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Immediate single-tooth replacement with acellular dermal matrix allogeneic bone on sloped platform-switching implants: A case series

KEY WORDS
aesthetics, bone graft, immediate placement, single implant, surgical procedure

ABSTRACT
Achieving predictable success with implants in the aesthetic zone is essential for clinicians. Promoting marginal bone and stability of the gingival environment is key to obtaining a predictable aesthetic outcome. The present study aimed to describe a technique that combines a flapless approach to immediate extraction and placement of sloped implants, using an acellular dermal matrix to contain the coronal aspect of a deproteinised bovine bone mineral graft. This minimally invasive technique results in stable augmentation of soft tissue thickness to ensure predictable aesthetic results. A collection of case reports with a follow-up period of up to 45 months is presented to demonstrate the surgical technique. Clinical presentation showed relative stability of the soft tissue margins during the evaluation period.

Conflict-of-interest statement: *The authors declare there are no conflicts of interest relating to this study*.

Introduction

Establishing a predictable protocol for tooth replacement in the aesthetic zone is an ongoing challenge in dentistry. The most common concerns have centred on the ability to create stable marginal bone and soft tissue environments around the final prosthetic restoration[1,2]. Prevention of marginal bone and soft tissue loss leads to more favourable and stable long-term aesthetic results and peri-implant health[3].

Multiple factors have been identified as having an influence on the pursuit of stable aesthetic outcomes, including pretreatment biotype[4,5], immediate versus delayed implant placement[5], immediate provisionalisation[6,7], osseous grafting options in immediate extraction sites[8], use of ovate pontics[9], flapped versus flapless approaches, and use of autogenous or allogeneic soft tissue for augmentation.

Some studies have shown that a flapless surgical approach reduces marginal bone loss after implant placement[10,11], whereas others suggest this has no clear impact on peri-implant tissue architecture[12]. Although long-term papilla height preservation has been shown to depend on the height of the bone supporting the adjacent teeth[13], it is possible to influence midfacial tissue behaviour. In addition to immediate provisionalisation, placing a connective tissue graft with bone grafting has been shown to successfully preserve tissue height[14-16]; however, Khzam et al[17] found that subepithelial connective tissue graft (SECTG) procedures did not exert a consistent benefit on tissue height.

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The value of gingival thickness has been studied and shown to impact postsurgical bone healing. Tissue thickness appears to influence the loss of bone around implants during primary healing[18]. The use of allogeneic dermal grafts has also been shown to increase the tissue thickness around implants[19]. Placement of an autogenous gingival graft or allogeneic graft requires either a flapped approach or tunnelling between the facial plate and soft tissue. Separating the tissue from the facial plate may have consequences on the preservation of marginal bone[20]. It is important to consider that all dental implants used in previous studies had one common characteristic: a flat platform. Implants with sloped platforms may offer significant advantages, especially when placed in fresh extraction sites. Thin facial plates tend to undergo resorption and lose height after tooth extraction; thus, an implant with a sloped platform is advantageous in cases where the ridge presents with a facial 'slope' defect. Placing an implant with the same shape as the crest could maximise its adaptation to the natural anatomy of the alveolar bone and prevent exposure of the textured portions of the implant. The successful maintenance of marginal soft and hard tissues after placement of sloped implants has also been demonstrated. Schiegnitz et al[21] showed a slight increase in gingival thickness after 2 years of function using a sloping shoulder implant. Lee and Siu[22] also showed increased gingival thickness as well as bone maintenance after 2 years using a sloped implant.

The present study aims to describe a technique that combines a flapless surgical approach with immediate extraction and implant insertion using an acellular dermal matrix (ADM) placed to contain a deproteinised bovine bone mineral (DBBM) socket graft and to augment the gingival thickness facial to a sloped implant/abutment area without any tunnelling of the soft tissue. The posttreatment follow-up is presented to demonstrate the short-term stability of this technique.

Materials and methods

The inclusion criteria were as follows:

- aged ≥ 18 years with good oral hygiene;
- single failing anterior maxillary tooth with the presence of both adjacent and opposing natural dentition;
- sufficient residual bone volume to accommodate immediate implant placement.

The exclusion criteria were as follows:

- history of smoking;
- head and neck radiation treatment;
- uncontrolled diabetes;
- lack of stable posterior occlusion.

