

## CASE REPORT

# Multidisciplinary management of implant failure: A case report

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**Key Clinical Message**

This case report presents the interest of multidisciplinary management of extreme peri-implantitis requiring removal of implant emphasizing the different surgical and showing that the ovate pontic of conventional bridge is an optimal alternative for rehabilitation of the premolar sector, despite the fact that its main diffusion has been in the anterior sector due to the high demand aesthetic.

**Abstract**

Peri-implantitis leads to gradual peri-implant bone loss. Severe and extreme cases lead to complete implant failure and imply lost implants have to be removed. Residual ridge deformity management after implant removal is one of the factors contributing to improved aesthetic and functional results. Various grafting procedures have been developed to achieve this goal. This report describes a case of implant removal from the upper right first premolar due to advanced peri-implantitis in a 51-year-old female patient. Guided bone regeneration with a alloplastic bone graft and resorbable collagen membrane combined with roll pedicle connective tissue graft was used for both socket and soft-tissue augmentation. This was combined with ovate design conventional provisional bridge. After a 6-month of healing phase, a perfect adaptation of the marginal gingiva around the provisional restoration was obtained. Cone beam computed tomography revealed significant bone fill and buccolingual dimensional stability. A conventional all-ceramic bridge with an oval pontic design was chosen as a definitive prosthetic solution to compensate for edentulism and maintain the good aesthetic results. According to the encouraging result obtained in this clinical case, the conventional prosthetic restoration associated with surgical reconstruction of failing tissues can be considered as a successful treatment in the case of advanced peri-implantitis requiring implant removal.

**KEYWORDS**

implant failure, multidisciplinary management, ovate pontic, peri-implantitis

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## 1 | INTRODUCTION

Dental implant is a highly anticipated therapy with widespread use. He has become embedded within a large number of dental practices around the world and has grown and evolved rapidly, driven by consumer demand for immediate fixed tooth replacements.<sup>1</sup>

However, various cases of implant complications have been reported, in particular peri-implantitis. It is featured by progressive bone loss that results from the inflammation evoked by the colonization of the peri-implant sulcus by pathogenic bacteria.<sup>2</sup> The diagnosis is based on composite criteria, including radiographic and clinical features such as progressive bone loss ( $\pm 0.5$  mm), increased probing pocket depth, erythema, and bleeding on gentle probing with or without suppuration.<sup>3</sup>

Various surgical and nonsurgical modalities have been proposed in order to resolve soft tissue inflammation and to halt progressive bone loss. It was noted that when implants with  $\geq 50\%$  of bone loss, the most reasonable therapy to eradicate the disease is to remove the implant.<sup>4,5</sup>

In order to preserve the periodontally compromised natural dentition after implant removal, we must reconstruct lost ridge anatomy by a periodontal plastic surgery designed to restore the hard and/or soft tissues of the alveolar ridge to their former dimensions and give the restorative dentist an opportunity to provide patients with fixed prostheses that are truly aesthetic. Furthermore, if a bridge restoration should be made to close the space, the missing tooth will be substituted with a pontic.<sup>6</sup>

There are several types of pontic designs, each with different advantages and disadvantages. Ovate pontic is the most aesthetically appealing design. Its convex tissue surface resides in a soft tissue depression or hollow in the residual ridge, which makes it appear that a tooth is literally emerging from the tooth socket of the missing area. Apart from esthetics, clinically healthy, functional, and hygienic conditions can be established at ovate pontic sites if appropriate plaque control is performed.<sup>7,8</sup>

Through a well-illustrated clinical case of advanced peri-implantitis requiring removal of the implant on the upper right first premolar. We will describe the different

clinical stages of augmentation of the failing ridge after implant removal by guided bone regeneration (GBR) with a alloplastic bone graft using collagenated corticocancellous heterologous particulate bone mix substitute and resorbable collagen membrane (RCM) combined with roll pedicle connective tissue graft. Then we will show the interest of the conventional bridge with oval pontic design in postsurgical healing and obtaining perfect marginal tissue adaptation around the prosthetic restoration.

## 2 | CASE PRESENTATION

A 51-year-old, non-smoking, systemically healthy female visited the department of fixed prosthesis to evaluate her prosthetic restorations made in private practice 3 years ago.

