Delayed immediate implant placement and direct soft-tissue management

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In the case of implant planning, the preservation of soft tissue and bone is essential for functional and aesthetic long-term success. There are now various different techniques and materials available. The timing of implant insertion and soft-tissue shaping play a crucial role, as do the measures taken in advance of the planned therapy. A targeted strategy can generate favourable conditions before implant placement. In this context, the use of bone grafting materials in combination with intravenously collected autologous platelet concentrates (I-PRF and A-PRF) has become increasingly important in recent years. With this "biologisation" of specially developed bone grafting materials for alveolar management, stable preservation of the extraction socket and the bone can be expected while promoting wound healing. The greatest loss of bone and, as a result, soft tissue occurs in the first 12 months after tooth extraction. In the literature, loss rates of up to 60% are reported.[3] In this regard, Tan et al. were able to show in a systematic review that six months after extraction there is a horizontal bone loss of 29–63% and a vertical bone loss of 11–22%. The transverse bone loss was found to be higher than the vertical bone loss.[12] This was also confirmed by Araujo and Lindhe in their animal studies. They found that the greatest changes to the alveolar process in the area of the buccal wall occurred within three to six months after tooth extraction.[2] In implant dentistry, these are limiting factors in daily practice. However, it is crucial to have sufficient hard and soft tissue both in quantity and in quality to achieve the goals of implant therapy.[5]

Preventive interventions can aid in counteracting bone loss and resorptive processes in order to preserve hard and soft tissue.[7] In this regard, alveolar stabilisation is a method performed during or after tooth extraction to minimise external resorption of the alveolar process, preserve bone, and promote and support bone formation within the extraction socket.[6] Various terms are used for this in the literature, such as alveolar ridge preservation (for three- or two-walled defects), socket preservation (for circularly intact alveoli), socket seal technique and alveolar preservation. The aim of these methods is to fill the fresh extraction socket with a bone grafting material and to achieve stabilisation of the alveolar walls.[9] In this regard, the use of bone substitute materials biologised with platelet-rich plasma (I-PRF and A-PRF) is described in the literature as a successful means to preserve bone and soft tissue and to support the healing process.[8, 11] In the following case report, socket preservation with CERASORB® Foam (curasan) and I-PRF (IntraSpin®, Bio-Horizons Camlog), obtained according to the Low Speed Centrifugation Concept (LSCC) of Prof. Shahram Ghanaati, was performed after extraction of tooth #12.[15] Similar cases were reported by Palm et al. and Al-Nawas et al. in the past.[13, 14] The implant was positioned and inserted six weeks later on the basis of external planning (DEDICAM, CAMLOG) and using a surgical guide with depth stop (CAMLOG Guide System®). An intra-oral scan (Medit i500®, Kulzer) was performed intra-operatively, and the first surgical phase concluded with submerged healing. During this period, a new type of healing abutment was fabricated entirely from PEEK material. After a healing period of three months, this PEEK healing abutment was used directly after implant exposure in order to shape the peri-implant soft tissue optimally and atraumatically in a few treatment steps. Finally, the prosthetic restoration was realised with a ceramic-veneered CAD/CAM-fabricated crown.

Case report

A healthy 55-year-old female patient presented to the practice with an unsalvageable tooth #12. Clinically, the oral situation was unremarkable. The patient reported that the crown was loose and that it rotated slightly. She also reported pain on biting. The radiographic evaluation revealed that the tooth had been endodontically treated and restored with a metal post. Dislocation of the post and core with the crown and a deep fracture were detected, and the patient was informed accordingly (Figs. 1 & 2). A few days later, tooth #12 was extracted gently and atraumatically with the aim of preserving the alveolar walls as far as possible. Special periotomes and instruments (KLACK set®, Geistlich Biomaterials) were used for this purpose (Figs. 3 & 4). Since an implant restoration was planned in this case, it was decided in advance, and together with the patient, that appropriate measures for bone preservation should be taken. The condition of the alveolus after extraction is an important criterion for deciding which treatment protocol should be used, that is,

