Changing the abutment only once – innovative impression procedure used restoring a single implant

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In implant prosthetics, there is an increasing demand for concepts that help avoid multiple abutment swaps in the course of treatment. One approach suggests the intraoperative capturing of the implant position with a powder-free intraoral scanner. This enables the user to place the final restoration or individual abutment upon re-entry[1,2]. Another option involves the production of a definitive custom abutment, which is placed immediately after insertion of the implant[3]. An interesting alternative suitable for procedures with open healing and without immediate loading is the use of a scanable healing abutment. This component is special in that it serves as a healing abutment and as a scanbody. As usual, the healing abutment is placed immediately after implant insertion. All information about the implant position, the implant type and the emergence profile is embedded into the surface geometry of the abutment. Based on this information, the prosthetic components are produced in a computer-aided procedure. The abutment only needs to be changed after the healing phase when the final prosthetic components are placed.

One of the main goals of the presented concepts is the avoidance of any unnecessary traumatization of the peri-implant soft tissues. This approach might have a positive effect on the stability of the peri-implant soft tissues and the bone and might reduce an increase in the inflammation values of the tissue[4,5,6]. Moreover, a less frequent placement and removal of an abutment prevents wear in the area of the implant-abutment interface, which might cause screw loosening and bacterial colonization of the implant’s internal aspect[7,8].

The following case report describes how to proceed when using a scanable healing abutment.

Initial situation
The 55-year-old female patient complained about discomfort in the area of the endodontically treated maxillary left first molar. After thorough clinical and radiographic diagnosis, the molar proved unsustainable. During the initial consultation, all diagnostic findings were summarized and the treatment options presented. The team informed the patient of the fact that apart from the need to restore the interdental space in the area of the first molar to be extracted, it was necessary to replace the existing restoration of the adjacent premolar. Thanks to the good general health and an ideal oral hygiene behavior, it was possible to offer an implant-based solution. In the end, the patient opted for an implant-based single crown and initially against a replacement of the restoration on the premolar.

Based on the expressed demands, the restorative team decided to produce a hybrid-abutment crown made of polymer-infiltrated ceramic on a titanium base to serve as a long-term temporary. This would allow the team to place a definitive crown and to replace the restoration on the adjacent tooth at a later date. In order to reduce the number of abutment swaps to the required minimum, it was decided to insert a commercially available tapered implant of a renowned manufacturer (Biomet Certain Implant System, Zimmer Biomet) and to place a scanable healing abutment (BellaTek® Encode® Healing Abutment, BellaTek® Encode® Impression System, Zimmer Biomet, Valencia, Spain). The latter has already proven its worth in clinical use[9-12].
Initially, the crown of the first molar was removed, followed by the separate extraction of every single root to ensure a gentle procedure. Figures 1 and 2 show the clinical situation immediately prior to implant placement 16 weeks after the extraction. The soft tissue conditions were good and the amount of bone was sufficient for the insertion of an enossal implant.

**Surgical procedure**
For implant placement, a mucoperiosteal flap was created first (Fig. 3). Afterwards, the pilot hole was prepared. In order to check the axis and ensure that the future orientation of the implant would be advantageous for the planned prosthetic part, a paralleling post was used (Fig. 4).

Following preparation of the implant site with system-specific shaping drills (Premium Surgery Kit, Zimmer Biomet) until reaching the desired implant diameter (5.0 mm) (Fig. 5), the Tapered Implant with integrated platform switching and a highly modern hybrid surface (3i T3 Tapered Implant with DCD surface, Zimmer Biomet) was placed (Fig. 6). While the implant has a diameter of 5.0 mm, the diameter of its restorative platform is only 4.1 mm; the length is 8.5 mm. Primary stability was obtained with a torque of approximately 35 Ncm.
Subsequently, the two-piece scanable healing abutment (BellaTek Encode), which is available in different sizes, was screwed onto the implant. In the present case, an abutment with a 6 mm emergence profile and a height of 4 mm was selected. Suturing was carried out with Prolene blue monofilament suture (Ethicon, Norderstedt) in the size 6-0. Figure 7 displays the situation immediately after the surgical intervention. The suture was removed after ten days.

**Digital intraoral impression**

Eight weeks later, the patient presented for a check-up and for digital impression taking. The soft tissue conditions were good with no irritations present and the healing abutment with its specific geometrical codes on the surface was clearly visible (Figs. 8 and 9). The pits in their predefined pattern contain specific information about the implant position, the height and diameter of the abutment and the emergence profile. By capturing the healing abutment with an intraoral scanner and decoding the information with the CAD software, the details are made available for the computer-aided design of the custom abutment or crown. Hence, the healing abutment also serves as a scanbody. In the present case, the impression was taken with a high-precision intraoral scanner (3M True Definition Scanner, 3M, Seefeld), which offers an STL output option for data processing with diverse software solutions.