All patients received standardised diagnosis and treatment planning. Following the administration of local anaesthetics, the failing tooth was extracted with minimal trauma to the supporting tissue. The socket was debrided mechanically prior to implant osteotomy preparation. Surgical guides were fabricated using a diagnostic wax-up of the planned prosthesis design and used to help position the implant for a screw-retained restoration. Implants with sloped platforms were placed (Astra Tech OsseoSpeed Profile EV, Dentsply Sirona, Charlotte, NC, USA) immediately after tooth extraction, with the facial aspect of the implant at the prosthetic platform 3 mm apical to the predetermined gingival margin. The vertical positioning of the implant was further guided by placing the facial neck of the implant approximately 1 mm apical to the facial osseous crest. Efforts were made to create a more palatal osteotomy and position the implant to maximise the facial gap between the implant platform and the buccal plate of the tooth socket. The sloped prosthetic platform allowed the palatal aspect of the implant to be positioned 1.3 mm more coronally (Fig 1a). Xenogeneic bone (Bio-Oss Collagen, Geistlich, Wolhusen, Switzerland) was utilised to fill the implant–socket gap up to the height of the facial plate (Fig 1b). Then, either a two-piece healing abutment or a customised temporary polyetheretherketone (PEEK) plastic cylinder (TempDesign EV, Dentsply Sirona) was placed and hand-tightened onto the implant.

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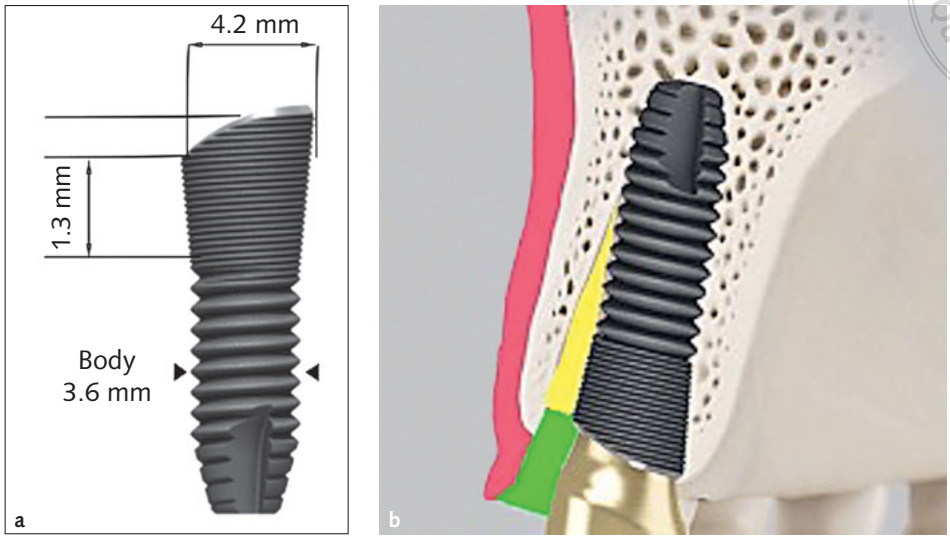

Figs 1a-b Lateral view of the Astra Tech Profile EV implant. Both the conical and straight wall designs are available in two diameters and the platform height ranges from 1.3 to 1.7 mm. **(a)** Implant dimensions. **(b)** Zones for osseous grafting (yellow) and vertical Symbios PerioDerm (Dentsply Sirona) placement (green).

This created a void between the healing abutment and the surrounding soft tissue. A periapical radiograph was taken to verify complete seating of the abutments. The ADM allogeneic graft (Symbios PerioDerm Acellular Dermis, Dentsply Sirona) was prepared according to the directions given by the Musculoskeletal Transplant Foundation. The material was rehydrated in 100 ml sterile saline and then trimmed to a height of 3 mm and a length ranging from 8 to 12 mm. The ADM was placed with the dermal side orientated facially and in the space between the healing abutment and gingiva (Fig 1b). Mild force was used to apically position the dermal graft onto the DBBM area, before securing it using suture material (5-0 Vicryl [Ethicon, Somerville, NJ, USA] or 6-0 polypropylene [Hu-Friedy, Chicago, IL, USA]). Figures 2 and 3 illustrate the protocol for tooth removal, the palatal implant positioning with DBBM along the facial gap, and the placement of ADM vertically over the graft and between the gingival wall and healing abutment. The material was trimmed to match the height of the gingival margin.

