A leading-edge implant-supported prosthetic concept for long-term success and tissue stability

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Patient-specific restorations are the focus of state-of-the-art dentistry. A treatment concept tailored to the specific situation has also become indispensable in implant dentistry. Based on the case presented, this article describes how a custom abutment can be used to create an implant-supported crown very similar to the natural tooth in shape and soft-tissue profile.

A leading-edge treatment protocol distinguishes itself by a perfectly coordinated surgical-prosthetic procedure with the goal of harmony and long-term stability of peri-implant bone and keratinized mucosa. The key parameters of the concept are implant positioning in the lingual or palatal third of the alveolar ridge to ensure a buccal bone plate with a minimum thickness of 1.5 mm. In addition, a zone

Fig. 1, The radiograph (OPG) of the initial situation. The gap in region 36 is to be closed by means of an implant-supported prosthetic solution.

Figs. 2a–c. The three-dimensional image of the initial situation confirmed the suspected insufficient bone volume in the buccal area of region 36. The ideal implant location was determined in the planning software.

Figs. 3a & b. Comparison of planning and implementation. The implant (XiVE) was inserted into the bone as planned.

Fig. 4. The master cast with gingival mask and desired emergence profile.

Fig. 5a. Virtual wax-up of the abutment (ATLANTIS).

Fig. 5b. Fig. 2b

Fig. 2c
of keratinized mucosa of at least 3 mm must be maintained or created. The surgical approach is minimally invasive based on advanced diagnostics with three-dimensional DVT, imaging and virtual surgical planning. Furthermore, the "one-abutment-one-time" concept avoids frequent abutment changes with the consequence of peri-implant tissue loss. Lastly, the treatment concept includes a custom CAD/CAM fabricated abutment with anatomical contour, so that the crown margin terminates at the same level as the gingiva. This serves to avoid excess cement subgingivally and the occurrence of peri-implant inflammation.

The importance of stable peri-implant soft tissue for an implant-supported restoration is the topic of numerous publications. But how can the dentist achieve this goal in a safe and efficient manner? A well-coordinated treatment concept and optimal interlocking product components are required. The presented case report explains how the interdisciplinary treatment team can combine these aspects. The case report shows how an implant (XIVE) is used in region 36 with a custom abutment (ATLANTIS) fabricated using CAD/CAM technology.

Years of research and development have been invested in the implant design and surface, and the best possible outcome has been achieved in this case.
Now attention is being focused on the implant abutment. In addition to standardized abutments, components customized to the patient are becoming increasingly important and promise highly aesthetic results and long-term stability. State-of-the-art restorations also focus on other factors such as a minimally invasive procedure and a prognosis-oriented approach, for instance the prevention of peri-implantitis. Before the abutment is fabricated, implant placement or planning of the optimal implant position must be taken into account. The emergence of the implant platform or collar from the soft tissue must be taken into consideration at this stage, and the abutment must be designed accordingly. Three-dimensional diagnostics provide the ideal basis for the conceptual planning.

The optimum result can be visualized in advance and the treatment sequence precisely defined.

**Initial situation and planning**

The patient approached the treatment team with a wish for an implant-supported prosthetic restoration in region 36. The patient’s general medical history revealed no anomalies. The oral situation also indicated no significant need for treatment. The maxilla was fully dentulous, but a radicular cyst on tooth 12 was diagnosed radiographically. Surgical treatment of this cyst is scheduled in the near future. A similar picture emerged in the mandible. After closing the gap in region 36 and restoring tooth 12, the treatment will be completed. The initial radiograph (OPG) showed sufficient vertical bone (Fig. 1), but a lack of buccal bone volume from a clinical perspective. This was confirmed in the three-dimensional view (DVT). The implant (XIVE, DENTSPLY Implants) in region 36 was planned virtually in a slightly lingual position using a planning and navigation software and the need for augmentation in the buccal area was evaluated (Figs. 2a–c). The concave profile of the alveolar ridge would not allow for an aesthetically satisfactory result without grafting. The goal was to achieve a buccal plate of approximately 2 mm, and thus a slightly convex ridge in this area. This required systematic treatment planning. All natural structures of hard and soft tissue should be optimally
preserved and stabilized. This requirement was incorporated into the planning, and the emergence profile of the implant from the soft tissue was considered already at this early stage. The final implant location was based on the existing anatomical parameters and the desired prosthetic restoration (Fig. 3a).

**Initial surgical session**

According to the plan and the drilling protocol, the implant was inserted in region 36 and the bone grafted in the buccal area (Fig. 3b). To fabricate the abutment during the healing phase of the implant, it was necessary to transfer the situation (implant location) from the mouth to the cast model as precisely as possible. The index registration proved successful for this purpose. The implant impression coping was screwed into place in the mouth and the implant location fixed using a plastic index key. After removing the central screw, the key was removed from the mouth with the impression coping and transferred to the dental laboratory with the impression coping for fabrication of the master cast. A cover screw was used to enable a submerged healing.