Clinical examination revealed:

1. Satisfactory single supradental zirconia crowns on 13 and 15.
2. Supra-implant zirconia prosthesis replacing the 14 associated with increased probing depth and abundant bleeding (Figure 1).
3. Excellent control of buccal hygiene with absence of signs of gingival inflammation.
4. The absence of signs of parafunctions, muscular disease or deleterious habits upon occlusal analysis.
5. Radiographic assessment by periapical radiograph and cone-beam computed tomography (CCT) showed advanced circumferential, bowl-shaped osteolysis exceeding two-thirds of the implant height (Figure 2).

## 3 | METHODS

### 3.1 | Diagnosis and therapeutic decision

Based on clinical and radiographic findings, a diagnosis of peri-implantitis with severe bone loss ( $>50\%$ ) was established. Implant was predicted hopeless and had to be extracted.

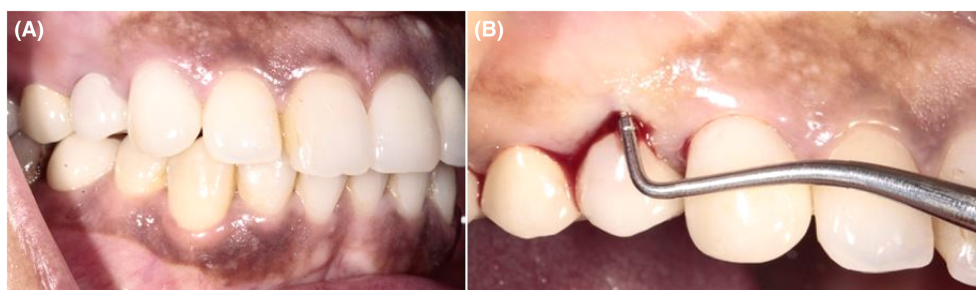
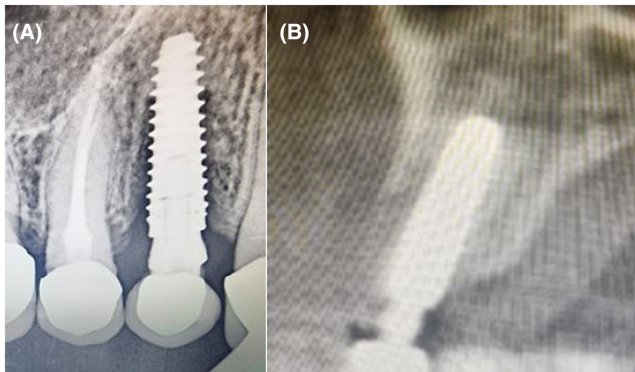


FIGURE 1 (A) Initial view and (B) probing depths greater than 6 mm with coexisting bleeding on probing of the implant site.



**FIGURE 2** Periapical radiograph (A) and CCT (B) showing advanced bone loss around the implant.

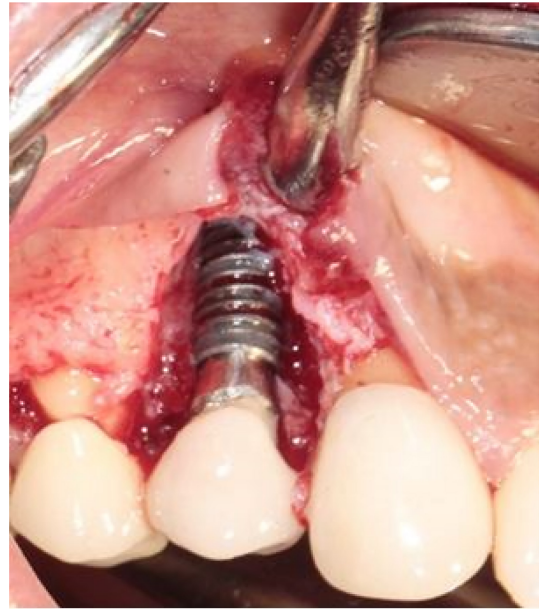
After discussing the different possible therapeutic options with the patient. She refused to place another implant. Given this context, surgical correction of tissue loss with GBR and autogenous connective tissue graft was planned after implant removal. Prosthetic rehabilitation will be carried out by a conventional zirconia bridge using the adjacent canine and premolar as abutments.