Sutures were placed from the facial to the palatal area and over the dermal graft to hold it in place. Postoperative medication included 875 mg amoxicillin two times a day for 1 week, dexamethasone for 2 days (3 mg taken the morning of the appointment and then 1.5 mg every 12 hours for three additional doses) and 600 mg ibuprofen taken every 6 hours as needed for pain. Patients received oral hygiene instructions and were advised to avoid brushing the grafted site after the procedure, and the sutures were removed at 2 to 3 weeks. Implants were tested for stability at 3 to 3.5 months after surgery. Patients returned to their restorative dental practitioner for provisionalisation, impression taking, custom abutment design and crown delivery.

Results

All patients presented deterioration of the ADM along the gingival margin at 2 weeks. This was no longer visible 3 to 4 weeks after implant placement (Figs 4a and b). None of the patients reported an unpleasant taste or odour. All implants passed a torque test at 3 months prior to undergoing restorative procedures. In all treated cases, stable and aesthetically acceptable soft tissue height and contours were observed. Posttreatment CBCT examination of the marginal bone level revealed crestal bone stability for a period of 16 to 45 months (Figs 3 to 5). The marginal bone level remained 1.0 to 2.3 mm coronal to the sloped implant platform for up to 45 months (Table 1) (Figs 3g, 4f and 5j).

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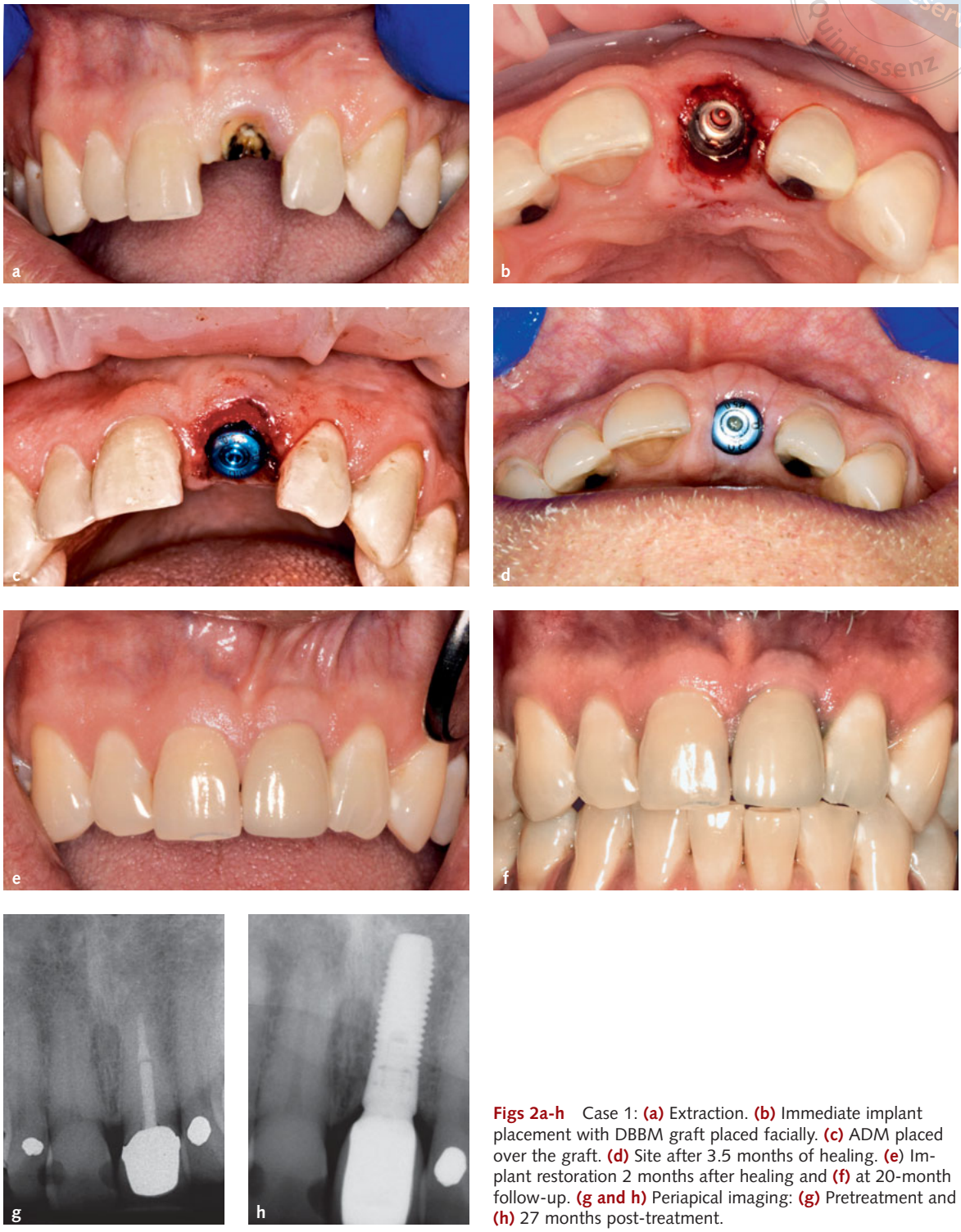

