

Replacement of the upper left central incisor with a Straumann® Bone Level Implant and a Straumann Customized Ceramic Abutment

by Dr. Ronald Jung and Master Dental Technician Xavier Zahno

Initial situation

The patient, a 30-year-old female dentist, contacted the Department of Fixed and Removable Prosthodontics and Dental Material Sciences at the University of Zurich, Switzerland, for implant therapy in the area of the upper left central incisor, tooth 21¹. This tooth had to be removed due to a significant internal resorption and subsequent caries (Fig. 1). It was horizontally fractured and was removed eight weeks before implant placement.

The patient's history showed no pathological findings and no contraindications with regard to dental implant therapy. The teeth adjacent to the extraction site (11 and 22) were without fillings or other dental treatment and the patient's expectations with regard to the esthetics of the treatment outcome were very high. In addition, the patient asked for a fixed temporary reconstruction for the entire treatment period.

Proceeding

The situation eight weeks after tooth removal showed a favorable height of the mesial papilla, but a more flat geometry at the distal papilla (Fig. 2a). This might be due to the rotation of tooth 22. The mucosa was healthy and classified as medium to highly scalloped with a thin mucosa biotype. The dental arch showed a labial concavity due to the bone remodeling during extraction socket healing (Fig. 2b).

During surgery, a Straumann Bone Level Implant (Regular CrossFit™ Connection Ø 4.1 mm, SLActive® 14 mm) was placed in site 21. A surgical guide was used to help ensure ideal three-dimensional placement (Figs. 3, 4). Despite the buccal bony defect, primary stability of the implant was achieved during placement. The authors recommend the use of a surgical guide for immediate or early implant placement protocols at the implantation site, as the surgical guide helps to ensure proper 3D positioning of the implant.



Fig. 1:
The pre-treatment orthopantomogram revealed a large internal resorption on tooth 21.



Figs. 2a, b:
The clinical situation 8 weeks after tooth removal, labial and incisal view.



Figs. 3a, b:
Placement of the bone level implant with the help of a surgical guide.



Figs. 4a, b:
The implant in place. Note the large labial bone defect caused by the internal resorption and subsequent remodeling of the extraction socket's bony walls.

¹The tooth identification system used in this article is that of the FDI World Dental Federation.

In order to regenerate the missing buccal bone, a simultaneous bone augmentation procedure with autogenous bone, xenogenic graft material and a resorbable membrane was performed. The labial aspect of the implant site was intentionally over-contoured to create an ideal labial bone profile. Subsequently, the augmentation site was covered with a resorbable collagen membrane (**Fig. 5a**).

Then, the flap was mobilized and care was taken to ensure tension-free wound closure (**Figs. 6a, 6b**).

According to the Third ITI Consensus Conference², complete or partial coverage of the implant is recommended in the anterior maxilla to optimize soft tissue volume.

The submucosal implant integration was uneventful. Four months after implant placement and bone augmentation, re-entry surgery was performed, first, to take an impression for a provisional crown and, second, to replace the closure screw with a conically shaped Straumann® healing abutment to initiate the mucosa conditioning phase (**Fig. 7**).

After a soft tissue healing phase of three weeks, the healing abutment was removed.

If the patient has high esthetic expectations as was the case here, it is of utmost importance to use a provisional crown. This provisional crown, on the one hand, is a diagnostic tool in order to sensitize the patient, the dentist and the dental technician to the form of the new tooth and, on the other hand, it shapes and conditions the peri-implant mucosa in a controllable process. Hence, a temporary crown was fabricated in the dental laboratory for the implant in site 21, using a Straumann temporary abutment.

The shape of the laboratory-made provisional crown (**Fig. 8**) was optimized in a chair-side procedure to establish an ideal shape, size, contour and texture of the crown (**Figs. 9, 10**).

After a soft tissue conditioning phase of two weeks, another adaptation of the provisional crown's shape was performed to further improve the emergence profile (**Figs. 11, 12**).

After a total of four weeks of conditioning (including two chairside adaptations of the provisional crown), the soft tissue had reached a favorable shape and contour, which allowed for



5a



5b

Figs. 5a, b:
Bone augmentation procedure and creation of a favorable labial profile by over-contouring the labial aspect of the implantation site.



6a



6b

Figs. 6a, b:
Tension-free wound closure and suturing, labial and incisal view.



7



8

Fig. 7:
The situation after re-entry and insertion of the healing abutment at four months after implant placement.

Fig. 8:
The provisional crown on a Straumann RC Implant Analog before delivery to the dentist. It was shaped in a way that allowed for easy chair-side optimization and finalization.



9



10

Fig. 9:
The provisional crown being optimized chair-side with a flowable, light-curing composite material.

Fig. 10:
The optimized provisional crown *in situ*.



