Utilisation of patient-specific CAD/CAM abutments for long-term soft-tissue management

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Fig. 1: The patient presented with a fractured maxillary left lateral incisor.

Fig. 2: After extraction of tooth 12, a transitional partial denture was delivered.

Fig. 3: A post-op radiograph taken immediately after implant placement (OsseoSpeed TX, DENTSPLY Implants; Ø 3.5 S, L 13 mm).

The traditional approach to soft-tissue contouring of an implant-supported restoration is to initially shape the surrounding peri-implant soft tissue of an edentulous site with hand-prepared stock healing abutments, which are later replaced with a custom abutment and final crown, both of which are designed to fit into the space and form created by the stock abutment. However, with the continued advancement of both 3-D imaging and digital abutment design technology, the final abutment can act as both a link between the implant and the crown, and as a tissue shaper that contributes directly to the final surrounding soft-tissue contours. This greatly aids the clinician in obtaining the desired aesthetic outcome.

Regardless of implant or healing cap diameter, the peri-implant sulcus shape often requires additional modelling to obtain more natural and optimised final restoration aesthetics. Traditional methods of tissue contouring include the use of temporary restorations to form the desired soft-tissue anatomy. Provisionals can be retained by bonding them to neighbouring teeth with properly shaped pontic contours that apply pressure to the peri-implant tissue in order to shape the tissue covering the implant. An alternative method is to use abutments that support overcontoured provisional crowns, which push out the peri-implant tissue as it heals. When the tissue matures around these types of provisionals, it takes on the shape of the gingival portion of the tooth, pontic, or temporary crown. The abutment and final crown are then fabricated to match the tissue contours.

A more efficient alternative to the traditional method for soft-tissue management is to employ patient-specific abutments that can effectively provide ideal anatomical formation of the soft tissue. These abutments can be designed with the desired specific profile that passively fills the healing cap-shaped sulcus from the top of the implant up to the sub-crestal tissue, and then expands just below the abutment shoulder region to the dimensions and contour of the tooth to be replaced. The lateral pressure applied induces the peri-implant sulcular tissue to stretch and adopt the abutment’s outer morphology as the shape of the sulcular inner wall.

At insertion, the seating of a larger, more anatomical abutment design results in significant tissue blanching when the tissue is stretched. However, the blanching generally resolves within one to two days after abutment placement. Multiple clinical trials utilising large anatomical abut-
ments followed since 2008 have found that healthy tissue that is absent of inflammation quickly forms as the tissue adapts to the abutment’s base shape. Additionally, over that same two- to three-year period of clinical observation, during which multiple cases of abutment-controlled peri-implant sulcular stretching were monitored, no significant recession around these abutments was noted.

Several important clinical prerequisites should be met when sulcular stretching of the peri-implant tissue using fully anatomical patient-specific abutments is attempted, including the following:

- Any required tissue grafting, bone grafting or ridge distraction should be performed and the area fully healed.
- The top of the implant should be located at least 2.5 mm below the soft-tissue crest, and in the middle or lingual third of the ridge crest.
- The edentulous ridge should be well-formed with a crestal height comparable to the gingival margin heights of the neighbouring teeth.
- The peri-implant sulcus should be significantly smaller than the tooth to be replaced.

Case presentation

The patient presented with a fractured maxillary left lateral incisor in need of extraction (Figs. 1–3).

After several months of healing, an impression was taken (Figs. 4 & 5), and sent to the laboratory with a prescription for the fabrication of an ATLANTIS patient-specific abutment in zirconia (DENTSPLY Implants; Fig. 6). The abutment was anatomically designed based on the desired final tooth shape to optimise both function and aesthetics (Fig. 7).

In order to seat an anatomical patient-specific abutment properly, the cover screw is retrieved and any loose granulation tissue found within the sulcus is curetted away (Fig. 8). The peri-implant sulcus is anesthetised circumferentially to minimise the patient discomfort resulting from the pressure the oversized abutment will apply to the soft tissue when it is screwed into place. If epinephrine is used, the peri-implant tissue will likely blanch from vasoconstriction. Fig. 4. Six months after hard- and soft-tissue graft procedures, the patient returned for the final impression. Fig. 5. A radiograph taken to verify proper seating of the transfer impression coping. Fig. 6. The impression and case materials were sent to the dental laboratory with a request for an ATLANTIS zirconia abutment. Fig. 7. Fabrication of the final crown. Fig. 8. The patient returned for placement of the final abutment and crown. Fig. 9. The fully anatomical abutment was seated to manage and shape the soft tissue. Initial blanching of the surrounding tissue was observed.
The abutment is then set into the implant, aligned properly, held down firmly into place, and the abutment screw is then torqued according to the manufacturer’s guidelines. During the screwing-in process, the anatomical abutment will compress and blanch the surrounding soft tissue (Figs. 9 & 10). Proper seating should be radiographically verified to ensure no soft tissue is trapped underneath the abutment that would keep the abutment from sealing fully with the top of the implant.

When using ATLANTIS patient-specific abutments, a final crown can often be placed during the same appointment in which the abutment is inserted. The final crown can be fabricated before the patient appointment by ordering an identical duplicate abutment made from the same digital abutment file used in designing the intra-oral abutment. The duplicate is an exact master die upon which the final crown can be constructed. It is our clinical observation that at routine follow-up of these stretched-sulcus anatomical abutment cases, a consistent healthy soft-tissue response is visible, with stable maintenance of the hard- and soft-tissue contours over time (Figs. 11 & 12).

**Conclusion**

The utilisation of ATLANTIS patient-specific CAD/CAM abutments can help eliminate the need for prefabricated soft-tissue healing abutments, while providing natural anatomical and optimal aesthetic implant-supported restorative results. Patient-specific abutments with a specific sub-shoulder design and an emergence profile customised to the particular implant placement and site can be utilised to stretch a small, round peri-implant sulcus outwards and induce it to adopt the shape of the abutment, such that both the tissue and final crown contours appear natural.

With this technique, blanching of the soft tissue at the time of abutment placement is common but has minimal impact on the long-term marginal hard- and soft-tissue health, especially when used in combination with an internal conical connection implant.

Lastly, the use of patient-specific abutments both for soft-tissue sculpting and as the permanent abutment solution has significant clinical advantages over the traditional approach, including simplifying tissue contouring around dental implants for the restorative clinician, and reducing the number of procedures and procedural discomfort, and faster healing time for the patient.

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