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Case Report

Management of Early Dental Implant Complication: A Report of Two Cases

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ABSTRACT

Background: Early peri-implant complications may appear within a couple of weeks following implant installation. Such complications may compromise implant success and longevity. Prompt identification and treatment of these complexities can prevent complications and implant failure.

Case presentation: The study involved two patients referred for implant therapy owing to tooth loss, with no significant medical his-tory. Both patients underwent thorough periodontal and radiographical evaluation to assess the suitability of implant placement. The first patient, a healthy non-smoker, received a Bio horizons implant, while the second, a smoker, received a Nobel implant. Three weeks post dental implant placement, both patients experienced early complications, presenting with swelling and discomfort. Surgical intervention included anesthesia, flap elevation, granulation tissue removal, mechanical cleaning of the im-plant surface using a titanium brush, and filling of bone defects with grafting material (mixture of allograft and xenograft). Postoperative care included antibiotics, pain management, and oral hygiene instruction. After 4 months, the implants were uncovered, and the patients were then referred for the placement of implant crowns.

Conclusion: The reconstructive approach employed in these cases appears to be an effective method for managing early biological complications following dental implant installation. The successful restoration of healthy peri-implant tissues was achieved, indicating the potential efficacy of this treatment strategy.

INTRODUCTION

Complications associated with dental implants may manifest at any stage following the procedure of dental implant placement (Heitz-Mayfield et al., 2014; Kochar et al., 2022). Complications are classified based on their nature as either mechanical or biological (Ferreira et al., 2022). Complications can also be classified according to their incidence. Implant complications can be classified as "early" or "late" based on their onset (Lin et al., 2018). Management of complications is a clinically challenging procedure, and if not untreated, it may contribute to further progression, potentially resulting in implant failure (Kochar et al., 2022; S. H. Park & Wang, 2005).

A retrospective analysis revealed that 4.8% of 186 implants failed to achieve osseointegration and consequently had to be removed before loading (Krisam et al., 2019a). In a separate clinical trial involving more than 9000 implants, a failure rate of approximately 4% was observed. Notably, over 83% of these failures occurred before the placement of any prosthetic restoration (Staedt et al., 2020a). These findings underscore the pressing need for further research in implantology to mitigate premature implant failure and enhance long-term treatment outcomes.

Early detection and treatment of such complications, including an inflammatory condition of the tissues surrounding the implant, can prevent serious complications (AlGhamdi, 2012; Neely & Maalhagh-Fard, 2018). Risk factors for early biological complications have been extensively studied. Implant misalignment, high insertion torque, and thermal necrosis caused by the drilling heat are associated with implant failure. The quality and quantity of the surrounding bone, implant-specific characteristics, and patient-related variables, such as smoking and nutritional status, affect implant integration success. Implant outcomes can also be affected by systemic factors

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such as age and infection (AlDahlawi et al., 2018; Krisam et al., 2019b; Staedt et al., 2020b).

Mechanical debridement, antiseptics or antibiotics, and various surgical therapies have been proposed to treat peri-implant diseases. However, there is currently no universally recognised superior approach (Gianfilippo et al., 2020; Heitz-Mayfield & Salvi, 2018). There is no gold-standard method, tool, or substance for the treatment of peri-implant diseases (Di Gianfilippo et al., 2023; Schwarz et al., 2022). The surgical-treatment for peri-implantitis improved all clinical and radiographic parameters and reduced buccal recession (Derks et al., 2022). At the 12-month follow-up, titanium brush cleaning of the implant surface reduced bleeding on probing, decreased pocket depth, and increased radiographic bone fill compared with ultrasonic cleaning (de Tapia et al., 2019).

These findings suggest that while no gold-standard treatment for peri-implantitis has been identified, surgical interventions and using specific cleaning tools, such as titanium brushes, may improve clinical outcomes and address the challenges associated with this condition. Further studies and treatment options are required to understand early implant complications better and manage them. The current report explored a reconstructive approach's clinical and radiological outcomes as a treatment option for early dental implant complications.

