Immediate implant placement in the aesthetic zone

Partial-extraction therapy and dual-zone augmentation

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Studies have shown that the survival rate for implants placed in fresh extraction sockets is the same as that for conventionally placed implants [1–3]. Although the success rates for both immediate and delayed implant placement are comparable, the literature cautions us to expect recession of the facial gingiva following immediate implant placement [1]. We should be aware that systematic reviews include studies regardless of the surgical and prosthetic protocol used: flap procedures and flapless procedures; buccal, central or palatal implant positions; gap augmentation or no gap augmentation; primary wound closure or open healing.

A frequently cited literature review dates from 2009 [4]. In 2015, another systematic review concludes: "Immediate placement with immediate provisionalization of dental implants in the aesthetic zone results in excellent short-term treatment outcomes in terms of implant survival and minimal changes of peri-implant soft and hard tissue dimensions" [5]. Over time it became clear that to achieve a good aesthetic result, a post-extraction implant should be placed on the palatal aspect of the socket using a flapless procedure, and the gap should be augmented with a slowly resorbable bone substitute.

Blood is supplied to the buccal bone shield from threes sources: cancellous bone, the periosteum and the periodontal ligament. Since the average thickness of the buccal bone in the aesthetic zone is less than 1 mm [6], it hardly contains any well-vascularized cancellous bone tissue. After an extraction, no blood is supplied from the periodontal ligament, so that the periosteum remains the only one source of blood. For this reason, implants should be placed without raising a flap.

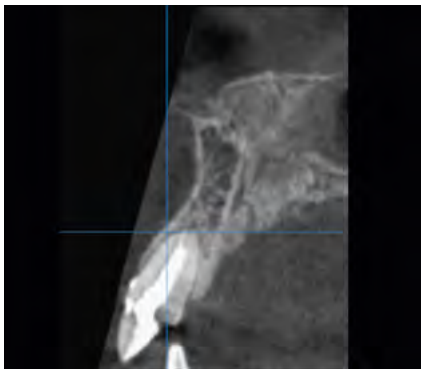
Lee showed that lingualized flapless implant placement into fresh extraction sockets preserves the buccal alveolar bone [7]. Gap augmentation with a slowly resorbable bone substitute can compensate for the bone-remodelling process [8,9].

Post-extraction implants placed in the palatal aspect of the socket in a flapless procedure with gap augmentation have a lower risk of mid-facial recession [10,11]. Additionally, immediate provisionalization and custom healing abutments have proven beneficial for the long-term stability of the marginal gingiva [5,12,13].

A further improvement can be achieved by performing partial extraction therapy (PET), especially when leaving a socket shield in place. The principle is to prepare the root such that the buccal/facial root section remains in situ, with its physiological relation to the buccal bone plate intact.

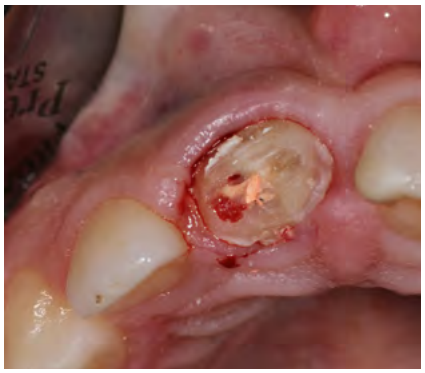
The periodontal attachment of the root section should remain vital and undamaged to prevent the post-extraction socket remodelling otherwise to be expected.

