# Periapical Lesion on an Implant after Socket Shield Technique: A Case Report

**Vitor de Toledo Stuani, Gustavo Gonçalves do Prado Manfredi, Adriana Campos Passanezi Sant'Ana and Maria Lúcia Rubo de Rezende**

**Department of Prosthodontics and Periodontology/Discipline of Periodontology, Bauru School of Dentistry - University of Sao Paulo Al, Octavio Pinheiro Brisolla 9-75, Bauru, 17012-901, Brazil**

**Abstract**

A 47-year-old Caucasian male presented with a radiolucent area around the apical region of an implant placed using the socket shield technique. A second surgical procedure was performed to curette the lesion and fill the defect with a xenogeneic bone graft. Twenty months after implant placement and 10 months after the second surgery, there was no sign of recurrence of the lesion and radiographic evaluation was consistent with new bone formation in the region. Thus, although numerous studies have demonstrated the effectiveness of the socket shield technique, this case report illustrates the need for further randomized clinical studies for a better understanding of the clinical complications and indications for the technique.

*Key words: Complication; implant periapical lesion; regeneration; socket shield*

## Introduction

The formation and development of the alveolar bone are in close dependence with the genesis and eruption of teeth. Confirmation of this relationship can be observed with the reduction or absence of growth of the alveolar bone in cases of ankylosis or dental agenesis (Eichenbaum, 1977). Similarly, the maintenance of the alveolar ridge maintains a strong relationship with the presence of the tooth. Following tooth extraction, a remodeling process within the extraction socket is triggered as part of the healing process, characterized by the formation of new bone concomitant to external loss of height and thickness of the bone tissue (Schropp *et al.*, 2003). Thus, dimensional changes in the contour of the alveolar ridge invariably occur after tooth extraction, which may result in unfavorable sites for dental implant placement and aesthetic complications (Araujo and Lindhe 2005a; Schropp *et al.*, 2003).

Seeking a method to limit the influence of post-extraction remodeling, Hürzeler *et al.* (2010) introduced a new approach for immediate implants in regions of extracted previously periodontal healthy teeth. Named the "socket shield technique", it preserves the buccal portion of the root to keep the local periodontal ligament intact to attenuate bone remodeling. Briefly, the root of a decoronated tooth is sectioned longitudinally into two halves. The palatal half is carefully extracted, and the buccal half is retained inside the dental alveolus. The site is then conventionally prepared for an immediate implant with a palatine approach, resulting in the titanium being in close contact with bone tissue palatally and with the root fragment buccally.

In a pre-clinical dog model, Hürzler *et al.* (2010) observed histologically the absence of remodeling in the buccal portion and new cementum formed on the surface of the implant in areas in contact with the root fragment. They also demonstrated in a case report that no clinical changes were noted, confirming osseointegration (Hürzeler *et al.*, 2010). However, the limitations of the technique are not well known, and its indication should be carefully considered. Since the technique is relatively recent, there have been no failures reported in the literature. Thus, the objective of this case report is to describe for the first time the management of a complication arising from an immediate implant placed using the socket shield technique.

Correspondence to: Vitor de Toledo Stuani, Department of Prosthodontics and Periodontology/Discipline of Periodontology, Bauru School of Dentistry - University of São Paulo, Al. Octavio Pinheiro Brisolla 9-75, Bauru, 17012-901, Brazil. Phone: +55 (14) 32358000; E-mail: vitortoledo@usp.br

## Case report

A male, Caucasian, 47-year-old patient systemically healthy but with a smoking habit sought dental care at the Integrated Rehabilitation Clinic at Bauru School of Dentistry, University of Sao Paulo. He reported constant loosening and bad odor associated with a cemented metal-ceramic prosthesis in the upper left lateral incisor (*Figure 1*). The tooth had been endodontically treated more than 10 years prior (*Figure 2*). After evaluation of the remaining root structure, the proposed treatment was tooth extraction with immediate implant placement and subsequent prosthetic rehabilitation. Due to the patient's bone architecture with pronounced root contours, we considered the possibility that post-extraction remodeling would compromise aesthetics. For this reason, it was decided to use the socket shield technique (Hürzeler, *et al.*, 2010).