11



12

Fig. 11:
The peri-implant soft tissue contour after two weeks of soft tissue conditioning.

Fig. 12:
The optimized provisional crown *in situ*. Note the improved height and curve of the peri-implant marginal mucosa.

² Proceedings of the Third ITI Consensus Conference. International Journal of Oral & Maxillofacial Implants Vol. 19, Supplement 2004.

impression-taking for the final crown (**Figs. 13a, b**).

To capture the soft tissue shape and emergence profile as precisely as possible, the final shape of the provisional crown (**Fig. 14**) was recorded in order to customize a Straumann® RC Open Tray Impression Post. For the creation of a customized impression post, the provisional crown was attached to the implant analog and its cervical portion was captured with a silicone impression material (**Figs. 15a, b**).

Subsequently, the provisional crown was substituted with an impression post. The impression created by the provisional crown was filled with a flowable, light curing composite material to transfer the soft tissue emergence profile to the impression post (**Fig. 15c**).

The custom impression post supports the delicate peri-implant soft tissue and facilitates precise impression taking (**Figs. 16, 17**).

In the dental laboratory, a cast was fabricated and a wax-up of the abutment was made with the etkon scan wax, developed for scanning with the etkon™ es1™ laser scanner. The scanner digitizes the implant position as well as the wax-up so that the abutment shape can be finished on the computer screen with a digital wax knife (**Fig. 18**).

The abutment was finished on the computer screen with the etkon visual™ 4 software (**Fig. 19a**). Subsequently, its dimensions were checked (**Fig. 19b**).

The design file was directly transferred to the Straumann milling center in Basel, Switzerland, via the Internet (**Fig. 19c**), where, after verifying the design, the abutment was milled.

The abutment was then shipped to the dental laboratory for final veneering (**Figs. 20a, b**).

Before finalization of the crown, the shape of the abutment was checked once more in the patient's mouth (**Fig. 21**).

The final full-ceramic, implant-borne screw-retained crown in situ (**Figs. 22a, b**). The peri-implant soft tissue contours are in harmony with those of the natural contralateral tooth. The treatment outcome is esthetically very pleasing.



Figs. 13a, b:
Soft tissue shape after four weeks of conditioning, labial and incisal view.



Fig. 14:
Final shape of the provisional crown at the time of impression-taking for final crown fabrication.



Figs. 15a-c:
Capturing of the provisional crown's shape for creation of a customized impression post.



Fig. 16:
The customized impression post *in situ*.



Fig. 17:
The impression before delivery to the dental lab for cast fabrication, scanning and fabrication of the final crown.



Fig. 18:
Scanning process in the dental laboratory.

The periapical radiograph taken at six months after implant placement demonstrated a well-integrated bone level implant and stable peri-implant bone contours (Fig. 23).

The overall esthetic treatment outcome was very satisfactory (Fig. 24).

When connected to the implant via the CrossFit™ Connection, the customized ceramic abutment is screw-tightened in the implant with the special anodized magenta basal screw at a tightening torque of 35 Ncm.

Basal screw for Straumann®
Customized Ceramic Abutment

Straumann Customized
Ceramic Abutment, ZrO₂

CrossFit Connection

Straumann RC Bone Level Implant



The dental lab work for this patient was done by Master Dental Technician Xavier Zahno, Center for Dental and Oral Medicine, Clinic for Fixed and Removable Prosthodontics at the University of Zurich/Switzerland. The authors would like to thank Dr. Adrian Bösch for his contribution to the treatment of this patient.



Figs. 19a-c:
Abutment finishing process and dimension check on the computer screen.

Design data ready to be transferred to the Straumann milling center.



Figs. 20a, b:
The customized ceramic abutment, singular and attached to an RC implant analog. Note its individual shape.



Fig. 21:
The customized ceramic abutment for a screw-retained reconstruction *in situ*.



Figs. 22a, b:
The final crown *in situ*, end-to-end bite and incisal view. Note the harmonious contour of the labial bone arch.

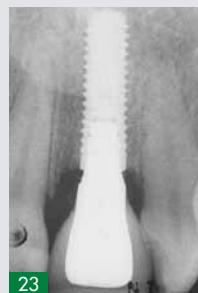


Fig. 23:
Final radiograph six months after implant placement.

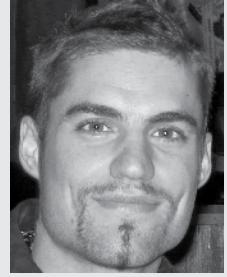


Fig. 24:
Final treatment result at six months after implant placement.

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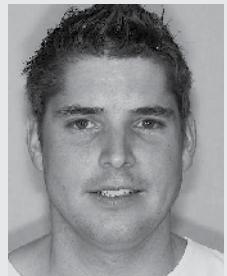
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