CASE REPORT

History and examination

This report included two patients with non-significant medical histories who were referred for implant therapy owing to tooth loss. Dental examination of these patients revealed the absence of gingival inflammation, and bleeding on probing was less than 10%. The patients exhibited a thick gingival phenotype with sufficient keratinized tissue around the missing teeth. The radiographic analysis utilized cone-beam computed tomography (CBCT) with the i-CAT Vision Q System set at 120 kVp and 37.07 mAs, an acquisition time of 26.9 s, and assessment conducted using ICAT Vision viewer, version 1.9.3.13. The CBCT images demonstrated complete socket bone filling and adequate alveolar bone height and width.

Case description

Patient (A) was a 33-year-old healthy nonsmoker with missing tooth #13. A Biohorizons single implant measuring 4.6 × 12 mm, with a 4.5 Plat (Biohorizons, Laser-Lok collar, RBT body, Birmingham, USA) was inserted to replace the missing tooth. Patient (B) was a 42-year-old male smoker (at the time of implant installation) with missing tooth #14. A noble single implant measuring 4.3 × 10 mm was placed to replace the missing tooth (Nobel Biocare, TiUnite surface, Göteborg, Sweden).

Post-installation, conventional periapical radiographs (PA) were obtained. Radiographs (PA) were obtained using a long paralleling technique and a digital radiograph sensor (Gendex GXS-700™ Dental X-Ray size 2 sensor, KaVo Kerr, Gendex Dental Systems North Penn Road Hatfield, USA). The radiographs were analyzed using a software program (ImageJ 1.54d, Wayne Rasband et al., National Institutes of Health, USA). At each implant, the top of the implant shoulder (IS), the most coronal position of the implant-bone (IB) contact, and the bone crest (BC) next to the implant were identified. The vertical (V) distance between the IS and IB and the horizontal (H) distance between the IS and BC were measured on a high-definition monitor (Figure 1) for the mesial and distal aspects of each implant. Known implant lengths and widths were used for the measurement calibration. One clinician performed all the radiographic measurements. Periodontal and peri-implant mucosal examinations were conducted, including probing pocket depth and bleeding on probing (BoP). Patients (A and B) presented to the periodontal clinic with swelling and discomfort 3 weeks after submerged dental implant installation. Clinical examination revealed localized intraoral swelling accompanied by a fistula and pus drainage (Figures 2B and 3A). Moreover, the radiographs showed radiolucency around the dental implants, indicating disease progression (Figure 4B and 5B). Therefore, immediate surgery was initiated.

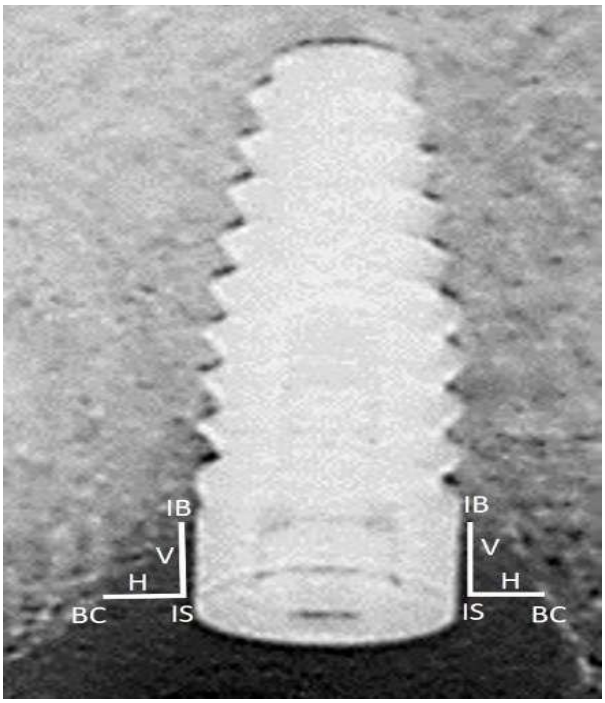

Figure 1. *An intra-oral radiograph illustrates the measurements of the extent of radiolucency enveloping the implant. IS=implant shoulder, BC=alveolar bone crest, IB=implant-bone contact, V= vertical bone loss (distance between IS and IB), H= horizontal bone loss (distance between IS and BC).*