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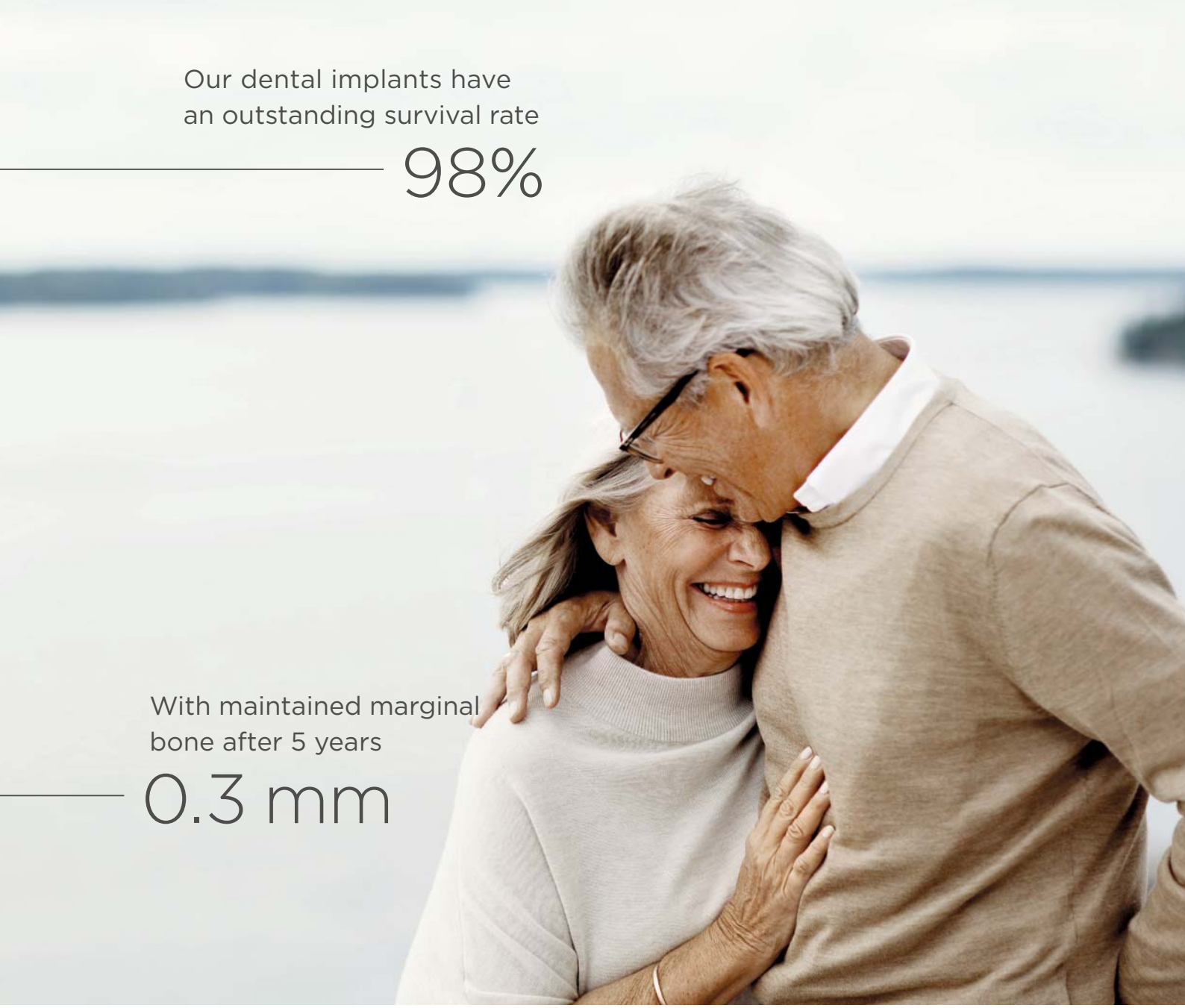

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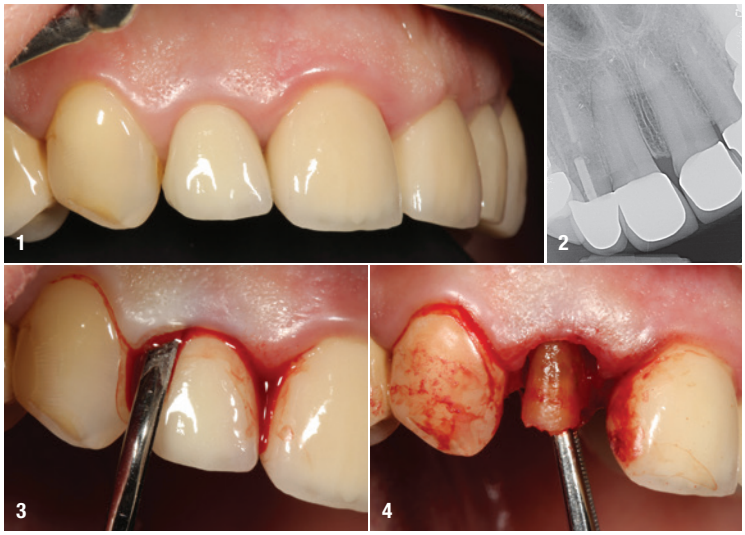


Fig. 1: Initial clinical situation of tooth #12. **Fig. 2:** Radiograph of tooth #12 showing failed endodontic treatment with the dislocated post restoration and deep complicated fracture. **Fig. 3:** Gentle detachment of marginal gingiva and periodontal ligament fibres using periotomes. **Fig. 4:** Atraumatic extraction of the tooth and the fractured fragment.

which bone grafting material with which resorptive properties should be used and when the implants should be placed. In the case described here, the alveolar bone could be preserved in all directions. The decision was made in favour of delayed immediate implant placement and the use of a bone regeneration material that is rapidly resorbed and quickly incorporated into the autogenous bone.