1 I Initial situation. The right central incisor is hopeless.

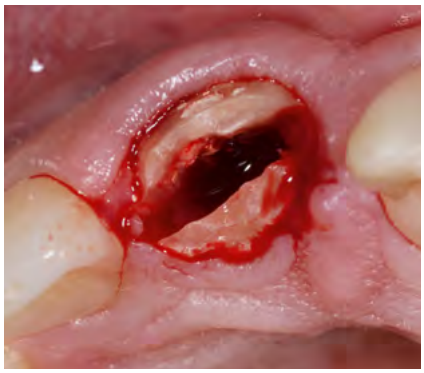


2 I Preoperative CBCT showing root decay. The buccal bone wall is present.

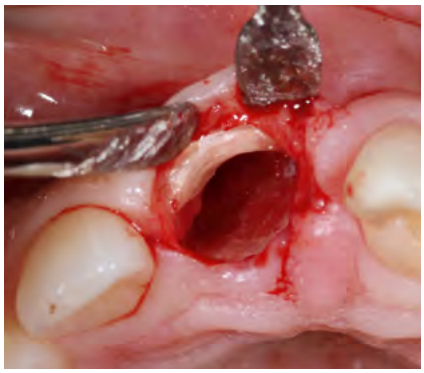
3 I Occlusal view prior to tooth extraction.



4 I The crown is hemisected. There is some root resorption.



5 I The root is separated in a mesiodistal direction. The palatal part of the root with the apex is taken out.



6 I A socket shield is prepared 1 mm above the buccal bone crest.

There are contraindications to the socket shield technique, such as periodontitis, root resorption and tooth mobility. The procedure is time-consuming and technically rather challenging. If there is a contraindication or if the socket shield fails during preparation, dual-zone augmentation is a possible alternative for achieving a highly aesthetic result. Dual-zone augmentation includes peri-implant hard as well as soft-tissue augmentation.

The socket-shield technique

In 2010, *Hürzeler* published an animal experimental study and a case report entitled "The socket-shield technique: A proof-of-principle report" [14]. One critical factor for buccal bundle-bone resorption is the loss of periodontal ligament. The resorption of the buccal bundle bone can be avoided by leaving a buccal root segment in place (socket-shield technique), as the biological integrity of the buccal periodontium (bundle bone) remains untouched.

In the last six years, several clinical studies have demonstrated the potential of buccal root retention (socket-shield technique) in combination with immediate implant placement to avoid significant changes in ridge shape after tooth extraction [15–17]. *Siormpas* published two- to five-year follow-ups of 46 implants placed immediately after extraction using the socket-shield technique [18]. He reported a 100 per cent survival rate.

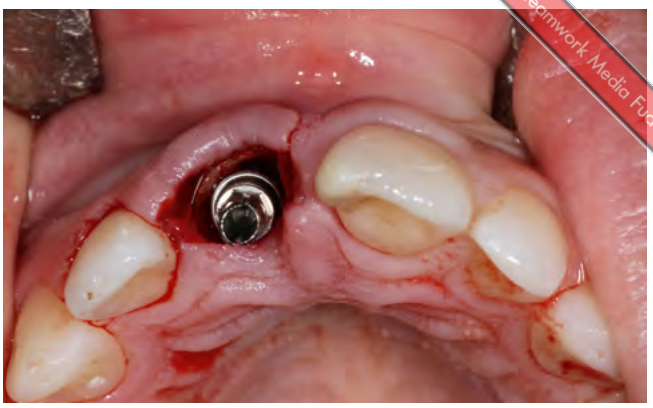
Case 1: Socket-shield technique

A 25-year-old female patient presented with a right central incisor that was non-restorable due to cervical decay (Figs. 1 to 3). The patient had good interproximal bone levels; all socket walls were present. There were some asymmetries of the gingival margins: On the right central incisor, the gingiva level was more coronal compared to the adjacent central incisor (see Fig. 1).

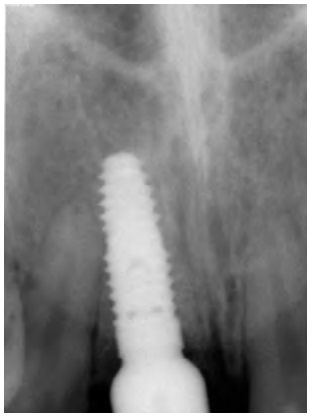
It was decided to replace the failing incisor with an implant-supported crown. To preserve as much hard and soft tissue as possible, an immediate post-extraction implant was to be placed in combination with partial-extraction therapy.