### 3.2 | Peri-implantitis treatment

Before the scheduled appointment for the surgery, the patient underwent an oral hygiene prophylaxis, and instructions for oral maintenance were given. One day before the surgery, the patient commenced antibiotic therapy with amoxicillin of 1 g for every 12 h.

Immediately prior to the surgical procedure, the patient was asked to rinse with 0.2% chlorhexidine mouth rinse. After local anesthesia was achieved, an intrasulcular incision around the implant extending from the mesial side of the maxillary right canine to the mesial side of the maxillary right second premolar was combined to two buccal releasing vertical incisions. Next, A full-thickness flap was elevated to expose the peri-implant bony defect. As diagnosed radiographically, advanced circumferential bowl-shaped osteolysis was found around the implant (**Figure 3**).

At this stage, implant was removed with an implant removal kit applying a reverse torque of 200 N/cm (**Figure 4**). Subsequently, partial thickness horizontal incision was made on the palatal aspect of ridge at distal line angle of right canine to mesial line angle of the right second premolar. From the horizontal incision line, an oblique incision was placed from mesial line angle of second premolar to mesial line angle of the second molar. Care was taken to maintain at least 3 mm distance from the gingival margin of teeth to the oblique



**FIGURE 3** Intra-surgical image showing the severe bone loss around the implant.



**FIGURE 4** Clinical view showing the implant removal site.

incision. The partial thickness flap was reflected from oblique incision line to expose the underlying connective tissue. Rollpedicle connective tissue graft technique was performed as proposed by Abrams (1980),<sup>9</sup> that comprised deepithelization of a palatal pedicle flap and exposure of palatal bone.

Comprehensive curettage of the sockets was performed followed by superficial corticotomies with a diamond bur within the sockets to boost bleeding.

Immediately after, the socket was filled with a prehydrated collagen-containing cortico-cellular heterologous bone gel injected using a syringe in order to compensate osseous defects (**Figure 5**). On the top of it, a RCM was used to fulfill the principle of compartmentalization and to provide stability to the bone graft.



In order to increase the buccolingual dimension of the edentulous ridge and ensure socket sealing, the palatal connective tissue pedicle was rolled under the buccal mucosa and secured with 5–0 vicryl suture to the labial flap. Then the donor palatal site was sutured with the same suture (Figure 6).

After surgery, the patient was instructed not to brush over the surgical area until instructed. He received pain control medication (paracetamol 750 mg every 6 h for 4 days), antibiotic (amoxicillin 500 mg every 8 h for 7 days), and chemical plaque control (0.12% chlorhexidine gluconate rinse every 12 h for 14 days). Healing was uneventful and the patient reported only mild discomfort. The sutures were removed after 2 weeks. The patient was maintained under professional supervision for oral hygiene control.

At reevaluation, 6 weeks after the surgical intervention, the patient presented with good soft tissue healing, with no signs of infection or inflammation (Figure 7).



**FIGURE 5** Periapical radiograph showing the socket filled with the prehydrated collagen-containing cortico-cellular heterologous bone gel.

### 3.3 | Provisional prosthetic rehabilitation

After removing the zirconia crowns on 13 and 45, three-unit fixed provisional resin bridge was fabricated to replace the 14. Initially, the pontic base was placed away from the edentulous site so as not to hinder healing (Figure 8).

Taking into account the sufficient thickness of the ridge obtained after surgery, the ovate pontic design was chosen to model the soft tissues and allow for a natural emergence profile.

The basal region of the provisional pontic was gradually increased by using a light-cured biocompatible fluid composite to form an ovate shape pressing on the edentulous ridge (Figure 9).

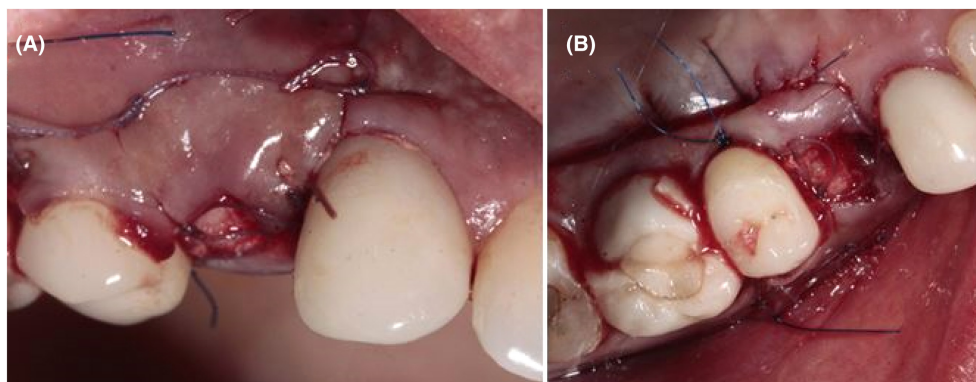
The pontic base must not create too much pressure on the gingiva, which may cause an ischemic condition. This procedure was repeated two or three times at intervals of 8–10 days until the desired shape of the pontic area was achieved.

