



# single-tooth implants in the esthetic zone

Challenge and opportunity

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## INTRODUCTION

**Single-tooth implants in the anterior region not only permit functional reconstruction at the highest level, but also for esthetic reasons. However, when providing cosmetically attractive treatment a wide number of parameters need to be taken into account and experience and knowledge of physiological processes is essential. The following describes the implant-supported reconstruction of an anterior tooth loss as the result of an accident.**

After extraction of the fractured root, we performed a reconstruction of the soft tissue to act as basis for an harmonic looking reconstruction of red-white esthetics. This was performed at the same time as implant placement via bone augmentation and connective tissue transplant. The applied surgical measures allowed optimization of the hard and soft tissue and, using a gingiva former, the shape of the gingiva could be adapted to the neighboring teeth. Delivery of a ceramic crown completed the attractive final cosmetic result. In the case of completely or partially toothless archs, implant-aided and -supported rehabilitation is a successful method of treatment in which single-tooth implants are largely used to restore

function and esthetics. Anatomically correct positioning of the implant can, however, only be realized, if the necessary bone level and soft tissue profile are considered in the planning and treatment. The shape and tooth-color are equally important for providing an esthetically harmonious appearance. The anterior region of the maxilla is not referred to as the esthetic zone without reason, after all, it is the most striking region of the stoma-tognathic system and also affects facial appearance.

This is why special rules apply to implant-supported single-tooth restoration in this region with regard to the choice of abutment: titanium abutments may show through translucent ceramics, lead to dark color effects or have a negative impact on the optical effect of the papillae. In the course of time, the edge of the abutment may even become visible due to changes in gingival profile. A number of established surgical procedures can be employed to improve conditions for a natural appearance of the restoration, however, the healing of the soft tissue plays a major role in ensuring long-term success of these measures. Ideally, primary wound healing remains the objective. Any loss of bone after tooth loss is to be compensated for with suitable augmentation techniques.

*1\_ Initial clinical situation with fractured tooth 21.*

*2\_ Corresponding X-ray with conservable root remains*

*3\_ After atraumatic extraction the alveolar cavity is closed with a free gingival graft.*

*4\_ The ovate pontic pre-forms the soft tissue.*



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## CASE REPORT

A 50-year-old female patient with inconspicuous medical history presented in our dental practice with complaints about tooth 21, which had been fractured in a traffic accident (Fig. 1). The X-ray showed no apical lucency in the area of the destroyed tooth (Fig. 2). Clinical examination showed a sufficient volume of attached gingiva, the frenulum was in a physiological position. However, the vestibular soft tissue was ruptured in the area of the fractured tooth. It seemed as if the bone underneath the rupture had also been involved. Although most of the mesial and distal papillae were in their correct position and still connected to the root cement of the neighboring teeth, the distal papillae had receded by a total of approx. 1 to 1.5 mm. As the length of the remaining root was insufficient for a combined endodontic-prosthetic restoration and the crown margin was to be positioned subgingivally to provide an optimal esthetic result, we decided to extract the remaining part of the root and to replace it with a Xive S plus implant. The periodontal fibres in the root area were loosened with a scalpel. The periodontal gap was extended with a periosteal elevator and the subcrestal fibres separated. This was the most atraumatic course of tooth extraction. Then, the extraction alveolar was carefully debrided to completely remove any remaining granulation tissue. To avoid damaging the labial bone lamella no force was exerted in bucco-palatinal direction during root extraction. The soft tissue remained undamaged by refraining from a vertical incision. Using palatinal mucosa as a free gingival graft, we ensured primary healing in the region of the extraction alveolar. This was previously measured with a periodontal probe, the corresponding trimmed graft placed over the alveolar and stabilized with sutures (Fig. 3). To support the mesial and distal papillae as well as conditioning the tissue, a temporary crown was constructed from composite material and

fixed to the neighboring teeth as an ovate pontic (Fig. 4). Implant placement was carried out six weeks later. Immediate implant placement after tooth extraction are usual, but in this case controlled bone regeneration was also required and made implant placement directly after extraction of the remaining root part inadvisable. A paracrestal incision some two to three millimeters palatinal to the alveolar ridge was carried out under local anesthesia, and a mucoperiosteal flap was prepared by using a periosteal elevator. The flap reached buccally to the mucogingival junction, this way, the alveolar ridge could be exposed. The bone was cleaned from connective tissue. The implant position was determined using a so-called locator. In order to safely avoid perforation of the labial bone, the implant was not to be inserted directly into the alveolar socket but shifted slightly in palatinal direction. To permit insertion of the implant within the so-called “esthetic window”, we determined the ideal bucco-palatinal alignment using surgical suture materials fixed to the neighboring teeth (Fig. 5). This allows for adequate dimensioning of the crown on the one hand, and provides sufficient labial tissue volume on the other. The implant site was prepared to take a Xive S plus (D 3.8 / L 15) implant. By involving the palatinal cortical bone and bone-specific preparation afforded by Xive, as well as the condensing thread of the implant, we achieved a torque of 50 Ncm during insertion. After placing the Xive implant in its final position an approximately two millimeter wide gap remained to the Lamina vestibularis (Fig. 6). We mixed the drill cuttings collected with a bone trap, which is standard procedure, with a xenogenic bone grafting material and filled the defect. As a means of protection, we covered it with a correspondingly trimmed absorbable membrane. This was covered with gingival graft from palatinal mucosa, the flap was repositioned and sutured (absorbable sutures 4.0, Figs. 7 and 8).