After removal of the prosthesis, the root surface was drilled with a diamond spherical drill to 1 mm supracrestally (*Figures 3A*, *3B*). Using a long conical drill, the root was segmented mesiodistally, dividing the root into a vestibular fragment and a palatine fragment. The palatine fragment was extracted atraumatically using delicate movements with a periotome (*Figure 3C*). After the removal of the palatine fragment, the site was prepared for the placement of an implant (4.3 x 13 mm Morse taper screw-shaped, Neodent®, Brazil) contacting the bone tissue palatally and the root surface buccally, with gaps < 1 mm (*Figure 3D*). The implant was stabilized at a torque of 50 N-cm. Immediately after implantation, a temporary acrylic crown was cemented onto a universal abutment. The patient received amoxicillin 500 mg every 8 hours for 7 days, nimesulide 100 mg every 12 hours for 3 days and chlorhexidine gluconate mouthwash 0.12% every 12 hours for 2 weeks.

Six months after the implant placement, the patient returned for the final prosthodontic treatment (*Figure 4*). On the radiographic examination, a radiolucent area was observed in the apex region of the implant (*Figure 5*), but without clinical signs of infection, inflammation, mobility or pain. The patient was followed radiographically and due to the progression of the lesion after four months (*Figure 6*), surgical intervention was prescribed.

**Figure 1.** ***Initial clinical aspect.***

**Figure 2.** ***Initial radiographic aspect.***

A trapezoidal incision was made in the alveolar mucosa and a full-thickness flap was raised (*Figure 7A*). After exposure of the bone tissue, a fenestration in the apical region was noted. Using a spherical diamond drill under constant irrigation (*Figure 7B*), the access to the cavity was enlarged, allowing the curettage of the lesion (*Figures 7C, 7D, 7E*). No signs of infection and suppuration were noted. Implant surfaces were scaled with implant curettes. After complete curettage of the soft tissue, the region was treated with citric acid (pH = 1 at 50%) for 30 seconds (*Figure 7F*) to demineralize the bone tissue and potentiate the regenerative process (Rezende *et al.*, 2014). After intense irrigation with saline solution, the cavity was filled with xenogenous bone graft (GenOx Inorg®, Baumer®, Brazil) and the flap was sutured with 5-0 nylon. The prescribed drug therapy was the same as described for implant placement surgery. After 14 days, the sutures were removed.

Twenty months after implant placement and 10 months after the second surgery, no clinical or radiographic signs were noted. An increase in the radiographic density in the surgical region suggested new bone formation (*Figures 8, 9*).