## 4 | RESULTS

At 6 months, the described prosthetic soft tissue-shaping technique achieved optimal labial marginal gum morphology around provisional restoration. We note the creation of a depression at a depth of approximately 1 mm into the gingiva allowing a good integration of the emergence profile of the pontic (Figure 10).

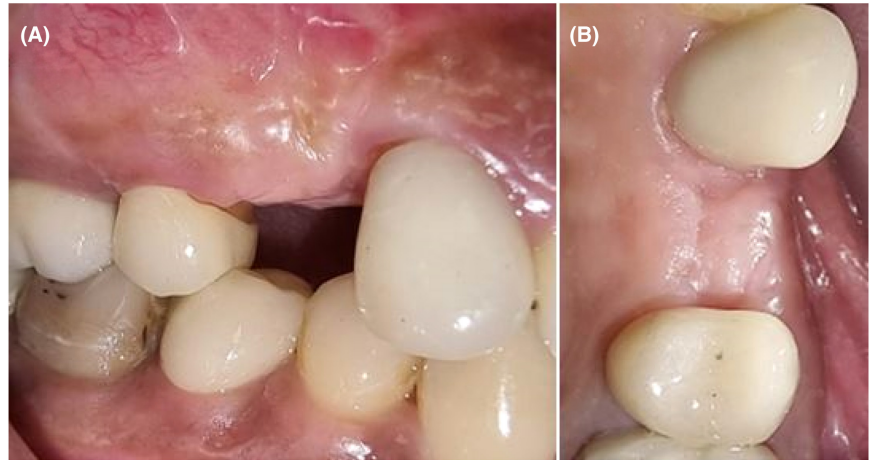
After the edentulous ridge was found to be full and healthy, an impression was taken in order to transfer accurately the gingival profile generated by the surface of the provisional pontic to a working cast. The impression technique used is described in (Figure 11).

This impression technique will allow the laboratory technician to replicate on the definitive prosthesis all aspects of the form and contours of the provisional restoration (Figure 12).



**FIGURE 6** (A) suturing the palatal connective tissue pedicle to the labial flap. (B) Suturing the palatal donor site.

**FIGURE 7** Vestibular (A) and occlusal (B) view 6 weeks after surgery showing good healing of the soft tissues.



**FIGURE 8** Photo showing the provisional bridge placed away from the edentulous site.

Reassessment by periapical radiograph and cone beam computed tomography revealed a buccolingual dimensional stability at 12 months, bone gain with some residual alloplastic bone graft particles in the socket (Figure 13).

Finally, the patient was advised to brush and clean the oral cavity thoroughly, particularly the area under the pontic which should be cleaned regularly using dental floss in order to prevent tissue inflammation.

The patient was very satisfied with the aesthetic and functional results obtained.

## 5 | DISCUSSION

Treatment of peri-implantitis is still considered a clinical challenge. The treatment modalities should be chosen based on the severity of peri-implant diseases, amount of bone loss and the morphology of peri-implant bony defects.<sup>10</sup> The efficacy of different interventions for peri-implantitis still remains a subject of debate owing to poor predictability in the long term. Scientific

evidence indicates that surgical procedures seem to be more effective than nonsurgical therapy. However, it is always recommended that defects exceeding 50% of the total length of the infected dental implants should be removed.<sup>11,12</sup>

In the case reported here, the implant at the right maxillary first premolar must be removed due advanced peri-implant bone loss. Indeed, after removal of the implant, the edentulous site must be compensated by the placement of another implant or by a conventional bridge.