Figs 2a-h Case 1: **(a)** Extraction. **(b)** Immediate implant placement with DBBM graft placed facially. **(c)** ADM placed over the graft. **(d)** Site after 3.5 months of healing. **(e)** Implant restoration 2 months after healing and **(f)** at 20-month follow-up. **(g and h)** Periapical imaging: **(g)** Pretreatment and **(h)** 27 months post-treatment.

Discussion

This protocol employed specific procedures to maximise marginal hard and soft tissue preservation following tooth extraction and immediate implant placement in the aesthetic zone. All cases were treated by flapless extraction, insertion of a sloped implant and placement of DBBM in the residual facial socket space before securing with a vertically positioned thick (0.8 to 1.7 mm) ADM.

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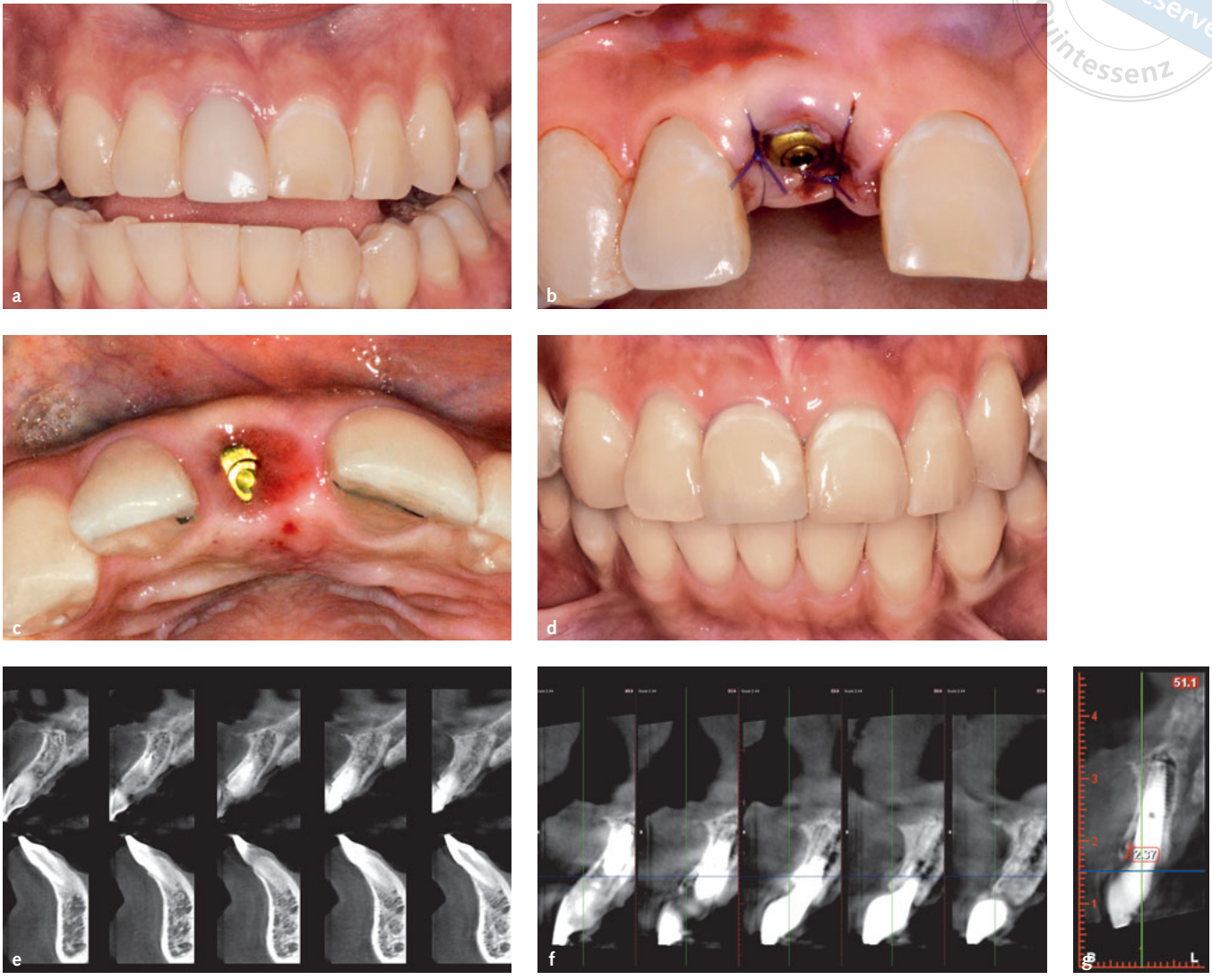