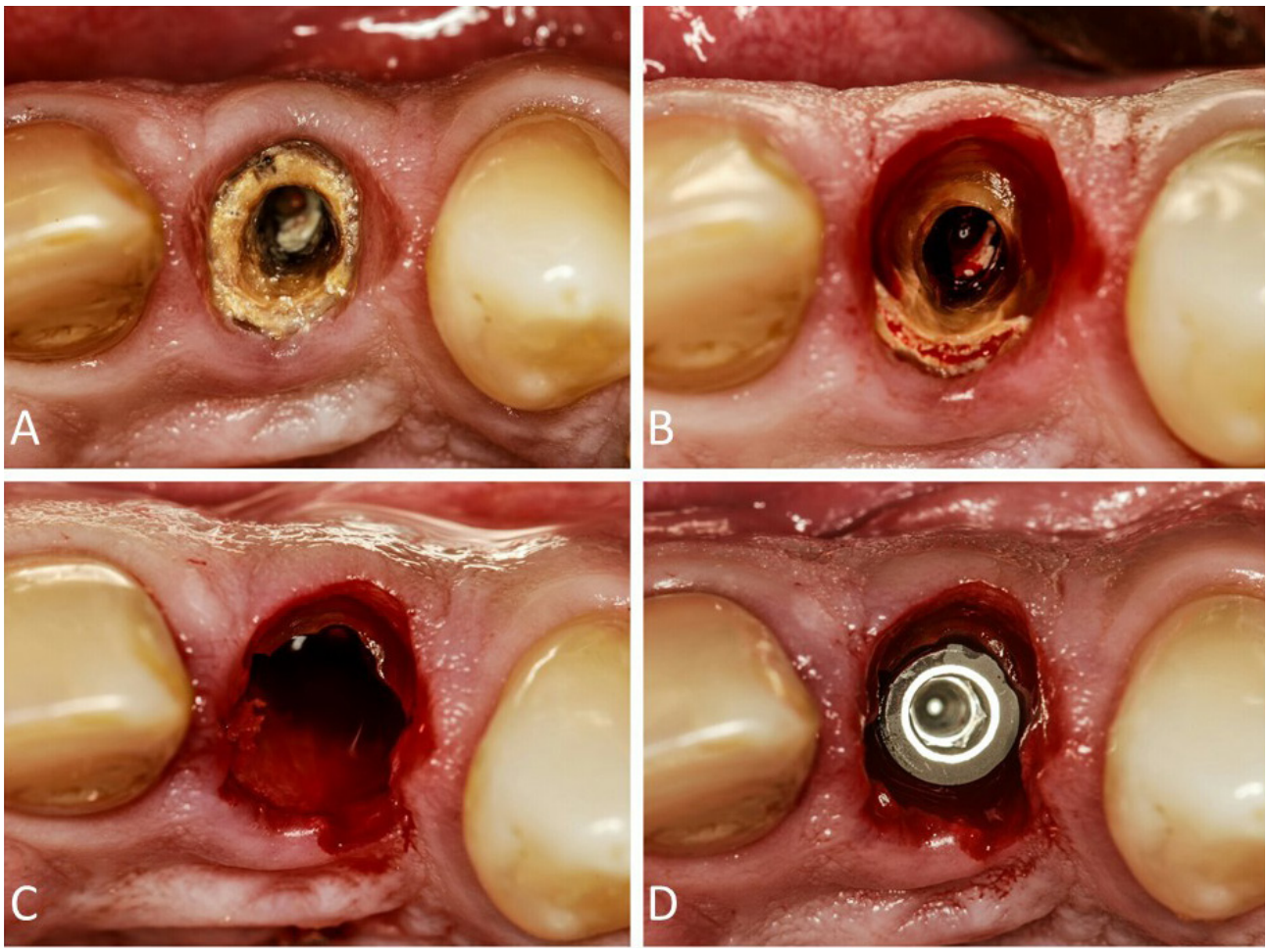


**Figure 3.** ***A- Root structure after prosthetic removal. B- Cervical buccal root drilled up to 1 mm supracrestally. C- Preservation of buccal root fragment and extraction of the palatine fragment. D- Implant placed in contact with bone and root surfaces.***


**Figure 4.** ***A- Immediate clinical aspect after implant placement. B- Clinical aspect 6 months after implant placement with a dimensional preservation of soft tissue.***