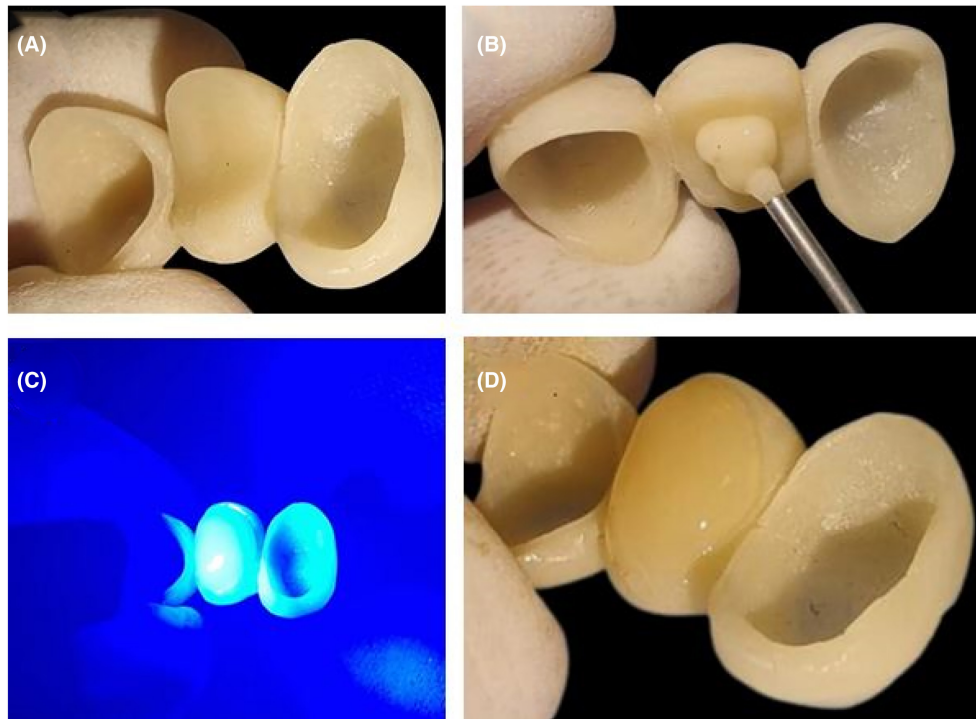
Regarding the implant solution; Zhou et al. in a systematic review about feasibility of dental implant replacement in failed sites found that the implants showed high survival rate (88.84%) after retreatment with a mean follow-up of 42 months. However, this survival rate always remains lower than that of implants placed at the first attempt (varies between 90.5% and 100%).<sup>13</sup>

Gomes et al.<sup>14</sup> and Se-Lim et al.<sup>15</sup> in more recent systematic reviews have corroborated these results. These authors, also noted that bone grafting simultaneous to implant removal associated or not with a soft-tissue grafting were common practice in failed sites and which requires a healing period of at least 4 months prior to reevaluation. In addition, the need for further grafting always remains possible in order to ensure good osseointegration of future implants.

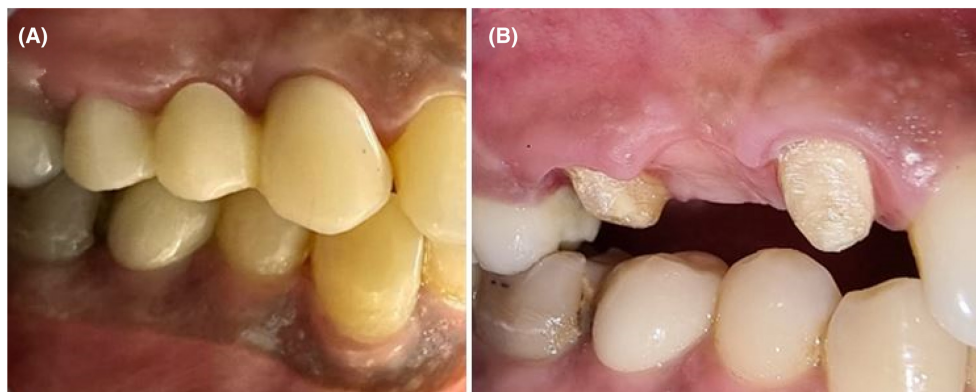
However, immediate implant placement in advanced defects carries significant risks and is not advocated.<sup>16</sup>

Due to the burden surgical interventions required to place another implant, the patient refused the implant solution for fear of another failure. She preferred the conventional bridge, and she had no problem with surgical ridge augmentation in order to improve the esthetics and function of the prosthetic restoration.