Case management

The implant site was anesthetized using an infiltration technique with the local anesthetic 2% mepivacaine with a 1:100000 vasoconstrictor (les laboratories medis S.A., Nabeul, Tunisia). Full-thickness mucoperiosteal flaps were elevated, extending from the mesial to the distal neighboring teeth, with vertical incisions (Figures 2C and

3B). The granulation tissue was removed around the implant. Gracey curette hand instruments and an ultrasonic scaler were used to remove residual granulation tissue. The implant surface was then mechanically cleaned using a titanium brush attached to a low-speed handpiece (HANS Korea Co., Ltd., NiTi Brush Omega, Korea). The surgical site was irrigated with saline solution. Bone substitution materials were used to fill the bone defects around the implant. The bone substitution materials were a combination of allografts (LifeNet Health, min/demin 70/30 cortical mix 250-1000 micron, Virginia, US) and xenografts (Matricel GmbH, creos xenogain bovine bone mineral matrix, S 0.2-1.0 mm; Herzogenrath, Germany, Nobel Biocare). The graft site was secured and covered with a resorbable collagen membrane (Matricel GmbH, Creos Xenoprotect, Herzogenrath, Germany, Nobel Biocare). The membranes were stabilized using periosteal sutures (Figure 3C). The top edge of the membrane was placed beneath the palatal flap. Non-resorbable 4.0 monofilament polypropylene (SMI; Steinerberg, Belgium) sutures were combined with horizontal mattresses and interrupted suturing techniques for periodontal flap closure (Figure 3D).

The postoperative medication regimen included 500 mg of amoxicillin administered for a week following the surgical procedure. Ibuprofen (600 mg) was prescribed for 4 days following the surgical procedure. Oral hygiene instructions were provided, including discontinuing mechanical brushing at the surgical site for 10 days and prescribing chlorhexidine mouth rinse for 1 week. The surgical sites were examined three weeks later, and the sutures were removed.

Implant Restoration: Four months after suture removal, the peri-implant mucosal pockets were measured, BOP was recorded, and radiographic examinations were repeated. The implant site was anesthetized using an infiltration technique with a local anaesthetic of 2% mepivacaine containing a vasoconstrictor at a ratio of 1:100000. The implants were exposed, and healing abutments were connected to the implants (Figures 4C and 5C). Four weeks later, the implants were restored with crowns. The final clinical and radiographic examinations were performed (Figure 6A and B).

Initial presentation

Clinical and surgical findings: The initial clinical examination revealed localized intraoral swelling accompanied by a fistula and pus drainage (Figures 2B and 3A). Periodontal examination of the neighboring teeth showed a healthy periodontium with PD ranging between 1 and 3 mm and BOP of <10%. Intra-surgically, the bone defect was characterized by circumferential bone loss surrounding the dental implant (Figure 2C and 4C). The bony defects ranged from 1 mm to 2 mm.

Implant radiological finding: The post-installation radiographs showed that the bone was at the shoulder level of the implant (Figure 4A and 5A). Radiographs taken 3 weeks after installation showed radiolucency around the dental implant (Figure 4B and 5B). The V measurement was approximately 1.5 mm on the mesial and distal sides of the implants. The H measurement was approximately 2.7 mm on both the mesial and distal sides of the implants (Table 1).