Figs 3a-g Case 2: **(a)** Preoperative view. **(b)** Site with graft sutured in place. **(c)** Site after 3.5 months of healing. **(d)** Implant restoration after 24 months. **(e to g)** CBCT imaging: **(e)** Pretreatment, **(f)** 45 months post-treatment, revealing adequate healing, and **(g)** marginal bone level at 45 months.

The impact of the sloped implant platform design on these results should be considered (Fig 1). This design permits placement of the implant in a more coronal position and closer engagement of both proximal and palatal bone to the original bone crest. The sloped platform seems to protect the facial aspect of the implant from premature thread exposure after initial postextraction healing. Lee and Siu[22] reported an increase in gingival dimensions 2 years after implant placement. Sloped implants' capacity for marginal gingival preservation was also supported by Schiegnitz et al[21]. The value of flapless management of immediate implant sites has been studied. Slagter et al[7] noted less midfacial recession when implants were placed without flap elevation compared to cases in which a flap was elevated and SECTGs were placed. Other studies have confirmed that crestal soft tissue and bone loss are reduced with a flapless approach[10,11], whereas Cooper et al[23] showed a minimal difference in the gingival zenith position between flapped and flapless procedures in fresh extraction sites. Jensen et al[24] treated a total of 40 consecutive patients with 65 alveolar split expansion procedures and using three different flap designs.

