CASE REPORT

Implant-supported anterior tooth restoration

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Abstract. Various options are available for restoring anterior teeth. Their choice is dictated by the severity of infection of the teeth to be extracted and the pocket depth. Immediate single-stage implant placement proved to be the least traumatic option, which best preserved the soft tissue. A differential use of surgical and prosthodontic techniques is indispensable to account for conditions in the individual case. Given an adequate amount of hard tissue, soft tissue contours can be expected to return to normal. Immediate implants combined with a soft tissue support have been found to ensure that the depth of even larger pockets is stable for years. (Keio J Med 55 (1): 23–28, March 2006)

Key words: dental implants, immediate implantation, delayed implantation, implant supported, immediate loading

Esthetic implant-supported anterior tooth restoration is the greatest challenge both surgeons and prosthodontists are confronted with. Ever since immediate implants have been available, there is conclusive scientific evidence showing that soft and hard tissue loss can only be prevented by implants. Although their indications are limited in the anterior maxilla, immediate implants should invariably be considered whenever an upper anterior tooth is extracted. However, esthetic aspects or periodontal infections may rule out immediate implant placement so that the risk of minor hard and soft tissue loss associated with delayed immediate implant placement may have to be put up with.[1,2,3]

The surgeon is called upon to keep in mind the subsequent prosthodontic work when placing implants and to make sure that implant positioning or bone grafting permit an optimal crown design and restoration of the papilla.[4] Implant systems are designed for differential diameters. Because of the tapering roots of upper anterior teeth, the placement of screw-shaped implants may be more difficult in the anterior maxilla than that of conical implants. The implant – to – tooth distance and the inter-implant distance as well as the hard tissue support of the mucosa also need to be attended to.[5,6,7]

The recommendations for immediate implant placement reported by Schulte continue to be valid and are still being followed in minimal invasive surgery today.[1,8,9]

With delayed immediate implant placement, some soft and hard tissue loss is inevitable despite the short interval of 6 to 8 weeks. The severity of ostitis or periodontitis following tooth extractions is one of the determinants of tissue loss.[2] Thanks to improved prosthodontic materials like zirconium oxide, electroplated crowns or ceramic suprastructures, less than optimal conditions post surgery can still be turned into a satisfactory or at least acceptable prosthodontic outcome. However, this requires the availability of an adequate amount of soft tissue. Temporary crowns help to contour and stabilize the soft tissue for subsequent definitive rehabilitation after an appropriate healing time.[11] Various options are available for successfully replacing the upper anterior teeth:

1. Single-stage immediate implants with
   (a) customized tissue contouring abutments
   (b) definitive crowns
2. Delayed immediate implants placed 6 to 8 weeks post extraction with
   (a) immediate impression taking and insertion of the definitive crown after implant exposure
   (b) soft tissue contouring with provisional crowns followed by later definitive crown insertion.

For these four options, long-term results are presented on the basis of case reports.

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Fig. 1 22, 11 and 12 extracted.

Fig. 2 Condition after appr. 1 week.

1. (a) Immediate implants with customized tissue contouring abutments

A female patient aged 68 years was referred for implants. 12, 11 and 22 showed grade 2 loosening. On probing, the pocket depth around all teeth was 11 mm causing exudation of pus and recurrent periodontal abscesses. The patient presented with a deep bite. The non-removable bridge she had been rehabilitated with was partly supported by implants.

Following periodontal pretreatment to control the acute infection, fixed bridgework was recommended for the time the implants would need to heal. 21 was trimmed to accommodate a crown with the neighboring teeth 22, 11 and 12 as pontics. Metal rests were bonded on 13 and 23 palatally in terms of a Maryland bridge without prior trimming. The metal bridge was veneered with plastic. One week later 12, 11 and 22 were extracted in local anesthesia and implants were placed despite the deep pockets. The inflammatory periodontal lesions had largely healed. Following Schulte's recommendations the implants, i.e. FRIALIT-2 Synchro screws with a Cellplus surface (Dentsply/Friadent, Mannheim, Germany), were placed palatally (Fig. 1).

Implant diameters were 4.5 mm for 12, 5.5 mm for 11 and 4.5 mm for 22. Implant length was 15 mm throughout. All implants were anchored in the cortical bone of the nasal floor (Fig. 2).

The implants were closely spaced in the bone with an inter-implant distance of no more than 1 to 1.5 mm. Implants with a smaller diameter did not achieve primary stability and had to be replaced by larger ones. Alternatively, the periodontal lesions could have been curetted to the point of healing. However, this would have caused substantial resorption of the mucosa and the alveolar process. Despite a pocket depth of 11 mm around 21, 9 mm around 12 and 9 mm around 22, the implants were seated down to the limbus. As tissue contouring abutments of adequate length to support the mucosa together with the papillae to the level of the mucogingival junction were not available, ProTect abutments were customized to the right size. All implants achieved primary stability.