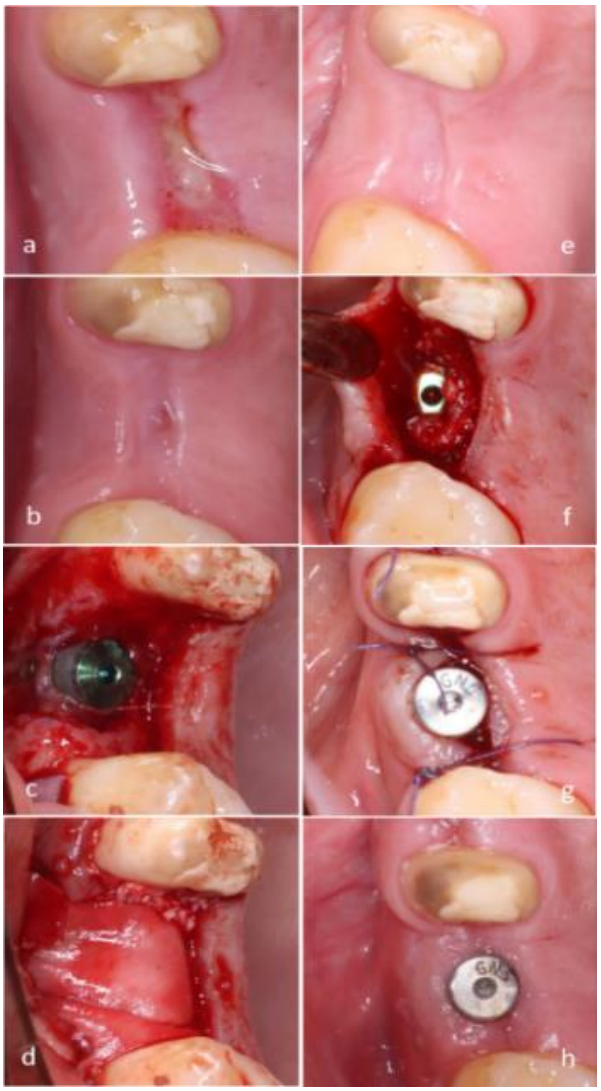

Figure 2. *Intra-oral clinical photograph (patient A) demonstrates various surgical procedure stages and post-surgical assessments. a) Healing of the surgical site 2 weeks after implant placement, revealing granulation tissue enveloping the space between the flap edges; b) mild intra-oral swelling accompanied by the presence of soft tissue fistula; c) flap elevation exposing granulation tissue adhering to the implant surface, and the bone defect contributed to the exposure of the buccal implant threads; d) application of a resorbable membrane barrier over the composite bone graft material; e) Follow-up at 4 months showed uneventful and complete healed surgical area; f) flap elevation during the second stage surgery; g) Placement of healing abutment and suturing of surgical flap using interrupted technique; and h) adaptation of the soft tissue around the abutment.*

Final presentation

Clinical findings: Healing following the surgical treatment of early complications was uneventful. The patient did not report any symptoms during the healing period. Periodontal examination revealed a healthy periodontium around the neighboring teeth. The clinical parameters

around the implant displayed a PD range of 1–4 mm and a BOP of <10%.

Case management radiological findings: The results of the bone level changes following surgical treatment for early complications is presented in Table (1). Radiological bone level changes (V) were approximately 1.5 mm of bone gain following surgical treatment and radiographic bone fill (H) was, on average, approximately 2.7 mm.

Table 1. *Bone level alterations around implants (patients A and B) following surgical intervention for early complications at the mesial and distal aspects.*

Patient	Bone level alterations around implants	Bone loss measurements		Distance
A		**Mesial**	**Distal**	**Average**
	V	1.5 mm	2.3 mm	1.9 mm
	H	2.3 mm	3.8 mm	3.05 mm
B		**Mesial**	**Distal**	**Average**
	V	1.3 mm	1.3 mm	1.3 mm
	H	2.1 mm	2.6 mm	2.4 mm
V=distance between the implant shoulder and the most coronal position of bone-to-implant contact; H=distance between implant shoulder and the crest of bone next to the implants.				