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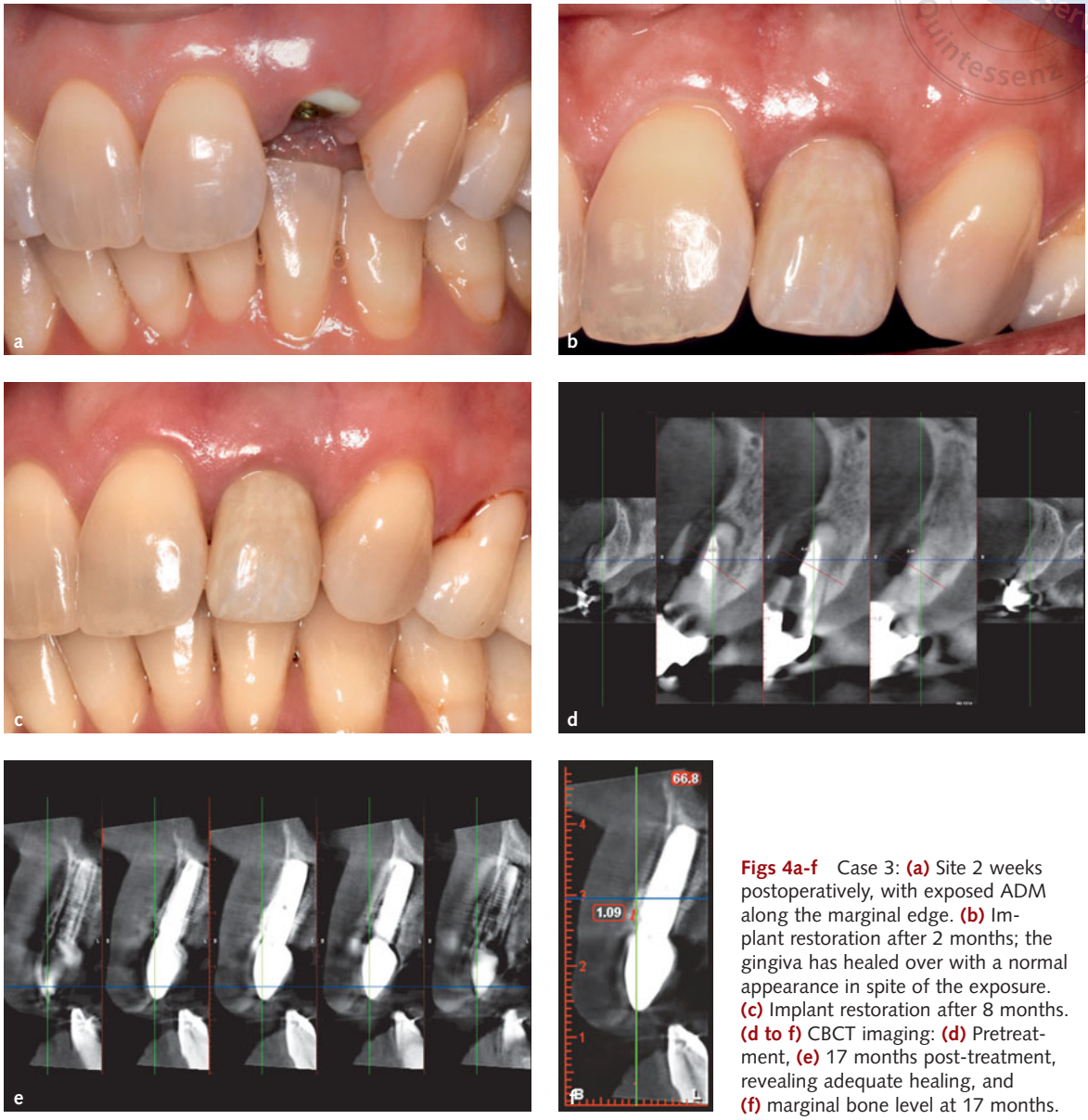

Figs 4a-f Case 3: **(a)** Site 2 weeks postoperatively, with exposed ADM along the marginal edge. **(b)** Implant restoration after 2 months; the gingiva has healed over with a normal appearance in spite of the exposure. **(c)** Implant restoration after 8 months. **(d to f)** CBCT imaging: **(d)** Pretreatment, **(e)** 17 months post-treatment, revealing adequate healing, and **(f)** marginal bone level at 17 months.

After 1 year, facial bone loss greater than 2 mm was noted mainly with full-thickness flaps, and bone was more stable with minimal flap reflection. Kan et al[25] showed that thinner biotypes demonstrated more bone loss around implants with immediate provisionalisation.

Gingival thickness around dental implants has been shown to be a predictor of marginal bone loss[14,26], whereas bone grafts with an SECTG have been reported to offer good results[14-16,27]. As well as autogenous bone, ADM has also been placed around implant sites, resulting in an increase in tissue thickness[19]. This increase was greatest when a graft was placed in thin biotype sites, whereas thickness was reduced in control sites.

Stability of horizontal dimensions seems to vary from site to site and from patient to patient. No attempt was made to augment hard or soft tissue outside the facial plate in the described cases. Ross et al[28] showed that most changes occurred within the first 3 months between implant placement/provisionalisation and delivery of the definitive restoration. Chappuis et al[29] showed 10-year stability of the soft tissue contours after early placement of implants with contour augmentation using guided bone regeneration. Amato et