After the crown had been hemisected (Fig. 4), the tooth was dissected in a mesiodistal direction, and the palatal and apical portions of the root were removed (Fig. 5). The vestibular socket shield was levelled to one millimetre above the buccal bone. A minimal flap was raised to shape the coronal part of the socket shield to smooth any sharp edges (Fig. 6).

7 I An implant (4,1 × 13 mm, Bego Semados RSX) is placed in a flapless procedure.



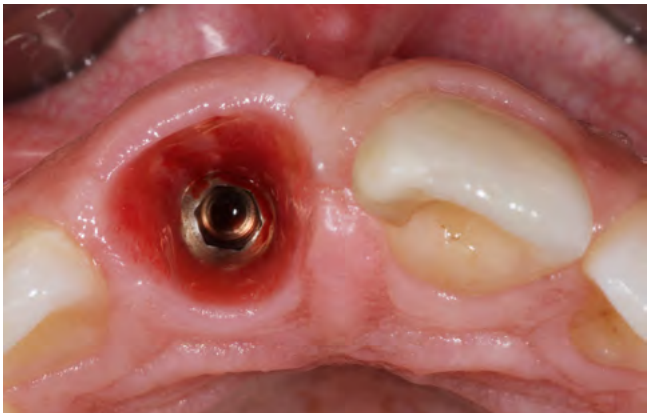
8 I Occlusal view showing the implant placed in the palatal aspect of the socket with some contact with the socket shield.



9 I Postoperative radiograph.

10 I The provisional crown is placed on the same day.

11 I Five months after surgery, the papillae are well maintained.



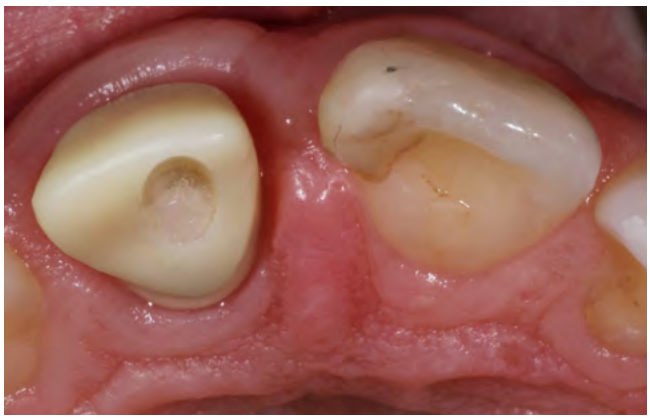
12 I The occlusal view shows no difference in horizontal ridge volume between the implant site and the adjacent tooth.

A 4.1 × 13 mm implant (Semados RSX; Bego, Bremen, Germany) was placed in a 3D comfort zone (Figs. 7 to 9). Since the insertion torque was 40 N·cm and the ISQ was 70, it was decided to restore it with an immediate provisional crown (Fig. 10).

Five months after the first (and only) surgery, the hard and soft tissue were very well preserved (Figs. 11 and 12). Figure 13 shows an occlusal view with a provisional crown in situ. The intentional retention of the facial aspect of the root preserved the tissue on the implant site. The CBCT taken one year after implant placement illustrates very well maintained buccal bundle bone (Fig. 14). Figures 15 and 16 show zirconium coping on a hybrid abutment. The sagittal view shows a natural emergence profile (Fig. 17). The pressable ceramic crown immediately after insertion is to be seen in Figure 18.

13 I Occlusal view with provisional crown.

14 I CBCT one year after implant insertion.



15 I Hybrid abutment, occlusal view, ...

16 I ... frontal view, ...

17 I ... and profile view.

18 I Screw-retained pressable-ceramic crown immediately after insertion. Prosthodontics: Dr Jagoda Berber Torbarac, Rident Clinic.