Socket preservation was performed with a β-tricalcium phosphate collagen matrix (CERASORB Foam), which was biologised in advance with I-PRF (platelet-rich fibrin concentrate; Fig. 5). In its hydrated, biologised state, the collagen matrix can be excellently shaped and adapted to the alveolar walls under as little compression as possible (Figs. 6 & 7). The augmentation site was covered crestally and sealed with a compressed A-PRF plug (Fig. 8). The site was then stabilised by means of cross-suturing (Fig. 9). Tight covering using the socket seal approach and a tissue punch was not necessary in this context. The gap was temporarily restored with an interim prosthesis, which was designed as a pontic in order to shape the soft tissue (Fig. 10). Lastly, a control radiograph was taken, and the optimal defect filling and almost structurally identical distribution of the matrix could be noted on the radiograph (Fig. 11). After the treatment, irritation-free, stable and, above all, pain-free healing was observed. As a result, planning for implant placement by means of CBCT (Orthophos XG 3D, Dentsply Sirona) could be carried out after only three weeks (Figs. 12 & 13). To achieve optimal 3D axial positioning of the implant in the vertical, mesiodistal and orovestibular directions, the CBCT/DICOM data sets were sent to an external planning centre (DEDICAM) via a secure channel and a surgical guide (CAMLOG® Guide, SMOP®, Swissmeda) was fabricated (Figs. 14 & 15).