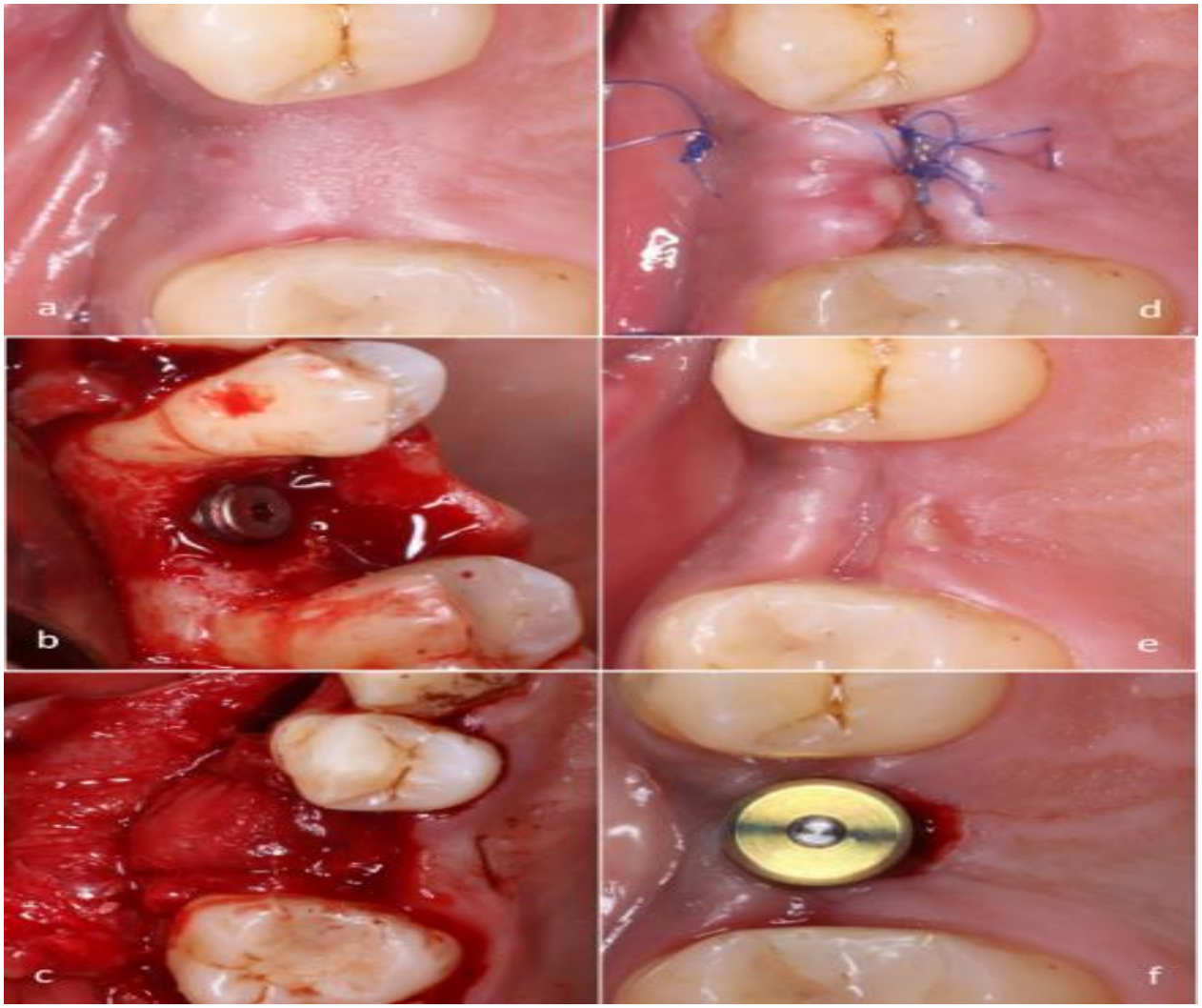

Figure 3. *Intra-oral photographs (patient B) showing the guide bone regeneration surgery around the implant. a) Detection of buccal soft tissue fistula; b) flap elevation disclosing a distinct Saucer-like bone defect encompassing the implant; c) application of resorbable collagen barrier enveloping the composite allograft and xenograft bone particulate; d) represents the surgical healing area 2 weeks after the surgery; f) implant site characterized by complete healing of periodontal soft tissue; and g) surgical placement of a healing abutment employing flapless approach.*

