follow-up of implants on site #8 (left) and #9 (right)

of site and adherence to bone socket wall) and chemical composition (construct with 90% bovine bone granules and 10% porcine collagen) allowed a better stabilization of the bone substitute on the tissue zone of fresh extraction sockets and an adequate support to the interproximal soft tissue/papilla during the wound healing process.

In fact, it has been shown in a dog study that particles of the same xenogenous graft used in the present report remained embedded in the connective tissue of the peri-implant mucosa following grafting of the gap between the implant and the walls of the socket; and that the buccal marginal tissue recession was prevented in the group grafted with the construct with 90% bovine bone granules and 10% porcine collagen.[20] It was also apparent from the histological analysis that the group treated with the construct (Bio-Oss Collagen®) had a thicker buccal peri-implant mucosa compared to that of the control group (i.e., immediate implant placement without grafting).[20] The authors also described that the use of this biomaterial at the time of implant placement not only in the buccal, but also in the interproximal gaps around the implant, resulted in no apparent loss of interproximal bone.[20] Consequently, it seems reasonable to assume that the same positive effect of grafting with Bio-Oss Collagen® in the bone and tissue zones on the facial aspect could also be achieved by grafting in those two zones of the interproximal aspects of a socket and/or a defect (i.e., interproximal grafting would result in better maintenance of papilla height). To date, it is noticeable that the studies on ARP/gap grafting have focused on the buccal aspect only and, to the best of our knowledge, intentional interproximal grafting to minimize loss of papilla height has not been explored so far.

Moreover, it should be noted that similar to other periodontal hard and soft tissues regenerative approaches, such as guided tissue regeneration[21] and root coverage procedures,[22] there are some inherent conditions that may affect the results of therapy. First, lack graft's micromotion may be considered the most important factor to the achievement of proper support and stabilization of the buccal/facial tissue and the interdental papilla. In such a way, the fabrication of a well-adapted immediate restoration/custom abutment that promotes a complete sealing of the alveolar socket, without compressing the soft tissue seems mandatory. Also, the provisional should not be removed until the end of the initial phase of healing (i.e., 6 months). Second, both local and systemic factors may have an impact on the wound healing outcomes. For instance, it is not clear whether smoking, the buccal bone thickness and how the integrity of the extraction sockets might influence the results achieved with BGF approach. It can be argued that despite the smoking status of patient one (a light smoker) and the evidence of buccal bone dehiscence for the treated patients, clinical and radiographic improvements were clearly demonstrated. Third, the patients reported here have no history of periodontitis and the reasons for tooth extraction were related to tooth trauma/root fracture, and failure of endodontic treatment.

FIGURE 18 Upper images: Pre-operative frontal picture showing that the level of the gingival margin on tooth #8 is more coronal compared to that of tooth #9. The tooth was splinted to #7 and #9 with composite resin due to a fracture. Periapical radiograph showing a bone defect on the mesial aspect of #8, the tooth was diagnosed with a fracture extending to the mesial aspect. Lower images: Clinical picture taken after 18 months of treatment showing the gingival margin better leveled with that of #9, and a satisfactory mesial papilla height. The peripaical radiograph taken 18 months later shows the graft particles coronal to the implant platform

FIGURE 19 Upper images: Pre-operative frontal picture showing tooth #9 slightly discolored and a lateral picture showing a black triangle on the distal aspect of the tooth. Tooth #9 had history of trauma and endodontic treatment. Pre-op CBCT shows significant bone loss on the distal aspect of #9 reaching the mesial aspect of #10 and involving part of the facial bone between #9 and #10. Tooth #10 was vital. Lower images: Post-op pictures (6 year follow up) showing the satisfactory level of the distal papilla to #9. The CBCT views show evidence of bone graft particles distal to the implant and above the implant platform, filling the bone defect

Therefore, the impact of the BGF approach in periodontitis patients may not be anticipated. Finally, it has been reported that the use of connective tissue graft with immediate implant placement improves buccal/facial soft tissue profile and minimizes mucosal recession in the esthetic zone,[23] particularly in patients with a thin gingival phenotype.[24] Since the patients treated in the present report had

intermediate to thick biotypes, and there was no initial indication to correct mucosal deficiencies, we opted to not perform CTG at the time of implant placement. This is also in agreement with a recent report that described the use of connective tissue grafts in only the group of patients with a thin phenotype (CTG was not used for the thick phenotype group), which resulted in similar outcomes in terms of midfacial soft tissue margin levels in both groups (thin and thick).[25] Therefore, it appears that a CTG should be used whenever facial contour should be corrected or in thin phenotypes to minimize midfacial mucosal recession. However, it should be kept in mind that the use of CTG does not seem to impact the maintenance or minimize the loss of papilla height, which is the primary objective of the BTG approach.