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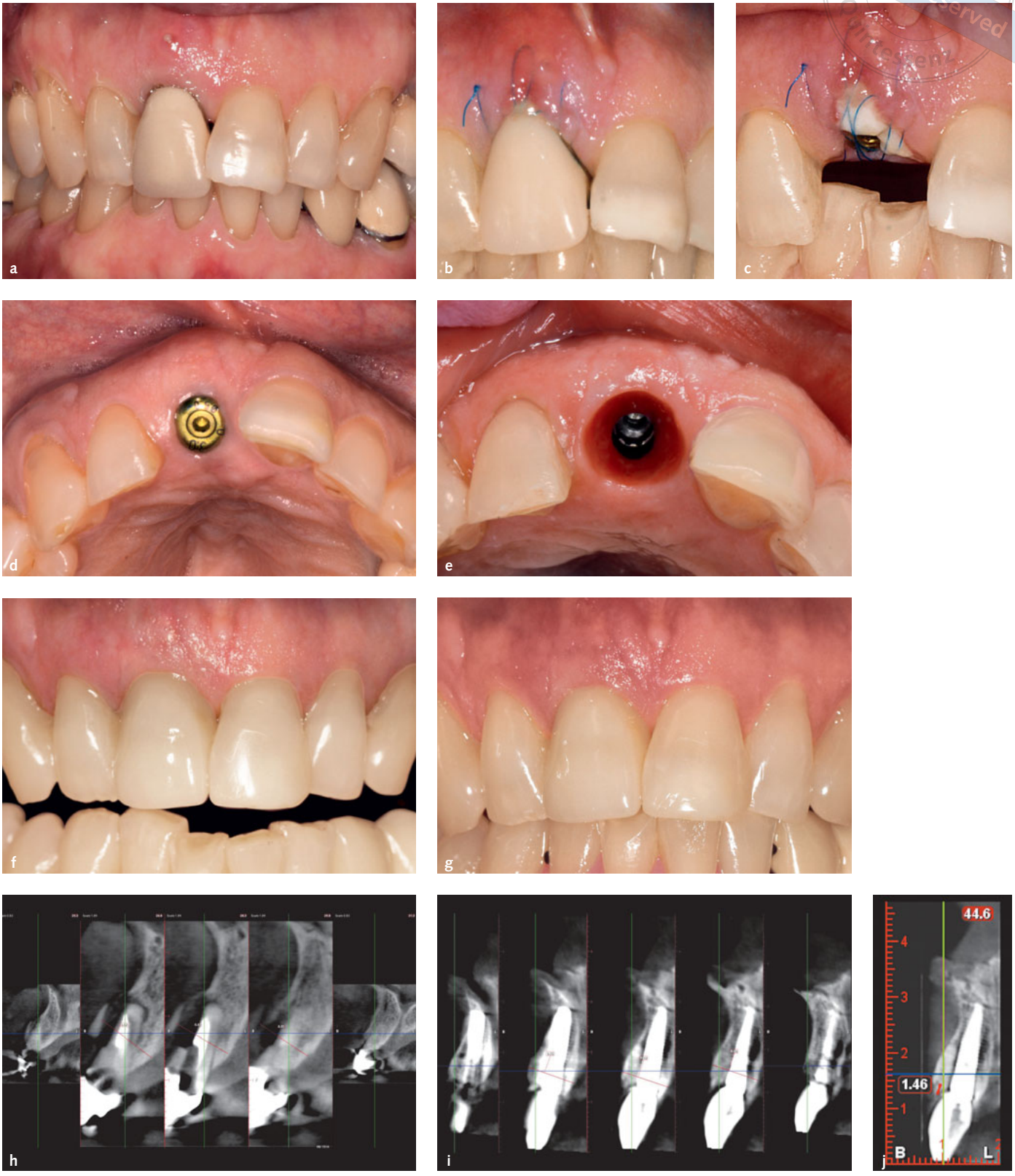

Figs 5a-j Case 4: **(a)** Preoperative view. **(b and c)** An ill-fitting provisional partial denture created trauma to the overlying gingival tissues and graft site facial to the implant site and caused exposure of the ADM. **(d)** The site healed after relief of the partial denture at 3 months. **(e)** Removal of the provisional restoration. **(f)** Implant restoration. **(g)** Implant restoration after 8 months. **(h to j)** CBCT imaging: **(h)** Pretreatment, **(i)** 16 months post-treatment, and **(j)** marginal bone level at 16 months.