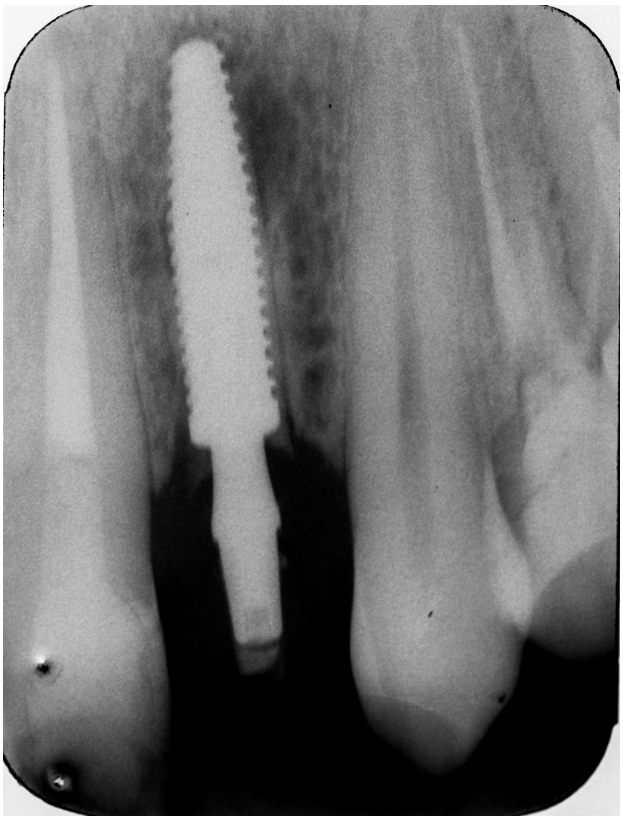

**Figure 5.** ***Radiography 6 months after implant placement showing radiolucent area on implant apical region.***

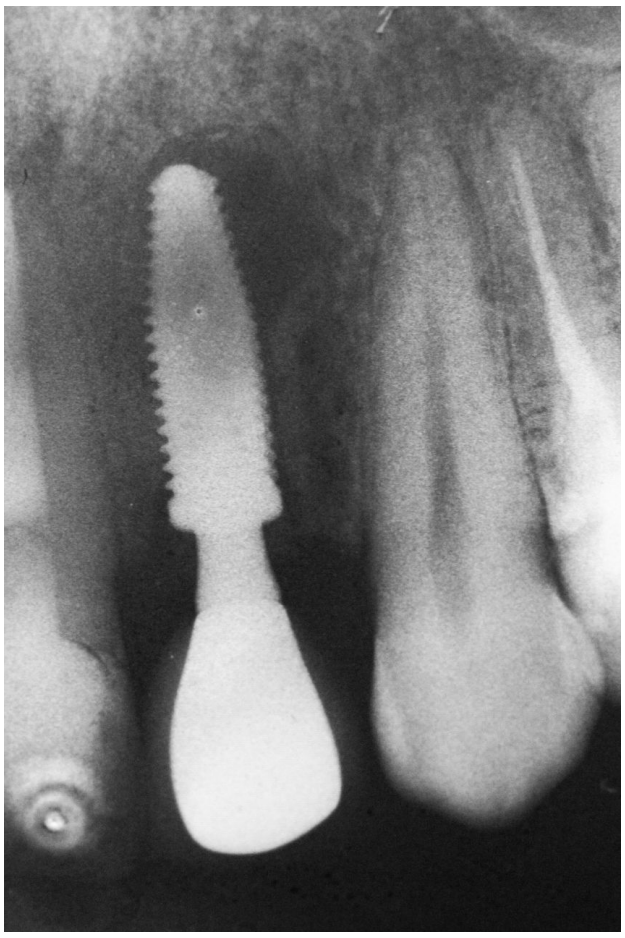

**Figure 6.** ***Progression of the lesion.***

## Discussion

Ridge remodeling after tooth extraction is a well-described phenomenon in the literature and can be attributed to the loss of the periodontal ligament, since a significant part of the blood vessels that nourish the bone tissue surrounding the alveolar process originate from this portion of the periodontium (Araujo and Lindhe, 2005a). To minimize the effects of post-extraction remodeling, procedures like the installation of immediate implants in fresh alveoli (Araujo *et al.*, 2005b; Botticelli *et al.*, 2004) and the use of bone grafts and/or membranes (Carmagnola *et al.*, 2003; Nevins *et al.*, 2006) have been tested. However, those techniques do not prevent the process (Araujo et al., 2005b; Fickl *et al.*, 2008).

Following the reasoning of the structural dependence of the alveolar ridge with the dental root, numerous studies have tested the hypothesis of root retention as a tool for the preservation of the ridge contour (Garver and Fenster, 1980; Filippi *et al.*, 2001). The principle of partial extraction therapies is the maintenance of the alveolar dimension through the partial or complete retention of the root structure, preserving the supracrestal fibers and the vascular contribution of the periodontal ligament (Gluckman *et al.*, 2016). Among these techniques, the socket shield is based on the maintenance of the buccal root fragment to preserve the alveolus dimension in immediate implant placement (Hürzeler *et al.*, 2010). Its main indication is the anterior region of the maxilla (Gluckman *et al.*, 2016). Although a relatively recently described procedure, its applicability has already been demonstrated in several articles (Baumer *et al.*, 2015; Gluckman *et al.*, 2016; Guirado *et al.*, 2016; Hürzeler, et al., 2010).

Periapical lesions on implants were first described by McAllister *et al.* (1992), with a prevalence of approximately 1.86% (Quirynen *et al.*, 2005). The causes of these lesions are difficult to identify due to their plurality, but may be due to the reactivation of preexisting pathologies, new tissue destruction or tissue scars (Chang and Hsu, 2007; Romanos *et al.*, 2011). These changes can be triggered by contamination of the implant surface, bone heating during osteotomy, excessive torque, poor bone quality, bone cortical perforation or thinning, excessive or premature overload, bone fracture and the presence of root fragments or foreign bodies in the interior of the bone (Chang and Hsu, 2007; Romanos *et al.*, 2011).