Dual-zone augmentation

Bone-zone augmentation between the implant and the socket wall reduces dimensional changes of the ridge after tooth extraction. A further improvement can be achieved by soft-zone augmentation. *Araújo* and coworkers showed that xenograft particles can be incorporated into the soft-tissue profile without any inflammatory reaction [19]. These incorporated particles provide substance to increase the soft-tissue profile as described by *Tarnow*, *Chu* and *Salama* [20,21]. The provisional restoration can then act as a "prosthetic socket seal" to protect, contain and maintain the blood clot and bone-graft material during the healing phase.

Tarnow, Chu and *Salama* also proved that hard- and soft-tissue grafting at the time of implant placement in combination with a contoured healing abutment or a provisional restoration result in the smallest amount of ridge contour change. This concept is called "dual-zone augmentation".

19 I Pre-treatment radiograph showing external root resorption of the left central incisor.

20 I Pre-treatment photograph showing incisors with wear and unaesthetic fillings.

21 I The smile line is high.

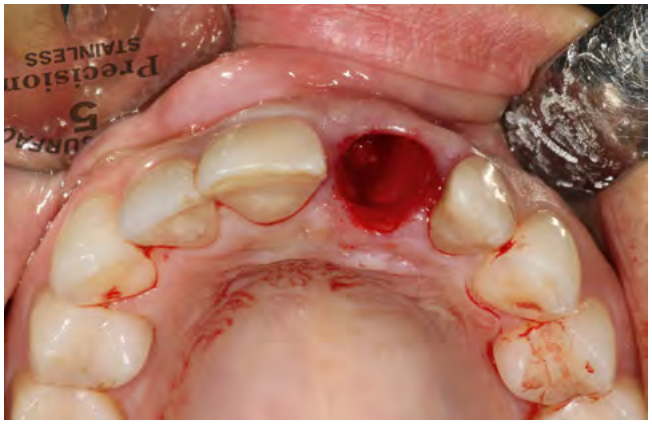
Case 2: Dual-zone augmentation

A 35-year-old healthy female patient, a non-smoker, presented with a left central incisor that was failing due to external root resorption (Fig. 19). The other incisors exhibited unaesthetic fillings and chipping (Fig. 20). The patient had a high smile line (Fig. 21).

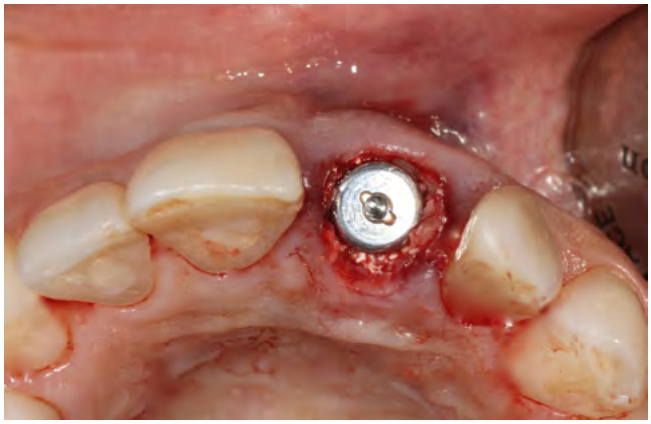
The treatment goal was to replace the left central incisor with an implant-supported crown and to preserve the papilla and the level of the facial gingival margin.

The treatment plan included immediate implant placement for the left central incisor, a pressable-ceramic crown for the right central incisor and veneers for the two lateral incisors.