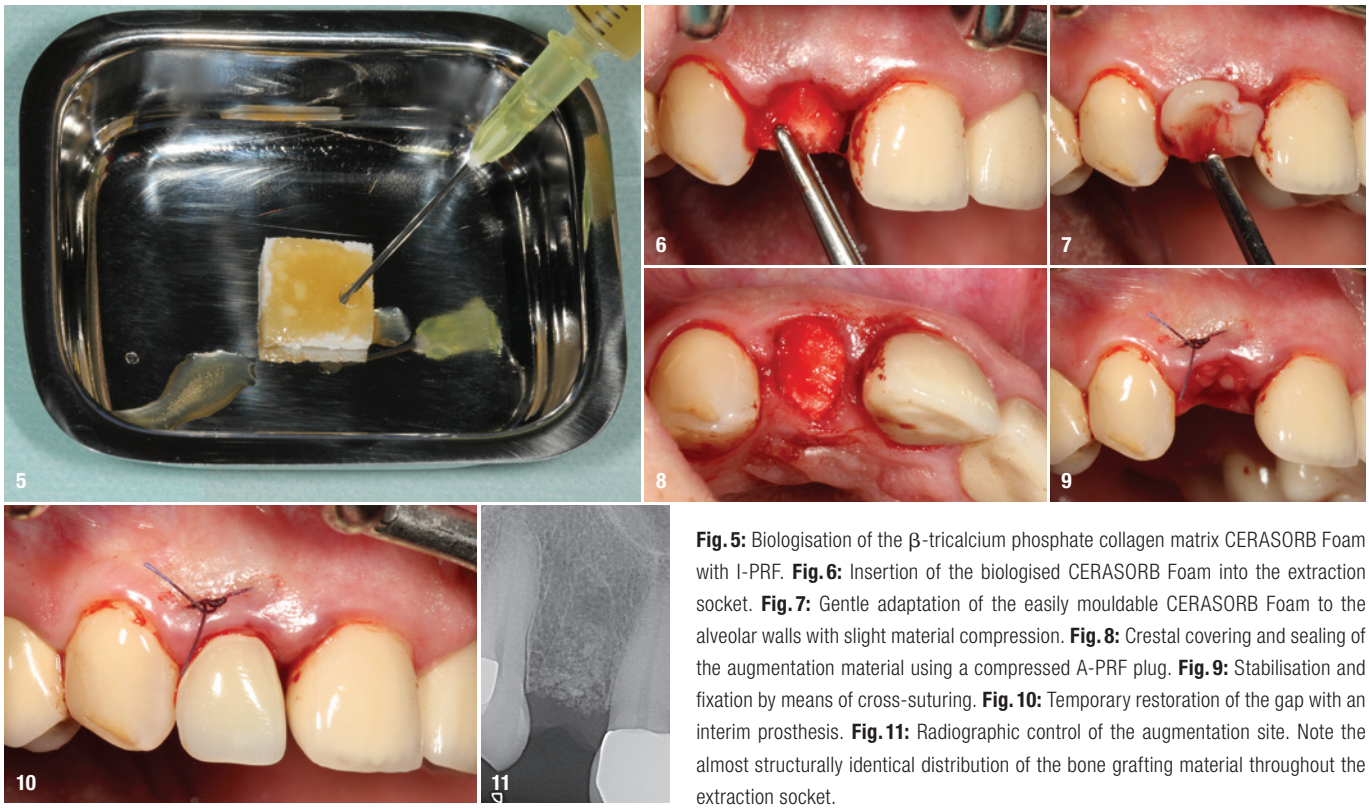


Fig. 5: Biologisation of the β-tricalcium phosphate collagen matrix CERASORB Foam with I-PRF. **Fig. 6:** Insertion of the biologised CERASORB Foam into the extraction socket. **Fig. 7:** Gentle adaptation of the easily mouldable CERASORB Foam to the alveolar walls with slight material compression. **Fig. 8:** Crestal covering and sealing of the augmentation material using a compressed A-PRF plug. **Fig. 9:** Stabilisation and fixation by means of cross-suturing. **Fig. 10:** Temporary restoration of the gap with an interim prosthesis. **Fig. 11:** Radiographic control of the augmentation site. Note the almost structurally identical distribution of the bone grafting material throughout the extraction socket.

An implant (CAMLOG PROGRESSIVE-LINE, CAMLOG; diameter: 3.8 mm; length: 13.0 mm) was chosen which would ensure sufficient high primary stability owing to its progressive thread design.

Six weeks after extraction and socket preservation, implant insertion in region #12 was performed under local anaesthesia. A crestal incision was made, and a flap was reflected in a minimally invasive manner. The surgical guide was put into position, and then the guide system and the 3.8 mm drill set (CAMLOG) were used to prepare the osteotomy in several steps to the planned length of 13 mm. Finally, guided implant placement was performed to a torque of 25 Ncm (Figs. 16–18). After final positioning of the implant (Fig. 19), the insertion post was removed and a PEEK scan body (CAMLOG) with the same diameter of the implant (3.8 mm) was inserted (Fig. 20). The implant and the jaws were then scanned intraoperatively (Medit i500® and Medit Link® software, Medit) to verify the position of the inserted implant (Figs. 21a & b). After scanning, the scan body was removed, the healing abutment was installed, the surgical site was tightly sutured for submerged healing and a dental panoramic tomogram (Orthophos XG 3D) was taken (Figs. 22a–c). During the healing phase of the implant, the scans were further processed for further planning (Fig. 23). The objective was to shape the soft tissue and to fabricate the definitive restoration in as few steps and as effectively as possible. Experience has shown that it is important to minimise insertion and extraction torque in order to protect and stabilise the peri-implant hard and soft tissue. This is essential for achieving long-term implant success, which, in the present case, was realised on the basis of the treatment protocol followed.

After an irritation-free healing phase of three months, the hard- and soft-tissue conditions were considered stable, and therefore the implant was exposed under local anaesthesia. Since the soft-tissue situation was considered quantitatively sufficient, the incision was made crestally. In collaboration with the external planning service centre (DEDICAM), a novel healing abutment was fabricated from PEEK during the healing phase and subsequently inserted. This one-piece healing abutment does not require further processing, thereby minimising possible sources of error and potential contamination (Fig. 24). The soft tissue was modelled in the coronal direction by means of a suspension suture, and the wound margins were fixed to the adjacent teeth by means of vertically modified backsuture (Fig. 25). Finally, a control radiograph was taken, and the interim prosthesis was adapted to the new situation (Fig. 26). With the customised healing abutment and the corresponding emergence profile, the soft tissue was entirely shaped within