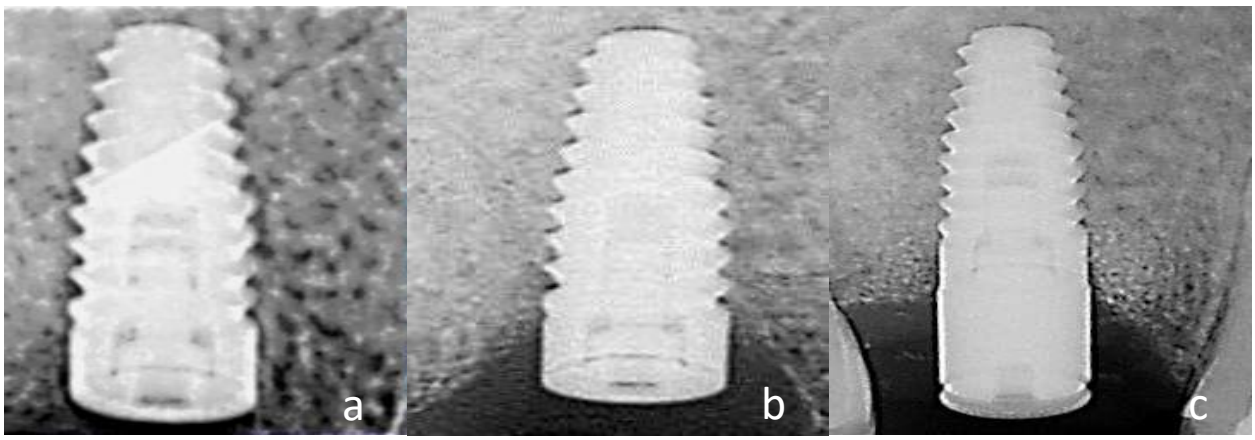

Figure 4. *Intra-oral periapical radiographs (patient A) showing the radiological bone level around the implant. a) Immediate post Implant #13 installation; b) evident radiolucency encircling the implant's coronal region; and c) radiological bone fill surrounding the implant 5 months after the surgical treatment.*

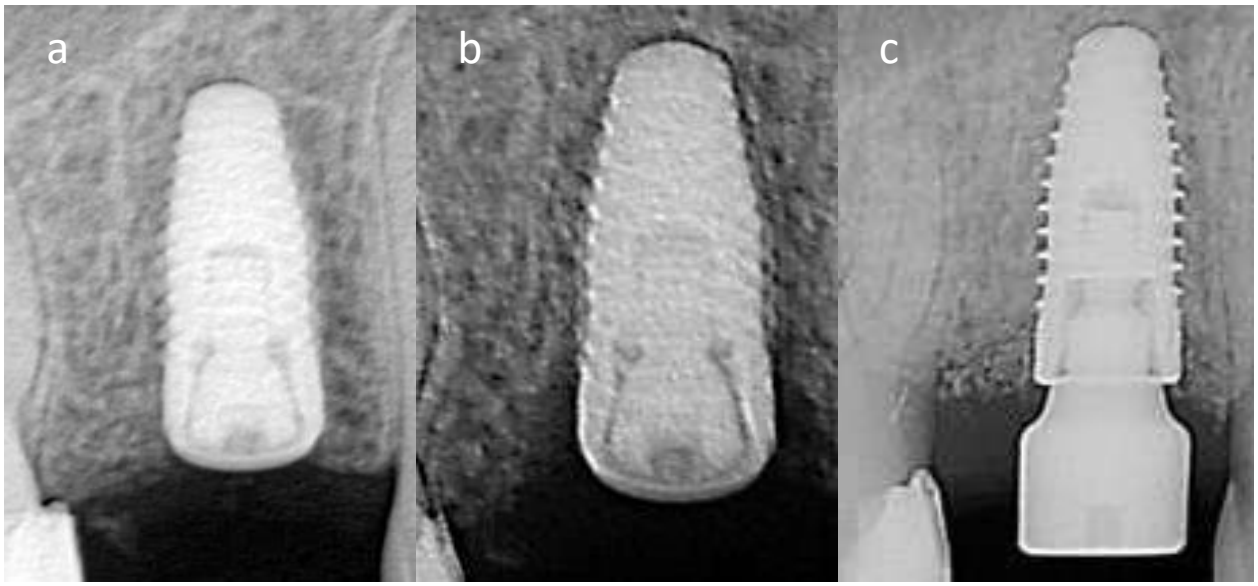

Figure 5. *Visualization of bone healing progression through intra-oral periapical radiographs (patient B). a) Immediate post-surgical installation of implant #14; b) identification of radiolucency related to top implant segment; and c) evidence of absence of radiolucency around the implant 5 months after the surgical therapy.*