The left central incisor was extracted as atraumatically as possible (Fig. 22). All socket walls were present. After thorough debridement, the implant site was prepared in the palatal aspect of the socket. Biological drilling as described by *Anitua* was performed (50 rpm without irrigation)

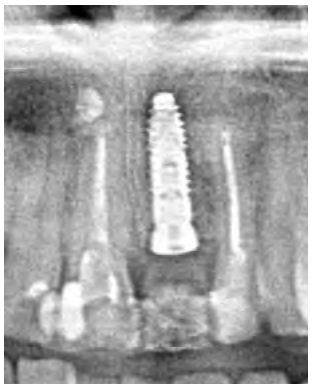


22 I The left incisor is removed in a flapless procedure.



23 I Situation immediately after implant insertion (4,5 × 13 mm, Bego Semados RSX); dual-zone augmentation.

24 I A Maryland bridge is inserted as a temporary restoration.



25 I Postoperative radiograph.

26 I After osseointegration of the implant, a provisional crown is produced.

27 I Zirconia abutment milled in Bego Medical. The adjacent teeth are treated with a crown and veneers.

28 I Situation immediately after definitive cementation of the implant crown and veneers.

29 I Occlusal view immediately after prosthetic rehabilitation.

30 I Radiograph after implant/prosthetic rehabilitation.

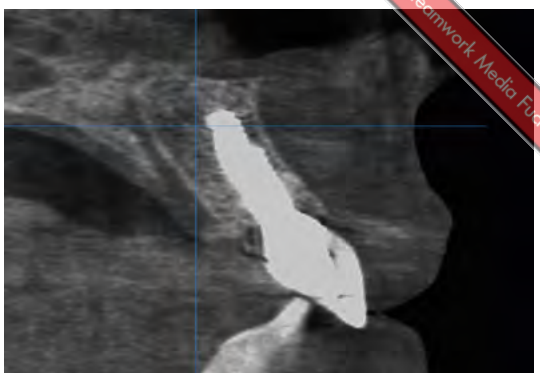
to collect autologous bone particles. A 4,5 × 13 mm implant (Semados RSX; Bego) was inserted with 40 N·cm of insertion torque.

The gap between the socket wall and the implant body was augmented with a mixture of two-thirds autologous bone particles and one-third of a xenograft material (Bego Oss). The same mixture was used to augment the space between the healing abutment and the soft tissue (Fig. 23).

Prior to implant placement, a provisional Maryland bridge was prepared. The pontic was designed to shape the peri-implant soft tissue (Figs. 24 and 25).

Following osseointegration of the implant, a provisional crown was placed and left in place for another three months (Fig. 26). An impression was taken, the cast was scanned and a zirconia abutment was designed. The abutment was milled in Bego Medical (Fig. 27). Pressable-ceramic crowns were cemented onto the implant and the adjacent central incisor. Both lateral incisors received veneers (Figs. 28 and 29). Figure 30 shows the radiograph taken after crown cementation.

31 I Radiograph 18 months after treatment showing a stabile peri-implant situation.



32 I CBCT 18 months after treatment showing well-maintained buccal bone.

33 I Clinical situation 18 months after treatment.

34 I Close-up showing pleasing peri-implant soft tissue.

35 I Clinical situation 18 months after treatment.

Eighteen months after the implant/prosthetic treatment, the peri-implant hard tissue was stable (Fig. 31). The CBCT scan showed the bone volume to have been preserved (Fig. 32). Both the papillae and the marginal gingiva were well maintained (Fig. 33). A close-up image showed a highly aesthetic outcome (Fig. 34). On a scale of 1 to 10, the patient rated the outcome a resounding 10 (Fig. 35).

Conclusion

Implants placed in fresh extraction sockets of type one (all socket walls present) have the same survival rates as conventionally placed implants. Mid-facial recession can be avoided if the implant is placed lingually in a flapless procedure and the gap is filled with a slowly resorbable bone substitute.

Immediate provisionalization and dual-zone augmentation are known to be key factors for minimizing hard- and soft-tissue volume changes.

Recently, an aspect of partial-extraction therapy, the socket-shield technique, found its way into implant dentistry. This technique provides dimensional stability around an implant site without the use of any adjunctive biomaterials.

The references are available at www.teamwork-media.de/literatur

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