Given that the buccal bone defects are large (>50% of the buccal bone plate missing), as well as the placement of dental implants on this site always remains likely at some



**FIGURE 9** (A) The base of pontic was concave. (B) Ovate pontic was prepared by adding flowable composite resin at the pontic base to get the ovate shape. (C) Light-curing. (D) Photographs showing proper contours of ovate pontic.



**FIGURE 10** Photos (A, B) showing the gingival sculpture around the provisional restoration 6 months after surgery.

point. We opted for GBR with an alloplastic bone graft and RCM immediately after implant removal.

Radiographically, this chosen surgical technique promoted good alveolar filling, bone gain as well as buccolingual dimensional stability at 12 months.

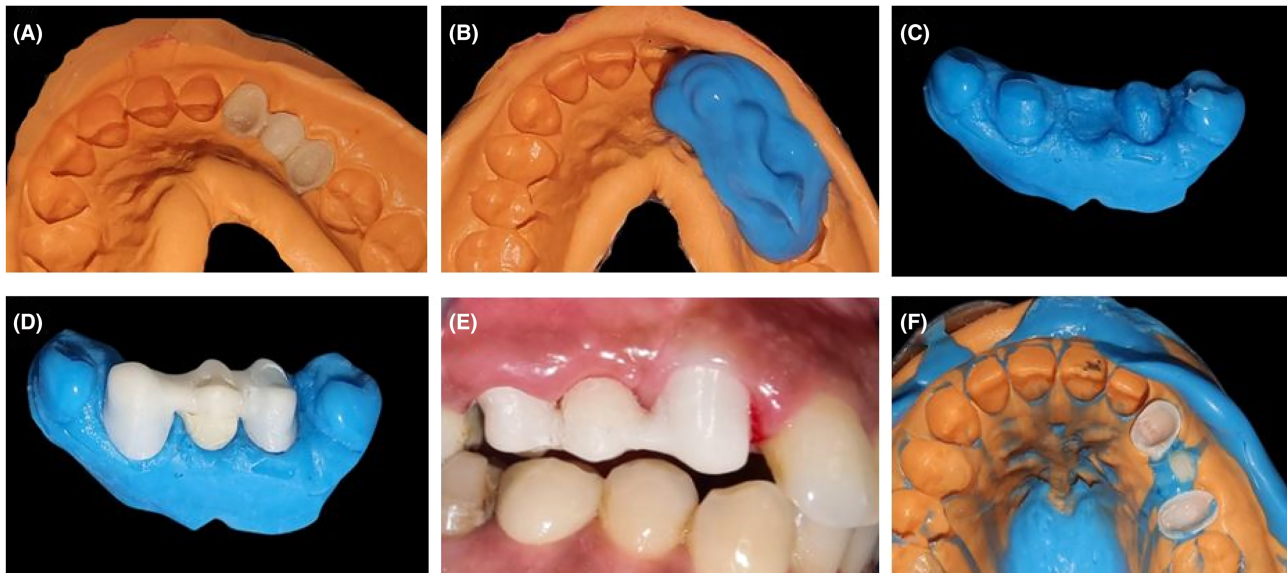
However, grafting particle remaining in the socket may influence the quality of osseointegration if an implant will be placed later. In contrast, animal studies have shown that residual graft particles have no impact on osseointegration and remain separated from implant surfaces by mineralized bone,<sup>17,18</sup> Indeed, the degree of change in bone quality depends on the resorption rate of the graft material and its ability to encourage bone formation.

In 2018, Artas et al. compared the effects of different bone grafts (xenografts, allografts, and alloplastic grafts) to treat peri-implant defects in rat calvarium treated by GBR. According to the results of the histological and immunohistochemical analyses, none of the grafts used in this study showed superiority with respect to new bone formation.<sup>19</sup>

In our case, the material used thanks to its dual phase structure containing a mineral bone phase, and an organic collagen phase represents a gradually resorbable biomaterial thus allowing a faster remodeling process and a higher amount of new bone formation.

However, It is not yet known whether this type of dual phase materials can promote osseous regeneration





**FIGURE 11** (A) Pick-up impression with the provisional restoration in place. (B) Inject regular-body vinyl polysiloxane impression material. (C) Silicone cast. (D) Adapt the zirconia coping with the contoured soft tissue registration by adding resin. (E) Place customized zirconia coping over the abutment teeth. (F) Make definitive transfer impression with customized zirconia coping in place.