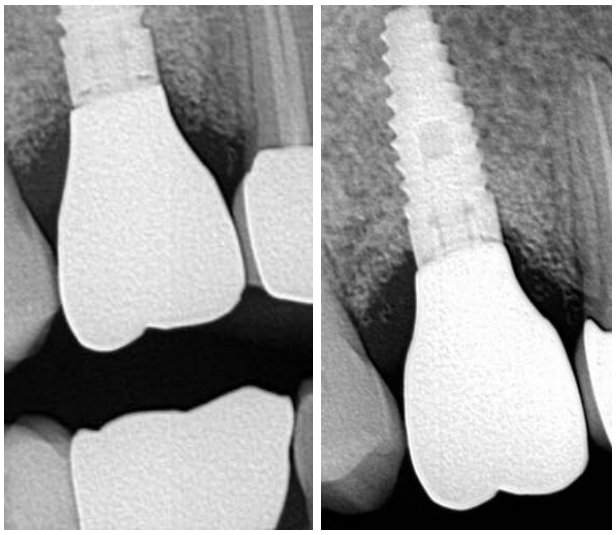

Figure 6. *Radiograph assessment for crown cementation in patient (A). a) Bitewing radiograph illustrating stable peri-implant bone level and b) periapical radiograph.*

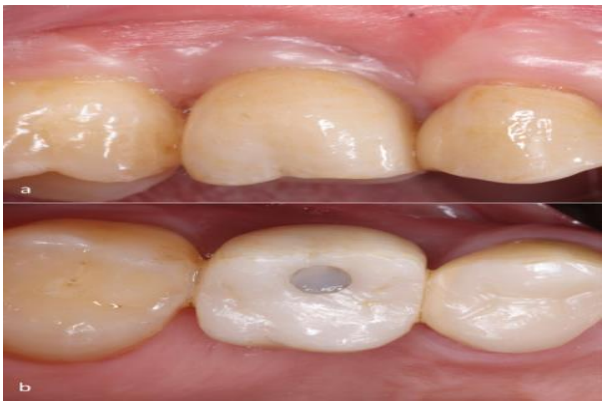

Figure 7. *Final implant restoration. Clinical photographs (6 months after implant restoration): a) Buccal view: the buccal clinical photograph of the final implant restoration depicting the external aspect and aesthetic integration of the implant with the surrounding gingival tissue. b) Occlusal View: the occlusal clinical photograph of the implant restoration focusing on the occlusal surface, showcasing the alignment, occlusal contacts, and interproximal relations with adjacent natural teeth.*

DISCUSSION

In these cases, we applied reconstructive surgical therapy for peri-implantitis as a treatment protocol for early biological complications following implant installation. The results showed that the reconstructive approach was an effective treatment protocol that may be a management strategy for treating early biological complications following implant installation. Healthy peri-implant tissues were established after the surgical treatment. Moreover, radiological outcomes indicated approximately 1.5 mm of bone fill 4 months after reconstructive surgical therapy. In addition, prosthetic replacement of the treated site showed good restoration of function and aesthetics after reconstructive surgical therapy.

Although the treatment modality in our reported cases has been described as an option for peri-implantitis (Derks et al., 2022; Isehed et al., 2016; Jepsen et al., 2016; Wohlfahrt et al., 2012)The same surgical approach, consisting of mechanical decontaminating the exposed implant surface, rinsing with saline, and using bone substitute materials to fill the bony defect, may also be effective for early biological complications.