**Fabrication of the abutment**

The dental technician used the index key to transfer the exact location of the implant to the cast and to mold a wax-up of the planned prosthetic restoration. Based on this specification, the ideal emergence profile was defined (based on biological width) (Fig. 4). A gingival mask provided the corresponding emergence profile of the basal abutment area. It was important to design the connection between the abutment and the later crown at gingival level to prevent excess cement from compromising the long-term result. A subgingival crown margin significantly increases the risk of overlooked excess cement.1

ATLANTIS (DENTSPLY Implants) was chosen to design and fabricate the abutment using CAD/CAM technology. This concept allows custom abutments for cement-retained prosthetic solutions to be created in a simple and efficient manner. After scanning the implant cast (with gingival mask), a detailed three-dimensional image of the intra-oral situation emerged. At the Design & Fabrication Center (ATLANTIS), a virtual abutment was fabricated based on the patient’s specific situation and an image of the situation sent to the treatment team via the web portal (Figs. 5a & b). After assessing the templates and slightly adapting the virtual wax-up in the 3-D editor, the design was released and fabrication of the abutment ordered (Fig. 5c). Zirconium oxide, titanium, and titanium-nitride-coated titanium (GoldHue) are available as materials for implementation. In this case, titanium was the material of choice for the abutment, for reasons of stability. The laboratory received the industrially fabricated abutment just a few days after receiving the ordering information. It fits perfectly on the cast model and required no rework. The instructions were to leave the basal area of the abutment untouched and not polish the abutment in any way. The titanium surface has a certain roughness in the area of the emergence profile, which optimally supports epithelial attachment of the soft tissue (Fig. 6). However, the abutment was not the only component to be fabricated in preparation for the next appointment (Figs. 7a & b). The temporary crown also had to be cemented in the mouth at the appointment for placing the abutment. Therefore, the dental technician fabricated a monolithic crown (CEREC, Sirona) made of lithium disilicate based on the wax-up (Fig. 7c).
Second surgical session

The closed healing phase was complication-free and resulted in an osseointegrated implant 36 a few weeks later, as well as a slightly convex profile of the buccal alveolar ridge thanks to the grafting measures. The goal of augmentation was achieved: a 3 mm thick attached gingiva (Fig. 8). In a gentle laser procedure, a small incision was made to expose the implant (Fig. 9). This minimally invasive procedure made it possible to avoid raising the periosteum of the buccal mucosa, which is essential for preserving the grafted bone. The cover screw was removed (Fig. 10) and the abutment inserted. A plastic index key, created in advance in the laboratory, was again used for accurate transfer from the cast to the patient's mouth. With the key attached over the adjacent teeth, the abutment was accurately transferred and screwed onto the implant in the mouth (Figs. 11a & b). A slight anemia in the buccal area confirmed the accuracy of the fit. The contour of the abutment emergence profile blended in well with the intra-oral conditions (Fig. 12). The "preparation margin" was at gingival level as desired (Fig. 13). After ensuring that the abutment met the specifications exactly and that the surface will allow epithelial adhesion in the basal area, the temporary crown fabricated in lithium disilicate using CAD/CAM technology was cemented (Fig. 14). The crown will "train" the bone, and over the coming months, shape the soft tissue profile accordingly before the final restoration is inserted. This way, the healing process and training of the peri-implant gingiva will run undisturbed (one-abutment-one-time).

Conclusion

In just two surgical treatment sessions, the gap in region 36 was treated using an implant-supported prosthetic restoration. The restoration met all anatomical, prosthetic, functional and aesthetic requirements. With the CAD/CAM method of fabricating the custom abutment (ATLANTIS), a restoration was realized in an efficient manner that meets the demands of state-of-the-art dentistry. Based on the "one-abutment-one-time" concept, the titanium abutment will not be removed again after insertion in the mouth. Preservation of the bone and training of the peri-implant soft tissue are thereby optimally supported. Since the crown margin was precisely determined during the virtual wax-up based on the emergence profile, the risk of excess cement and any resulting peri-implantitis was significantly reduced. The crown margin was at gingival level, which greatly simplifies removal of any excess cement. The procedure described allows long-term stable results and is ideal for referring practices that can realize the prosthetic restoration in a safe manner after implant placement.

Editorial note: A complete list of references is available from the publisher.

Fig. 12. The abutment is screwed on the implant in the exact position and is not removed again. Epithelial soft tissue apposition is not threatened. The screw access is sealed with composite.

Fig. 13. The radiographic check: The designed "biological width" allows optimal apposition of the gingiva in the basal area.

Fig. 14. Inserted crown made of lithium disilicate.