When considering the presence of a periapical lesion in an implant placed in endodontically treated tooth extraction areas, the persistence of previous contamination is quite plausible. In their review, Romans *et al.* (2011) observed that most of the periapical lesions in implants occurred in areas of previously endodontically compromised teeth. In addition, 65.6% of the cases had a fistula. However, in our case, no signs of infection were noted throughout the treatment, such as fistula formation or purulent collection. Neither complications resulting from the surgical procedure itself also appear to have been responsible for the presence of the lesion, since the preparation of the surgical alveolus was performed under intense irrigation and adequate torque. During the surgery for curettage of the lesion, it was also possible to evaluate the positioning of the apex of the implant, excluding the possibility of perforation or impairment of the buccal bone wall. Thus, we consider that the most probable cause for the triggering of the process was the extrusion of root residues or obturator material to the apical region during osteotomy and implant placement.

Our choice for management therapy followed that recommended by other authors, with apical exposure of the implant, curettage of the defect and bone regeneration, since the use of a membrane over the grafted material does not seem to exert influence on therapeutic success (Romanos *et al.*, 2011; Chan *et al.*, 2011). In this case report, citric acid was used not for implant surface decontamination, but as a conditioning agent of the bone surface to optimize bone healing. This approach was proposed by some authors who reported better bone grafts consolidation (Rezende *et al.*, 2014) and better pre-osteoblasts behavior when bone surfaces are demineralized (de Rezende *et al.*, 2015). Conversely, other authors used citric acid for 30 to 60 seconds for surface decontamination of hydroxyapatite-coated implants (McAllister *et al.*, 1992). Regardless of the adopted protocol, implants affected by apical lesions present a high survival rate after diagnosis and treatment, reaching 96.2% (Romanos *et al.*, 2011).