On the day of implant placement impressions were taken and the lab technician fabricated plastic-coated, highly polished tissue contouring abutments matching the ovoid diameters of the teeth. While he was at work, transfer copings were attached for 1 to 2 hours to maintain stable mucosal conditions and prevent mucosal collapse.

When ready, the customized tissue contouring abutments were put in place, the Maryland bridge was bonded with Panavia® (Kuraray Dent) and antibiotics were administered.

The customized tissue contouring abutments were checked for stability at weekly intervals and the mucosa was examined for alterations, shape and color. As the small inter-implant distances prevented papilla regeneration, the original tissue contouring abutments were replaced by other customized highly polished, plastic-veneered abutments with the diameters reduced by platform switching. With these, papilla-like soft tissue developed within the mucosa and persisted to the time of definitive management. Platform switching was also used for the definitive restoration, i.e. the 4.5 mm implant in 12 was fitted with a 3.8 mmD abutment and the 5.5 mm implant in 11 with a 4.5 mmD abutment. Both of these abutments were custom-designed. By the time of definitive management, the mucogingival junction was only slightly lower than around the natural tooth 21. The 3 implant-supported electroplated crowns were mounted on customized final abutments and retained with a horizontal screw. An electroplated crown was also used on 21 to avoid a translucency mismatch.

Fig. 3 Patient has been occlusally stable for the past year. Mucosal level matches that around natural tooth 21.

Fig. 4 22 extracted. Note apical granuloma.

Fig. 5 Transfer coping in place for impression.

At the follow-up visits scheduled at regular intervals in the subsequent 2 years, the vestibular probing depths dropped to 7 mm around 12, 8 mm around 11 and 6 mm around 22. Compared to 21, which was vital, the reduction of the mucogingival junction was negligible. The papillae between the implant-supported crowns were stable (Fig. 3).

1. (b) Immediate implants with definitive crowns

This patient, a 38-years-old female, presented with a root canalled, loosened (grade 2) 22. The pocket depth of 4 mm was not yet significantly abnormal. After duly considering all alternative treatments the patient opted for an immediate implant with an immediate definitive crown. 22 was extracted in local anesthesia. For implant placement Schulte's recommendations for tooth extraction, implant inclination and positioning to support the facial cortical plate were followed. Immediately after the FRIALIT – 2 Synchro implant (Dentsply/Friadent, Mannheim, Germany) with a grit-blasted acid-etched surface, a diameter of 4.5 mm and a length of 15 mm was placed, an impression was taken, a tissue contouring abutment was mounted on the implant and the patient was sent home for the day (Figs. 4–5).

In the meantime, the lab technician fabricated a horizontally screw-retained electroplated crown, which was veneered with ceramic. Rather than glaze-baked, the crown surface was polished mechanically to leave some scope for subsequent esthetic and functional crown finishing, i.e. baking the ceramic on metal, which increases the compressive force applied to the papilla and promotes papilla repair.

In the evening of the same day, the horizontally screw-retained electroplated crown matched in shape to 22 was mounted. The mucosa had meanwhile been stabilized by the tissue contouring abutment. On account of the compressive force generated by the permanent crown the supracoronal tissue briefly became anemic. The anemic reaction ought to subside within 8 to 10 minutes. If it does not, the compromised nutritive supply of the soft tissue is bound to lead to recessions.

Crown contacts were avoided during maximal intercuspidation, protrusion and lateral shift. The patient was recalled weekly and instructed to clean the tooth gently and not to bite or chew with it. The crown was checked for stability throughout the healing time of the implant. It was never taken off. The mucosa was sound without any loss in height or papillary volume.

After about 3 months, the crown was removed and finalized esthetically and functionally in the lab. Two years post management the mucosa was at the same level as that around the neighboring teeth. The dis-

Fig. 6 Labial view of implant-supported crown in 22, $\frac{1}{2}$ year later.

Fig. 7 Alveolar process exposed. Note extensive bone loss.

tances of the papilla from the contact points, the incisal edge and the implant base were also unchanged. All of the soft tissue had successfully been preserved (Fig. 6):

2. (a) Delayed immediate implants with immediate impression taking and insertion of the definitive crown after implant exposure

This 34-years-old female, who had lost 22 and was provided with a removable temporary partial, came for implant treatment. The tooth had been extracted elsewhere about 8 weeks ago. Even during this short interval, substantial hard and soft tissue loss had occurred by clinical evidence. The patient reported that the extraction had been very difficult and that she developed an infection after it.