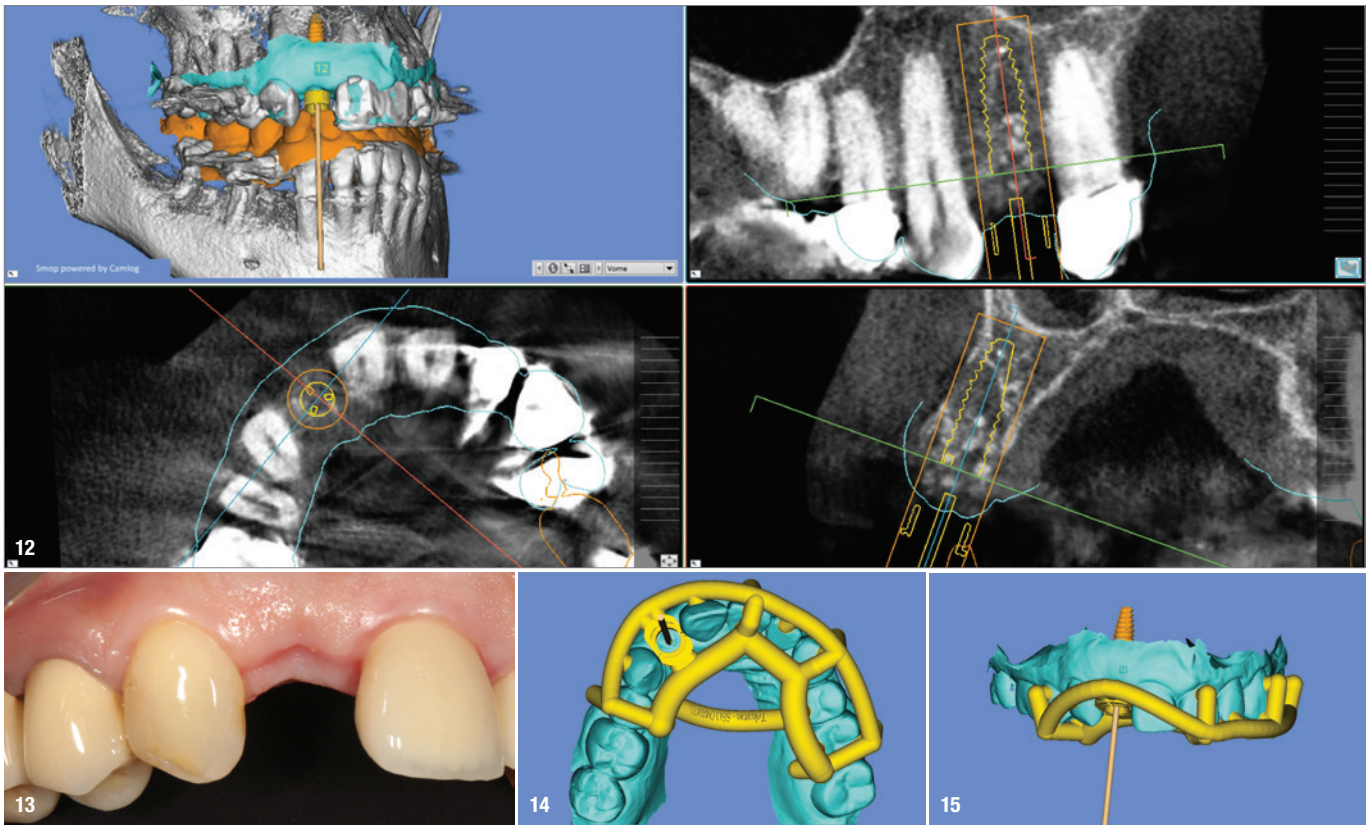
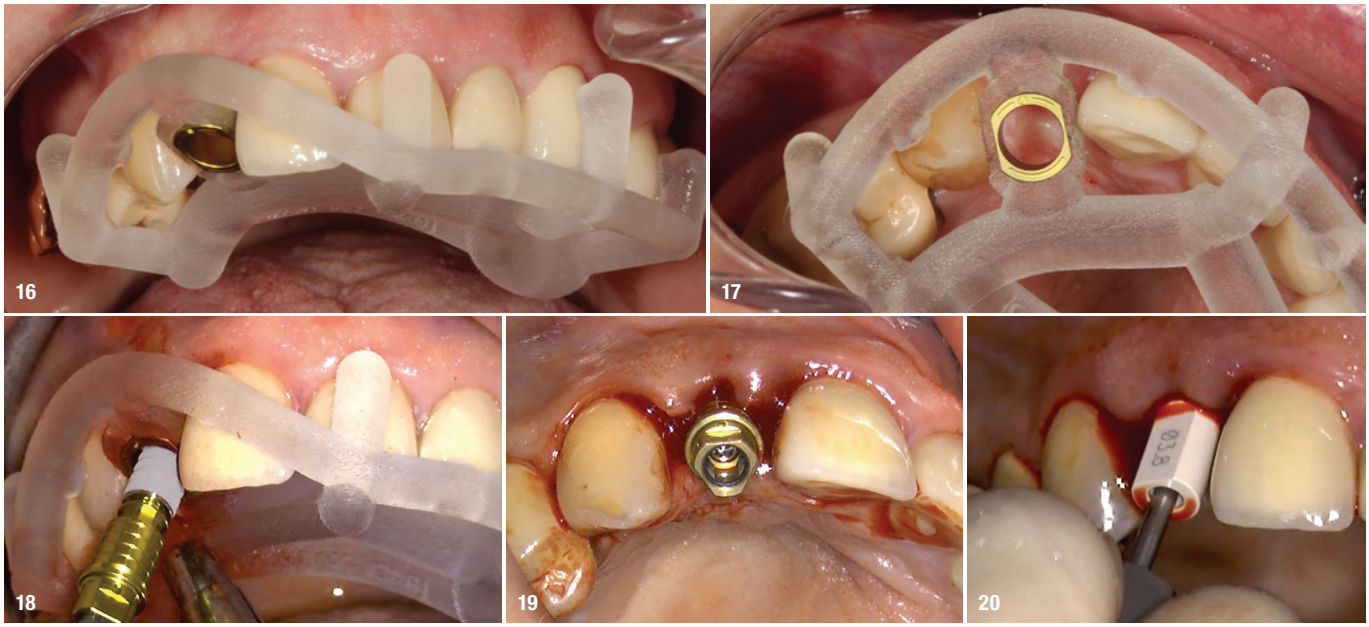