**FIGURE 12** Photo of the final restoration showing the best tissue integration.

more effectively than the commonly used pure deproteinized bovine bone minerals,  $\beta$ -tricalcium phosphate, or hydroxyapatite.<sup>20</sup>

Although much progress has been made in recent years in oral implantology, autogenous bone grafts remain the gold standard in GBR procedures due to their osteoinductive and osteoconductive properties.<sup>21</sup>

Recently, Monje et al.<sup>22</sup> suggested the use of biologics, in particular autologous blood-derived products may enhance healing and accelerate bone formation in sites where implants are removed because these sites differ substantially from tooth extraction sockets. Indeed, implants are ankylosed within the alveolar bone, which have neither

mechanoreception nor the elasticity provided by periodontal ligament fibers. Therefore, the surrounding bone may provide limited vascularization which may interfere with the healing and bone forming process within the socket.

The RCM was chosen in our case to promote the formation of blood vessels through its fibrous structure which helps to potentiate the process of bone regeneration in implant removal site. In addition it allows the exchange of fluids and absorption by the tissues, also contributing to the protection of the new bone formed.

Despite these advantages, resorbable membranes have not been shown to give more or less bone than non-resorbable, although they are less likely to undergo exposure and infection.<sup>23</sup>

After socket grafting, particulate bone substitutes could easily become dislodged, and RCM require complete coverage. In our case, the palatal connective tissue pedicle was used to ensure socket sealing. It offers the advantage of reducing the number of surgical sites and time. The pedicle will have its own vascular supply compared with free grafts. These latter are not well suited for use in areas where the blood supply to the recipient site has been compromised by implant removal surgery.

Xenografts can also be used and offer the advantage of color match and no donor site morbidity.<sup>24</sup>

The quality of healing of the grafted soft tissues depends largely on the pontic surface of the temporary restoration abutting the tissue. This surface in the present case was convex, smooth and highly polished made with Acrylic resin which was added many times to maintain the form of aesthetic interdental papilla.



FIGURE 13 (A) Periapical radiograph and (B) cone-beam computed tomography showing the good alveolar filling at 12 months.

This conditioning of the gum which involves additional expense and appointments presents the major disadvantage of ovate pontic. The patient must be aware of the need for frequent treatments and follow-ups. Our patient exhibited exceptionally good cooperation and oral hygiene. Zitzmann and colleagues reported that clinically healthy conditions can be established at pontic sites of the premolars and molars if appropriate plaque control is performed.<sup>25</sup>

In addition to oral hygiene, the degree of pressure placed on the edentulous ridge mucosa by the pontic can influence soft tissue healing; Tripodakis and Constantinides demonstrated that “hyperpressure” exerted from an ovate pontic resulted in a thinning of the epithelium, but no distinct histometric or morphometric measures were presented.<sup>26</sup>

Indeed, thanks to this close cooperation between the periodontist and the prosthodontist the conventional bridge with ovate pontic associated with a reconstruction of the ridge made it possible to obtain functional and aesthetic results in accordance with the patient’s requirements after implant removal due to advanced peri-implantitis.

## 6 | CONCLUSION

Therapeutic management of peri-implantitis still remains a subject of debate. Only a full understanding of the severity of the dimensional defects, the surgical techniques available and the aesthetic and functional needs of the fixed prosthetic restoration will allow the design of a treatment approach that will achieve the desired outcome.

### AUTHOR CONTRIBUTIONS

**Alaa Samadi:** Conceptualization; resources; validation; writing – original draft; writing – review and editing. **Zouheir Ismaili:** Writing – review and editing. **Amal El Yamani:** Writing – review and editing.

### FUNDING INFORMATION

This research received no external funding.

### CONFLICT OF INTEREST STATEMENT

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

### DATA AVAILABILITY STATEMENT

Data related to the study can be provided on reasonable request.

### CONSENT

Written informed consent was obtained from the patient to publish this report in accordance with the journal’s patient consent policy.

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**How to cite this article:** Samadi A, Ismaili Z, El Yamani A. Multidisciplinary management of implant failure: A case report. *Clin Case Rep*. 2024;12:e9269. doi:[10.1002/ccr3.9269](https://doi.org/10.1002/ccr3.9269)