Treatment alternatives were discussed with her and implant-supported restoration combined with bone grafting was agreed upon.

The neighboring teeth were caries-free. The alveolar process was exposed through a palatal incision in local anesthesia. The bone atrophy, which had already been noted on palpation, was confirmed intra-operatively (Fig. 7).

The pre-implant diagnostic workup had indicated the need for an implant with a diameter of 3.8 mm and a length of 15 mm. A FRIALIT-2 Synchro implant with a grit-blasted and acid-etched surface was chosen. The bone from the intended implant site was removed with a trephine. Implant placement itself was uneventful. One third of the implant surface was not buried in the host bone.

With due attention to the subsequent prosthodontic work, an impression was taken immediately after implant placement. This left the lab technician more than 3 months' time for fabricating the crown. After impression taking the area of bone loss was grafted with bone harvested from the retromolar region and with bone chips from the bone collector and the trephine. The graft was covered with a titanium mesh secured with screws before primary tension-free wound closure (Figs. 8a, 8b).

Healing was uneventful and the implant was uncovered after about 3 months. The titanium mesh was removed through the original incision. The quality of the alveolar process had substantially improved. The originally exposed implant surface was now covered by bone. The final abutment had a collar height of 0.5 mm and the crown, which had meanwhile been fabricated in the lab, was immediately mounted and retained with a horizontal screw. With interdental and inter-implant sutures in place, the wound was allowed to heal.

After about 4 weeks, the bland mucosa had become attached to the implant. At 2 years peri-implant mucosal conditions were stable despite the loss of about 1 mm in mucosal height compared to the neighboring tooth. The papillae were well preserved (Fig. 9).

3. (b) Delayed immediate implants with soft tissue contouring by temporary crowns and subsequent definitive management

This patient, a 34-years-old female, presented with loosening of 11 and 12. (Fig. 10a) As these teeth were not salvageable because of periodontal abscesses, they were extracted and the patient was temporized with a removable partial. Implants were placed about 8 weeks post extraction. In local anesthesia, a mucoperiosteal flap was raised through a palatal incision spanning 11 and 12. Alveolar bone loss was apparent both vertically and horizontally. Two FRIALIT-2 Synchro implants were placed, i.e. a 4.5 mmD in 12 and a 5.5 mmD in 11.

a

b

Fig. 8 a) Retromolar bone graft applied to alveolar process.
b) Graft covered with titanium mesh secured with screws.

a

b

Fig. 10 a) Periodontally compromised 11 and 12 in need of extraction.
b) Vestibular view showing stable mucosal conditions around horizontally screw-retained crowns appr. 2 years post insertion.

Fig. 9 Crown in 22 appr. 1 year after abutment was mounted.

Both implants were 15 mm long. They were not fully buried in bone, but left exposed about 2 mm above the alveolar process for augmentation with a bone substitute. The vertical 2-mm defect and the horizontal defect were grafted with BIO-OSS® (Geistlich, Wohlhusen, Switzerland). The grafts were covered with a resorbable membrane (Vycryl, Ethicon, Norderstedt, Germany), which was secured with the occlusal screws of the implants. Following submucosal vestibuloplasty the wound was closed with tension-free sutures. The patient was prescribed an anti-inflammatory (diclofenac) and an antibiotic (clindamycin) to prevent swelling and infection. Healing was uneventful. About 3 months later the implants were uncovered through the original

incision, tissue contouring abutments were mounted on them and stabilized with inter-implant sutures. The mucoperiosteal flap was repositioned and sutured against the abutments. For adequate mucosal support extra-high tissue contouring abutments were chosen. Loading by the denture was not allowed for about 1 week. About 8 days later, an impression was taken and temporary crowns were inserted on the same day. These were originally intended to be left in place for about 3 to 6 months for satisfactory soft tissue contouring. However, the soft tissue support provided by the crowns was found to be inadequate. As the patient spent some time abroad, she was prevented from showing up for crown recontouring. As a result, definitive rehabilitation was done after about 1 year. The inadequate soft tissue support had caused mucosal loss both vertically and horizontally. Electroplated crowns retained with horizontal screws were chosen for definitive restoration. The shoulder of the final abutments for the FRIALIT-2 implants was reduced to 0.5 mm for recontouring the mucosa to match the natural ovoid crown shape. In addition, the abutments were extended in length to counteract the leverage on the crowns. A small ischemic area just above the crown margin was seen after the crowns were mounted. This disappeared within approximately 8 to 10 minutes. Definitive management was completed by readjusting the ceramic crowns to provide more support for the papillae and the soft tissue.

At about 2 years after crown insertion the soft tissue was stable. (Fig. 10b)

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