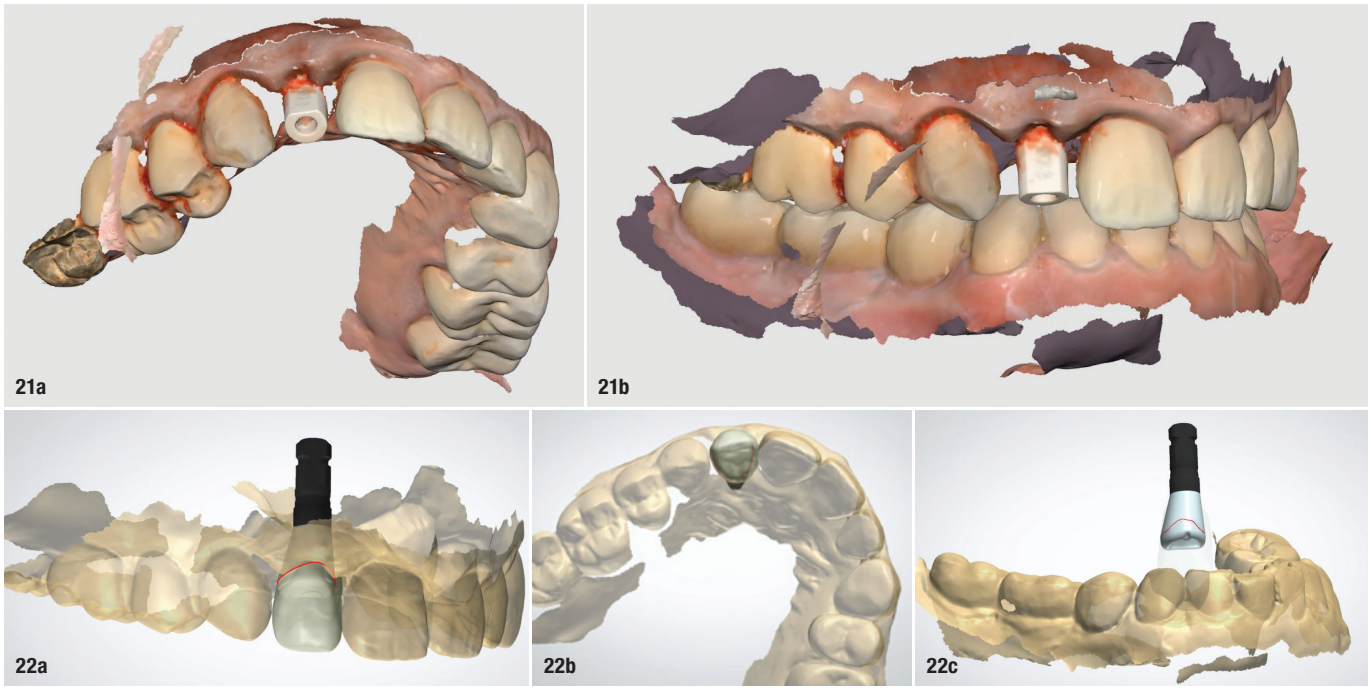