*5\_ Determining the ideal position for the implant with an Ighaut locator and surgical suture materials.*

*6\_ After insertion of the Xive S plus implant D 3.8 / L 15 a one to two millimeter wide gap remains.*

*7\_ An absorbable membrane and a connective tissue graft are placed over the implant and the filled defect.*

*8\_ The flap is repositioned and sutured.*



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As during the first intervention, Amoxicillin (Augmentin 1,000 mg) was given as antibiotic cover as well as chlorhexidine mouthwash solution and naproxen sodium (Apranax 275 mg) to be taken as required. Healing progressed without problems.

A further six months later and following successful osseointegration, uncovering was done using a scalpel (Figs. 9 to 11). The TempBase which was used as placement head and replaced with a cover screw after insertion, was re-inserted and temporarily restored with an appropriate chairside-modified TempBase Cap (Fig. 12). The transition between the plastic cap and the previously prepared temporary crown was filled with composite material. During delivery of the temporary crown, pressure was exerted on the underlying soft tissue and the papillae until the region became ischemic (Fig. 13). This condition needs to be reversible, and it is essential to check that the tissue regains its red coloring after a few minutes. According to our experience, this method achieves proliferation of the papillae coronally. After four weeks the temporary crown was removed and replaced with a transfer coping and the impression was made using a type-I-polyvinylsiloxane. The resulting ceramic crown manufactured in the laboratory was bonded to the matching Cercon abutment using a light-curing adhesive after try-in (Fig. 14). After three years, conditions remain stable with a pleasing esthetic appearance (Figs. 15 and 16).

## DISCUSSION

Implants for single-tooth replacement are an important and established treatment concept. In this case study an implant was placed soon after extraction of the traumatized tooth, as this appeared to be the most appropriate protocol, also with regard to the good condition of the remaining teeth. A number of investigations have shown ridge atrophy during the first year of tooth loss. As a rule, atrophy commences after the third week and the Crista alveolaris decreases by 30 to 50 per cent within the space of one year. To protect the bone against increasing degeneration through physiological load, the implant should ideally be placed directly after tooth extraction (immediate implant placement) or after four to six weeks at the latest (delayed immediate implant placement), once soft tissue healing is completed. If the gingiva and bone are not involved, the implant can be placed immediately. In cases where the tooth has been lost for endodontic reasons due to periodontal diseases or following trauma with bone and gingiva loss, augmentative procedures are usually also required. To ensure secure healing of the membranes and soft tissue grafts used for augmentation, the surgical area should be covered completely allowing primary healing. Ideally, the soft tissue is given four to six weeks to regenerate before placing the implant. Primary wound healing can be ensured by placing a free gingival graft over the extraction wound. To provide long-term success of the implant, the endosseous part of the implant must be covered completely by bone. Here, the vestibular regions of the implants play a major role. After bone reconstruction it is also important to cover the entire region with soft tissue. The combination of bone reconstruction or grafting with autogenous bone, which can,

9\_ The X-ray after six months demonstrates good bone regeneration.  
10\_ The clinical situation at the same time after removing interim treatment

11\_ Uncovery of the implant with a scalpel  
12\_ The TempBase abutment is reinserted and fitted with a TempBase Cap as temporary treatment.



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for example, be collected by using a bone trap, has proven a highly practicable method for augmentation. By covering with an absorbable collagen membrane, the soft tissue is isolated from the regenerative region. In this case, as the vestibular soft tissue was of insufficient volume despite the free gingival graft, a palatinal connective tissue graft was placed in addition to the augmented region. The thickness of the soft tissue affects the degree of recession. As a thick gingiva is better nourished, a connective tissue graft is often used in esthetic regions.

In the case of single-tooth restorations the localization of the implant is the most important factor for achieving esthetically pleasing reconstruction. Templates should be used for positioning. If this is not possible, the manual methods which have been in use for years can be employed. The length of the papillae, measured with a parodontal probe, bone thickness and the vestibular lamellae are very important for long-term stable treatment. In our case, we used the Iglhaut locator as the implant was not be placed directly into the alveolar socket but into a more palatinal-oriented position. From the literature we know that soft tissue is the mirror of bone. Using a palatinal connective tissue graft, a “thin gingival biotype” can be converted into a “thick biotype”. In our case we employed an envelope technique for transplantation of the sufficiently dimensioned palatinal-source mucosa graft. If the soft tissue is thick enough, it is possible to shape gingiva and papillae with temporary crowns. In addition, if there is sufficient distance to the bone, the papillae can even be “extended”. Pressure is exerted on the papillae to profile them in the direction of the crown. Sufficient connective

tissue thickness prevents the showing through of titanium, but a darker discoloration is definitely avoided by using zirconium dioxide abutments.

#### SUMMARY

Additional bone and soft tissue constructions are usually necessary to provide a long-term appealing reconstruction with single implants in the esthetic zone, and localization of the implant must be planned accurately. The implant should be placed as soon as possible after tooth loss. Zirconium dioxide is a proven material for abutments. ■

Literature on request from the author

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13\_ The temporary crown, fabricated chairside and modified on the basis of the TempBase cap, is pressed into position on the surrounding soft tissues.

14\_ Fitting of the laboratory-customized Cercon abutment

15\_ Final ceramic crown in situ adapts harmonically to the overall picture.

16\_ X-ray follow-up after three years demonstrates largely stable bone conditions.



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