In cases like the present one that requires precise recording of a metal object, the use of scan spray might have a positive effect on the scanning speed and the scan result. The reason is that the powder particles act as reference points and reduce light reflections on the surface. The selected scanner generally requires dusting with a thin layer of powder, which was applied after isolation of the working field (Fig. 10). Subsequently, the quadrant with the scanable healing abutment was captured, followed by a digital impression of the opposing dentition and of the teeth in occlusion (bite registration). Due to the three-dimensional representation of the impression data in high resolution, it is possible to check the quality of the scan immediately. If details are missing (e.g. in the area of the codes on the healing abutment), specific areas may be rescanned. In the present case, the scan contained all relevant details for decoding of the 3D-information (Fig. 11 and 12).
Design of the hybrid-abutment crown

The scan data was transferred to the milling center (Zfx Süd, Munich), where the team downloaded the STL file. The information embedded in the surface geometry of the healing abutment may be converted by use of a software add-on (Zfx Application Manager, Encode® Converter, Zfx, Munich). The dataset is imported into the module and the healing abutment is selected to initiate the decoding process. Afterwards, the user may check and – if necessary – modify the obtained information.

After approval, the SLT file was shown in the CAD software, which reduced the healing abutment automatically, revealing the emergence profile in its real form. Figure 13 shows the representation of the soft tissue below the transparent full-contour design proposal for the desired hybrid-abutment crown. The geometry of the prefabricated titanium base with rotation protection (Zfx) is available in the software library. Showing it will facilitate the designing of the hybrid ceramic parts (Fig. 14).

When designing the abutment, the user may modify the emergence profile. In this context, however, care should be taken not to put too much pressure on the peri-implant soft tissue. Hence, it is important for a high quality of the outcome that the dentist selects the correct size of the healing abutment. The screw channel was positioned automatically. Figure 15 shows the final design in the CAD software (Zfx).
Production of the long-term temporary

Subsequently, the material was selected and the milling paths were calculated with the CAM software (hyperDENT, FOLLOW-ME!, Munich). As planned, a modern, polymer-infiltrated hybrid ceramic material (VITA ENAMIC, VITA Zahnfabrik, Bad Säckingen) was used. This material is available in block form with an integrated connection to the titanium base (VITA ENAMIC IS). Using this block version, the manual process of integrating a screw channel is eliminated. The components of the hybrid-abutment crown after subtractive production of the hybrid ceramic part with an industrial milling machine (ULTRASONIC 20 linear, SÄUER, Stipshausen) is displayed in Figure 16.

Initial study results confirm the hybrid ceramic material’s suitability for the production of monolithic restorations[13,14]. For its use on implants, only promising in-vitro data and clinical experience reports are available so far[15,16]. However, the manufacturer explicitly recommends it for use in the described indication of a posterior abutment crown[17].

Adhesive luting of the hybrid ceramic part to the titanium base was carried out after the required pretreatment of the components with the self-curing resin cement Multilink Hybrid Abutment (Ivoclar Vivadent, Schaan, Liechtenstein). For polishing of the crown, the associated polishing set (VITA ENAMIC Polishing Set technical, VITA Zahnfabrik) was used. The result is displayed in Figure 17. Finally, the fit and occlusion of the crown were checked on a laser-sintered resin model (Zfx Digital-intraModel System, Zfx) (Fig. 18).

Placement

In the dental office, the healing abutment was removed (Fig. 19). What followed were the try-in and direct fixation of the crown on the implant (Fig. 20). Putting too much pressure on the surrounding soft tissue will cause ischemia, which is identifiable by a whitish appearance of the mucosa. In the present case, this clinical issue did not occur, which indicated a favorable stress distribution in the area of the emergence profile. The correct fit of the long-term temporary was checks with the aid of a radiograph (Fig. 21) before closing the screw channel with PTFE tape and composite (Tetric EvoCeram, A2, Ivoclar Vivadent) (Fig. 22 and 23).
Conclusion

The treatment concept presented here is an adequate option for the restoration of single implants in the posterior region. The use of a scanable healing abutment enables the clinician to avoid unnecessary abutment swaps without the need to change the familiar surgical protocol and to do without a separate scanbody. The prosthetic workflow protocol is regulated in the dental laboratory, but variable in all directions in the dental office. Apart from the option of capturing the intraoral situation with virtually every intraoral scanner, it is also possible to take a conventional impression followed by scanning of a model. Moreover, the dentist can flexibly select the date of the impression appointment. Depending on the desired workflow and available equipment, this factor may be beneficial as compared to processes that require an intraoperative impression with a powder-free intraoral scanner. The method used in the present case is an interesting treatment concept, which might contribute to a higher workflow efficiency, fewer appointments and an increased patient comfort.
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References