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Table 1 Description of reported cases

Patient	Age/sex	Tooth	Probing depth, recession, gingival inflammation	Radiographic evaluation	Marginal bone level relative to edge of implant sloped platform	Length of follow-up	Complications	Actions taken
1	51/M	Maxillary left central incisor	2 mm midfacial probing depth, 0.5 mm less recession, healthy tissue	Pre- and postoperative periapical imaging	NA	27 mo	None	NA
2	25/F	Maxillary right central incisor	2 mm midfacial probing depth, 0.5 mm less recession, mild gingivitis	Pre- and postoperative CBCT	+2.3 mm	45 mo	None	NA
3	61/F	Maxillary left lateral incisor	3 mm midfacial probing depth, 0.5 mm less recession, mild gingivitis	Pre- and postoperative CBCT	+1.0 mm	17 mo	Exposed ADM	Roll brushing technique
4	77/M	Maxillary right central incisor	2 mm midfacial probing depth, 0.5 mm greater recession, healthy tissue	Pre- and postoperative CBCT	+1.4 mm	16 mo	Trauma from partial denture, exposed ADM	NA

NA, not applicable.

al[30] compared healing between groups with a healing abutment and an immediate provisional restoration. The groups were further split into subgroups that did or did not receive a bone graft[30]. Where graft material was placed with a healing abutment, minimal horizontal reduction was noted at the 5-mm level, but significant horizontal reduction (approximately 1 mm) was found in the most coronal 3 mm because of the lack of mechanical support for the soft tissue from any provisional restoration[30].

The value of using CBCT to assess the stability of the osseous architecture is open to question. When bone thickness is less than the voxel size (1 mm), the facial plate is not readily visible in CBCT imaging and is further obscured by the beam scattering off the implant when imaging posttreatment results[31]. However, CBCT is widely used to evaluate buccal plate thickness due to its ability to provide 3D images and the fact that it exposes patients to a lower dose of radiation compared to traditional medical computed tomography scans[32,33]. The value of placing a healing abutment to support the graft and soft tissue is unclear. The approach employed for the cases in the present series emphasised a minimally invasive surgical approach while still following a more palatal osteotomy to create a 2-mm gap for grafting with DBBM. The long-term stability of sites treated with DBBM in the socket gap without grafting outside the facial plate remains to be seen. A quantitative assessment with volumetric measurements prior to and after treatment would help determine the stability of this approach and provide a more objective and practical reference.

Conclusion

Based on the limitations of this case series, it can be concluded that flapless immediate placement of sloping implants combined with ADM marginal soft tissue grafting and DBBM socket grafting may lead to predictable aesthetic results for up to 24 months. Partial exposure of the ADM appears to pose a minimal risk to long-term healing. Future controlled clinical trials should confirm these findings and validate this treatment approach.

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Literature abstract

Int J Oral Maxillofac Implants 2021;36:122–125.

Basma HS, Misch CM. Extraction socket grafting and ridge augmentation failures associated with clindamycin antibiotic therapy: a retrospective study

Purpose: The aim of this retrospective study was to determine if penicillin allergy and/or clindamycin therapy may contribute to a higher incidence of postsurgical infections after bone augmentation. **Materials and methods:** This retrospective study analyzed patients between 2014 and 2019 who received bone augmentation procedures (socket grafting [SG]; ridge augmentation [RA]) prior to placement of dental implants. All the grafting procedures were performed under preoperative and postoperative oral antibiotic coverage with either amoxicillin or clindamycin for patients who reported penicillin allergy. Infections associated with the bone augmentation procedures were recorded. **Results:** In this study, 1,814 patients received 2,961 bone augmentation procedures (2,530 SG, 431 A). In the 2,530 SG procedures, 270 (10.7%) were associated with a penicillin allergy. Infections occurred in 91 of the 2,530 SG sites (3.6%). However, the infection rate was 10.7% (29 SG sites) for clindamycin and only 2.7% (62 SG sites) for amoxicillin ($P < .02$). In the 431 RA procedures, 71 (16.5%) were associated with a penicillin allergy. Overall infections occurred in 31 of the 431 sites (7.2%). However, the infection rate was 22.5% (16 RA sites) for clindamycin and only 4.2% for amoxicillin (15 RA sites; $P < .01$). Penicillin-allergic patients taking clindamycin demonstrated a higher risk of infection with a risk ratio of 6.9 (95% CI) and 4.5 (95% CI) compared with nonallergic patients taking amoxicillin for RA and SG, respectively. **Conclusion:** Penicillin allergy and the use of clindamycin following SG and RA procedures was associated with a higher rate of infection and may be a risk factor for bone augmentation complications. **Correspondence to:** basma86@uab.edu.
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