It should also be mentioned that the cases presented in this report were treated with the same implant system with the same design (bone level) at the level of the platform. Furthermore all implants received the same type of abutment and immediate restoration/provisionals after implant placement. As mentioned in the description of the cases, all the immediate restorations had a narrow and concave contour, and those characteristics appear to be important for a better peri-implant tissue maintenance since flat and wide abutments result in more peri-implant bone loss.[26] Another interesting observation was that the implant sites were treated with the same protocol, with the exception that the abutment and the immediate composite resin restoration placed on patient one was never removed. On the second patient, the immediate abutments/provisionals were removed 14 and 6 months after being placed on sites #8 and #9, respectively, and changed to zirconia customized abutments for the delivery of final ceramic crowns. After the delivery of the final crowns, we noticed that the bone peak and the presence of graft particles coronal to the inter-implant bone peak remodeled and exhibited height loss, even after being apparently stable for several months after implant placement. It is possible that the prosthetic manipulation resulted in some injury and inflammation of the tissue seal around the implants which, in turn, resulted in some loss of bone height. This is in agreement with the concept that the "one abutment one time (OAOT)" protocol is beneficial for the maintenance of tissue levels around implants.[27,28] In fact we have treated other cases combining the BTG and the OAOT protocols and have observed an even better maintenance of the hard/soft tissue levels around implants.

According to the 2018 ITI Consensus Report, immediate implant placement plus immediate restorations/loading (type 1A protocol) is a well-documented treatment protocol associated to an overall 98% survival rate.[29] Some of the clinical recommendations from this Consensus are that type 1A protocol should be applied when the socket bone walls are intact, the socket's buccal bone width is ≥1 mm in thickness, and in thick gingival phenotypes.[29] However, the Consensus Report and Clinical Recommendations of the XV European Workshop in Periodontology on the management of extraction sockets and timing for implant placement states that, among other conditions, immediate implants should be avoided when extraction sites have severely damaged socket walls (more than 50% loss of one or more walls), suggesting that partial bone loss of socket walls would not be a contra-indication for immediate implant placement.[30] Likewise, studies on immediate implants have included sockets with partial buccal bone loss with positive outcomes,[31–33] and case reports of immediate implants placed in sockets with damaged buccal bone walls have addressed protocols to successfully reconstruct the buccal bone achieving good final esthetic outcomes.[34,35] Therefore, it seems that the proper reconstructive procedure (hard and/or soft tissue) is key to achieve an optimal esthetic result. The BGF approach emerges as an additional reconstructive option with the potential to minimize buccal/facial and, more importantly, interproximal tissue collapse and to maximize esthetic outcomes.

It is important to point out some limitations of the present report. First, the clinical and radiographic outcomes of the BGF approach around a limited number of implants and patients are reported. A greater number of clinical cases need to be conducted to confirm these outcomes. In fact, we have applied this technique in all of our cases both in the esthetic as well in the non-esthetic sites with very positive outcomes, but in the present report we have reported those cases with longer follow-up periods. Second, we did not conduct clinical and/or radiographic measurements of the papilla height/bone height before and after the BGF approach. However, the clinical pictures and the radiographs clearly show that the papilla height was clinically well maintained and the presence of bone graft particles is seen coronal to the interproximal bone crests.

5 | CONCLUSION

Within the limits of this report, the BGF approach emerges as an interesting treatment procedure for attaining simultaneous facial gap grafting and interproximal bone peaks improvement and papilla height maintenance, when immediate implant placement is required in anterior zone in cases with high risk of papilla height collapse. Proper stabilization of the bone substitute and the marginal adaptation delivered by the provisional restoration/custom healing abutment seems to be associated to the positive short- to long-term clinical and radiographic outcomes observed in this case series.

DISCLOSURE

The authors declare that they do not have any financial interest in the companies whose materials are included in this article.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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