Fig. 12: Evaluation of 3D diagnostics showed sufficient stable bony conditions in all directions. **Fig. 13:** Clinical situation before implant placement. **Figs. 14 & 15:** Planning of the surgical guide (CAMLOG Guide), vertical and ventral views.

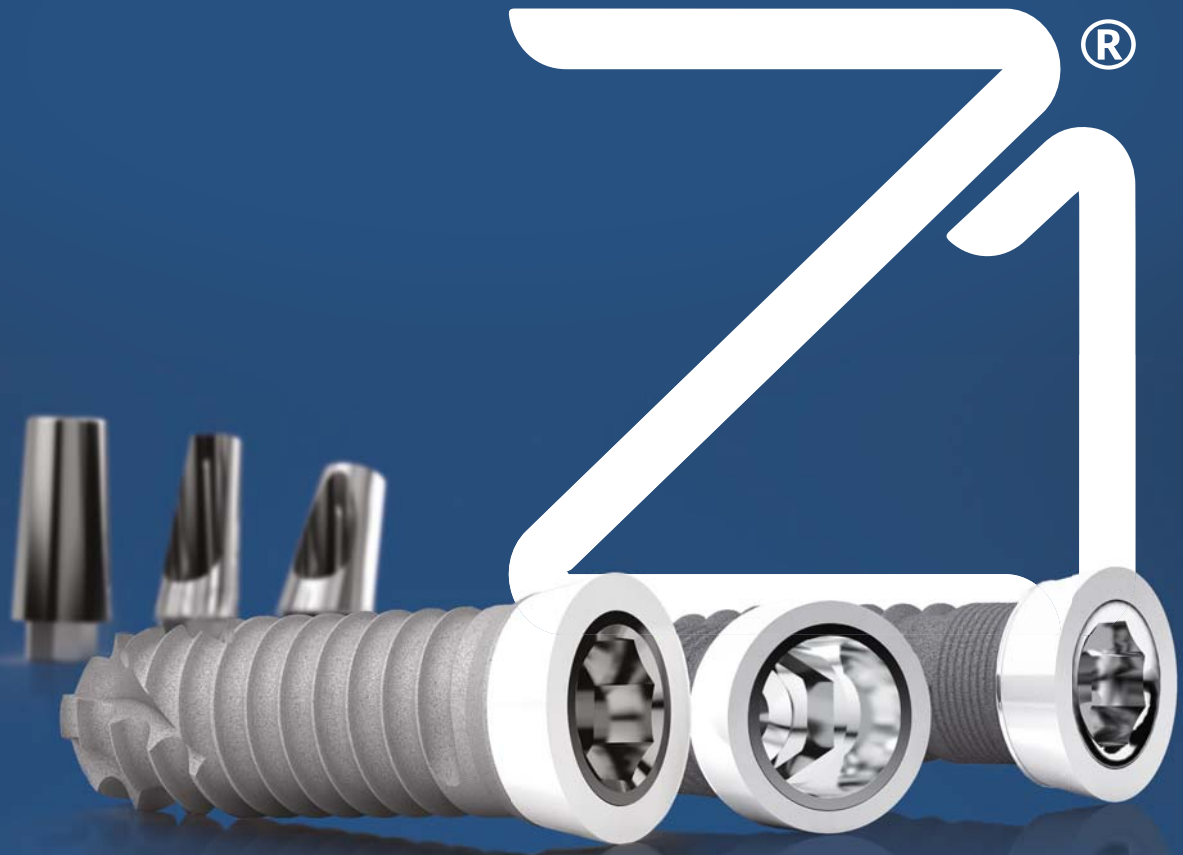


Figs. 16–18: Ventral and crestal views of the inserted surgical guide and guided implant placement in region #12. **Fig. 19:** Final position of the implant in region #12. **Fig. 20:** Insertion of the PEEK scan body.

three weeks, and within the healing period. No further treatment steps, impressions or other measures were necessary. Not only is the treatment protocol shortened in this way, but the soft tissue is also protected from stress. The healing abutment is not radiopaque; thus, its position cannot be checked on radiographs at present. However, the correct position of the fixation screw is clearly visible. In this case, the focus was on the implant itself, the bone and tissue regeneration, and the control of the healing of the implant site after three months. There was homogeneous and continuous bony healing of the implant site throughout (Fig. 26).



Figs. 21a & b: Determination of the final implant position by means of intra-oral 3D scanning. **Figs. 22a–c:** Different views: buccal view **(a)**, vertical view **(b)**, maxilla segmented on to the planned restoration **(c)**. The emergence profile of the healing abutment was matched to a virtual crown and designed accordingly (3Shape CAD Software®).