In the current report, health status was re-established following reconstructive surgical therapy for peri-implant disease. Early complications of dental implants may result from excessive installation force, infection during installation, or other unknown reasons (Aldahlawi et al., 2018; Krisam et al., 2019b; Staedt et al., 2020b). Such early complications are often observed in smokers or those with poor oral hygiene (S.-H. Park & Wang, 2005). In this report, despite one patient being a smoker at the time of implant installation, both patients developed early complications. The primary objective of the surgical approach is to decontaminate the previously infected implant surface and re-establish healthy peri-implant tissues (de Tapia et al., 2019; Derks et al., 2022; Tomasi et al., 2019)Thus, surgical treatment may be considered for similar complications if other local and systemic predisposing factors are controlled.

In the subsequent second-stage surgical intervention, all implants exhibited commendable stability and were encased by a matrix of osseous tissues. Notably, a discernable presence of non-resorbed bone particles was identified, ostensibly representing remnants of the xenograft material (Zampara et al., 2022)In contrast to allogeneic graft counterparts, the utilization of xenograft materials was attributed to a comparatively higher prevalence of these residual osseous fragments. This difference can be attributed to the prolonged resorption timeline intrinsic to the xenograft substances.

The observed relationship between the morphology of bone defects and the selected treatment modality suggests a noteworthy association. Specifically, guided bone regeneration techniques exhibit a distinct inclination toward achieving heightened success rates (>50%) (Renvert et al., 2021), particularly in instances featuring circumferentially contained bone defects. The present study's radiological findings showed favorable outcomes regarding defect filling. The enhanced radiographic outcomes were achieved through a combined approach of implant surface mechanical cleaning and bone augmentation in managing bone resorption around implants (Tomasi et al., 2019). The morphological characteristics of the defect play a critical role in the efficacy of reconstructive peri-implant therapy. In cases with circumferential intra-bony defects, such as those observed in our study, the reconstructive methodology has shown bone regeneration around the implant (Schwarz et al., 2010). Nevertheless, the outcomes are not guaranteed. The clinical parameters, such as reduction in probing pocket depth and bleeding on probing, or radiographic outcomes could be the same with flap utilization with no bone augmentation, except less peri-implant mucosal recession with grafted bone defect (Derks et al., 2022).

Per mechanical cleaning standards, irrigation is critical for removing any material adhered to the implant's surface (Claffey et al., 2008; Heitz-Mayfield et al., 2012; Schwarz et al., 2017). The irrigation solution used was saline, which exhibited efficacy equivalent to that of other disinfection treatments (Carcuac et al., 2016).

The nature of the current case report, however, offers limited evidence of treatment efficiency. Nevertheless, it is essential to acknowledge that the nature of the disease and the timing may pose challenges in developing a well-designed method. Moreover, these complications occur in only a limited percentage of dental implants. Thus, our case report could be considered proof of the treatment concept, which needs to be investigated using a controlled prospective method. Thus, it is still necessary to conduct extensive longitudinal research in a multicenter manner to extensively explore and investigate the observed tendencies and, as a result, develop definite treatment procedures for impaired implants.

CONCLUSION

The reconstructive approach may be considered an effective treatment option for managing early biological complications following implant installation. Moreover, healthy peri-implant tissue can be established after surgical treatment. Further controlled investigation with a longitudinal design is essential to investigate the observed findings further.

AUTHOR CONTRIBUTION

WB: Conception, Data Collection, and Drafting of the article. BF: Data Collection, Data analysis and interpretation, drafting, and critical revision of the manuscript. All authors approved the final version to be published.

DECLARATIONS

Ethical Approval

The institutional review board approved the study and performed it following the principles of the Declaration of Helsinki.

Participants Consent

All participants gave informed consent at the onset of the study. They were assured of confidentiality and their right to withdraw from the study.

Source of Funding

No public, private, or nonprofit organizations supported this study financially.

Conflict of Interest

All authors have declared that no financial support was received from any organization for the submitted work. All authors have declared that no other relationships or activities could appear to have influenced the submitted work.

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