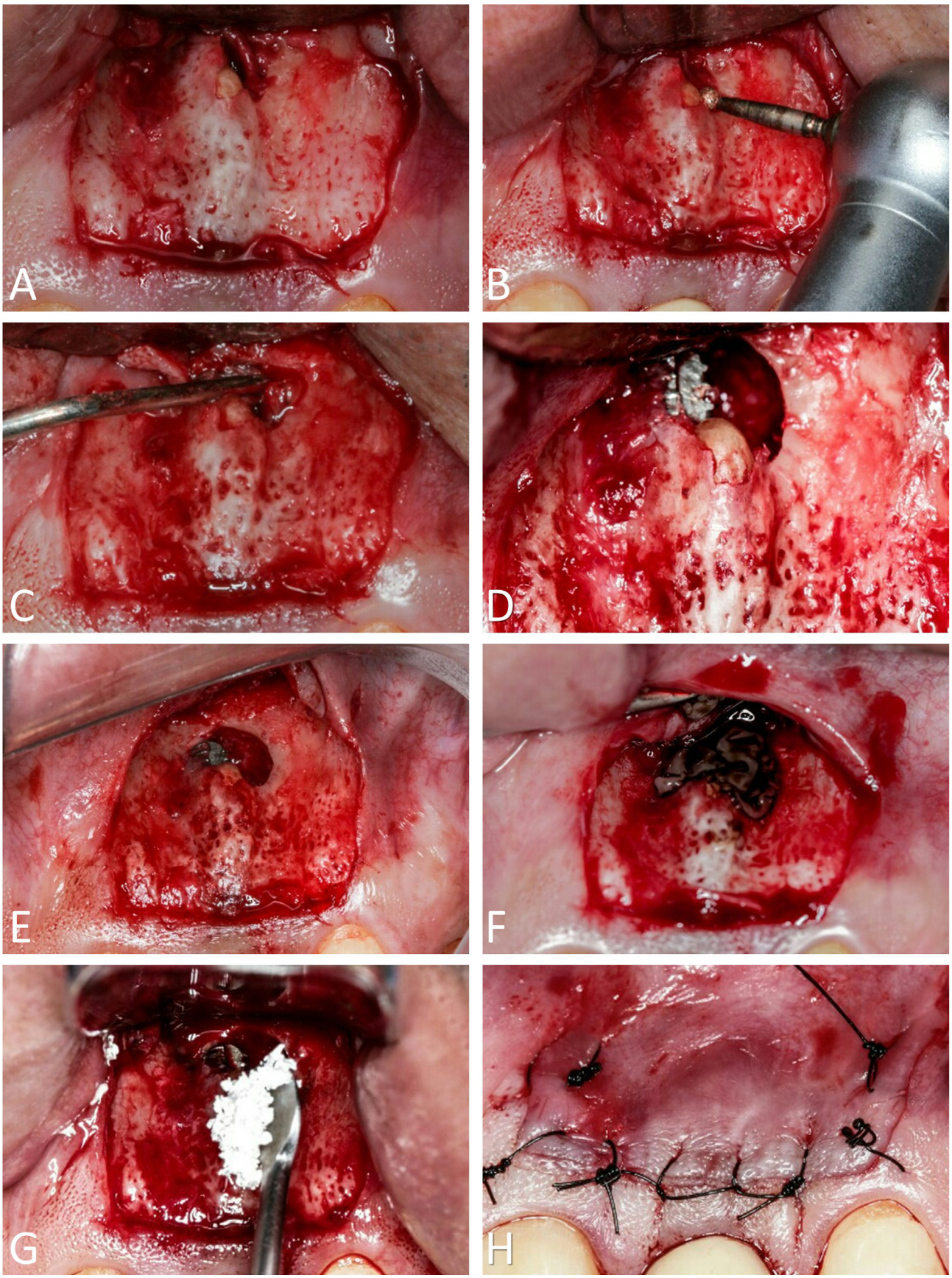


**Figure 7.** *A- Trapezoidal incision with a mucoperiosteal thickness showing bone fenestration at implant apical region. B- Lesion access enlargement using a spherical diamond drill under constant. C- Curettage with Lucas curette. D-In the zoomed image, it is possible to observe the preservation of buccal wall, according to what is proposed by the socket shield technique. E- Apical implant region after lesion and implant curettage. F- Chemical bone treatment with citric acid (pH1 at 50%) for 30 seconds. G- Filling the defect with xenogenic bone graft. H- Sutures.*

**Figure 8.** ***Clinical aspect 20 months after implant placement and 10 months after the second surgery.***

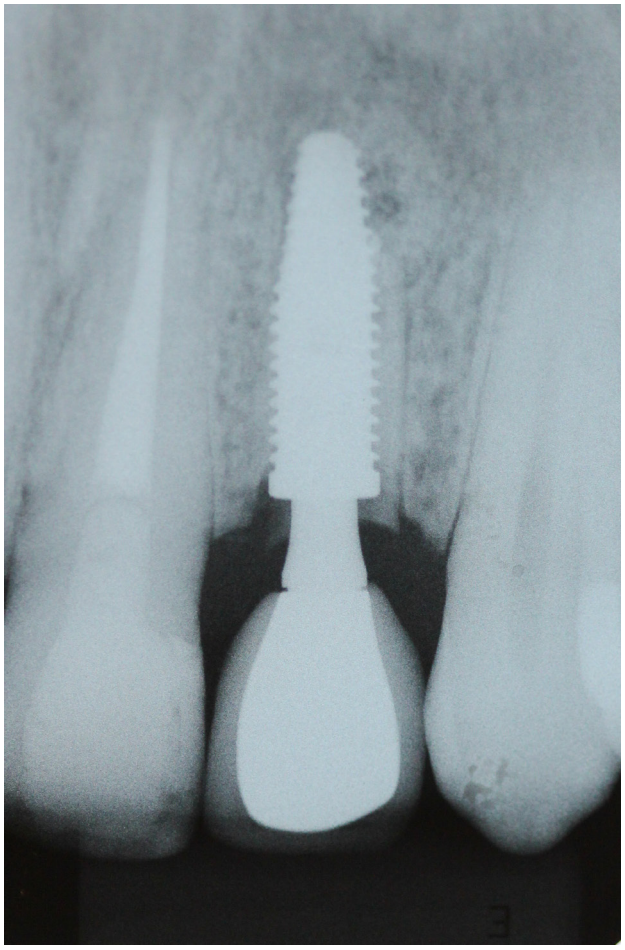

**Figure 9.** ***Radiographic aspect 20 months after implant placement and 10 months after the second surgery.***

## Conclusion

Although recently developed, the socket shield technique has shown promising results. However, for daily applicability in the clinic, there is still a lack of evidence that demonstrates the limitations of the technique and how to manage its complications, such as that presented in this case report. Thus, reconciling the beneficial potential of the technique and the uncertainties of its success, randomized clinical trials and long-term follow-up are of great importance for a better understanding of this new treatment approach in implantology.

### *Acknowledgments and conflict of interest*

The authors present no conflict of interest. No funding source supported this work.

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