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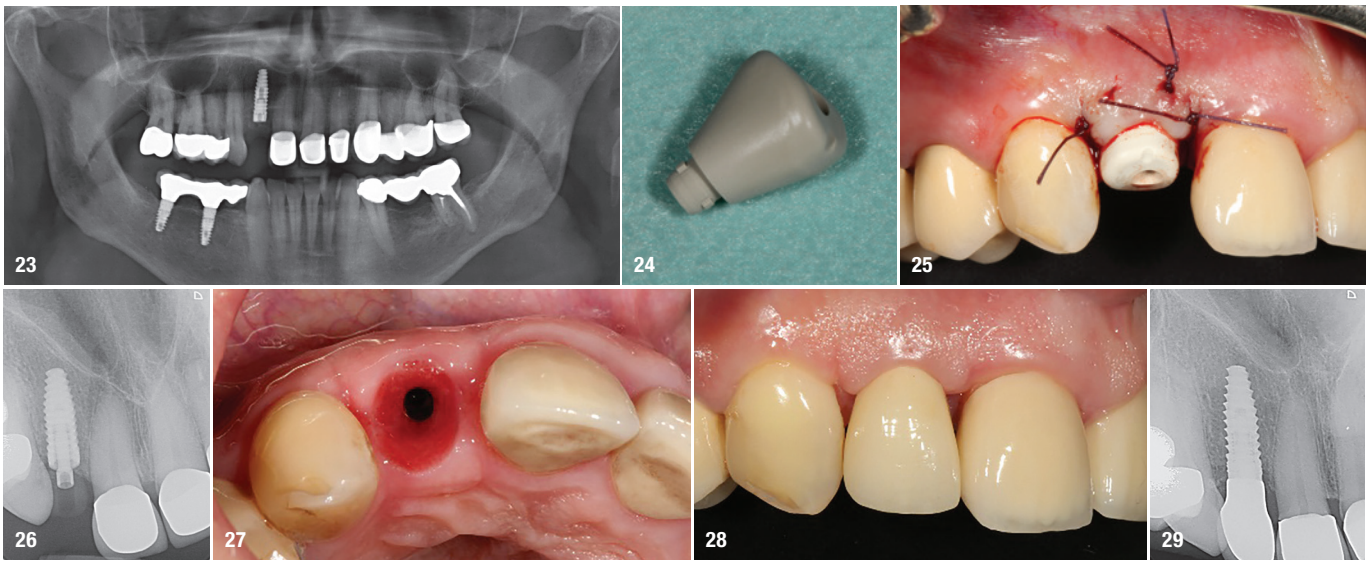

Fig. 23: Dental panoramic tomogram after implant placement in region #12 and post-op control at three months. **Fig. 24:** Healing abutment made of PEEK. **Fig. 25:** Inserted individual healing abutment and fixation of the peri-implant mucosa. **Fig. 26:** Periapical radiograph for radiographic control of the implant in region #12. **Fig. 27:** Vertical view shows the individually shaped mucosa immediately before the installation of the definitive superstructure. **Fig. 28:** Buccal view of the definitive crown in region #12. **Fig. 29:** Radiographic control of the implant in region #12 after installation of the definitive crown.

After a healing period of nearly three months, the definitive restoration of the implant in region #12 was carried out. A fully-veneered zirconia crown was fabricated in a CAD/CAM procedure. The customised zirconia abutment was bonded to the titanium base. The crown was then cemented onto the abutment. Following the final restoration, a final radiographic control was taken. Since the crown was placed immediately after customisation, further aesthetic remodelling of the approximal peri-implant mucosa is to be expected over time. Overall, a non-irritant, aesthetically pleasing and satisfactory result was achieved (Figs. 27–29).

Conclusion

Restoration in the anterior region is one of the greatest challenges in implant dentistry. The demands and expectations of patients regarding the aesthetic zone are very high.[4,7,10] In order to meet these expectations and to achieve an aesthetically predictable and prognostically reliable aesthetic long-term result, it is vital to ensure the preservation of the soft tissue. Extensive augmentation of the bone and soft tissue should be avoided if possible, and the tissue should not be put under stress after implant placement.[1] Preventive, predictable and minimally invasive measures aid in preserving bone and soft tissue. In the present case, implant surgery in the aesthetic zone was successfully carried out by means of a gentle extraction technique, alveolar management adapted to the situation using β-tricalcium phosphate collagen matrix (CERASORB Foam) biologised according to LSCC, delayed implant placement, as well as direct soft-tissue management after exposure using a prefabricated customised healing abutment. The case demonstrates how adequately sized and contoured hard and soft tissue for implant restoration in the aesthetically relevant zone can be achieved in preventive and efficient treatment steps that are kept as short as possible.

Author details

Literature

about the author

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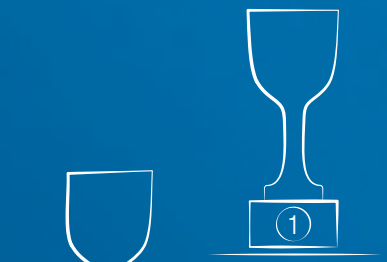

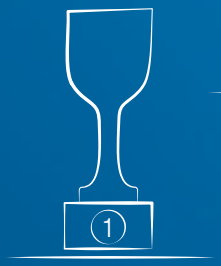

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