Digital workflow: From planning to restoration

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High-quality treatment results that are individual to each patient can be drawn up for the edentulous jaw in the combination of innovative procedures for implant surgery and reasoned prosthetic concepts. In this article, the authors describe the digital workflow for the tried-and-tested immediate restoration concept SKY fast & fixed and discuss the possibilities of transverse screwing, amongst others.

Introduction

Digital technologies help simplify the process involved in implantology and often accelerate the process, whilst at the same time offering a high level of accuracy. High-precision results can be achieved in an efficient manner by combining the digital production of the superstructure. In addition to digital know-how, proven fundamentals are promising factors. This includes patient compliance, a sound dental and dental technical knowledge, surgical and manual skills, the perfect materials and products and close consultation within the treatment team. On the basis of this, modern computer-guided procedures offer an optimum basis for re-interpreting tried-and-tested implant prosthetic concepts such as the SKY fast & fixed (bredent medical). This article shows the digital workflow using a patient case as an example.
Anchoring

The “fixed” treatment option has become important for edentulous jaws and jaws that are becoming edentulous. Many patients state that they are not satisfied with the classic removable total prosthesis; in particular, if they lose the last few teeth they still have. They want an aesthetic, functional implant prosthetic restoration. However, areas of limitation, such as suboptimal anatomical circumstances, are often encountered. In order to be able to avoid bone augmentation, measures where possible in these cases, as well as problematic implant positions and limited aesthetics, suitable implant prosthetic solutions are sought. The SKY fast & fixed concept is one of those.

In principle, a distinction is made between screwed and cemented prostheses in fixed implant prosthesis. In an edentulous jaw, we generally prefer a screwed reconstruction. In contrast to cementing, the main benefit is the fact that the restoration can be removed from the implants without problems. For example, if an abutment were to loosen or a repair be required, the restoration can be carried out with ease. What is more, hygiene measures are simplified, which is an important aspect, particularly with regard to professional implant aftercare.

The treatment concept

In the SKY fast & fixed therapy, the implants are inserted in the local bone in such a way that they can be restored immediately after insertion with a fixed temporary bridge. Osseointegration is supported by means of primary interlocking. In order to be able to insert the implants into the jaw without augmentation measures where possible, meticulous preoperative investigations and an implant component especially designed for use in this situation are pre-requisites. This objective can generally be achieved by means of angled insertion of the posterior implants. The immediate temporary restoration is guaranteed by means of screwing onto the implants, resulting in stable interlocking. The pre-fabricated interim restoration is made from plastic. Due to the relatively low elasticity module, the load application on the implants can be cushioned during the healing phase. Following successful osseointegration, several prosthetic configurations lead to the desired result. The primary requirement of the restoration is the tension-free fit on the implants.

Transverse screwing

Due to the type of screwing of the dental prosthesis, a choice can be made between two variants in the described concept. In addition to occlusal screwing, a bonding element is also offered for the transverse (horizontal) screwing. This offers an aesthetic benefit in many situations. Orthograde screwing—screw channel emerging occlusally, often especially means a compromising solution in the anterior region in terms of aesthetics. The seal of the screw channel in the visible region of the front teeth limits the dental technician with regard to the aesthetic design. Adequate alternatives include normal bonding elements in the region that is not visible.

The SKY fast & fixed abutment with horizontal circumferential groove is available for this and is restored using a pre-fabricated transverse screwed coping. This type of screwing involves bolting in the true sense of the word. The thread for the bolt screw is located in the bridge framework. The bolt screw and the cylindrical surfaces form a unit (Fig. 1). Fixation is carried out as three-point fixation, which prevents tilting. Thanks to
the slightly inclined position of the bolt screw, the prosthetic coping is “pressed” onto the abutment platform without showing a gap once it is tightened. The treatment team benefits from the transverse bonding of the dental prosthesis with the implants with excellent aesthetics and a complete lack of tension.

**Patient case**

The 48-year-old patient came for a consultation in the practice due to an unsatisfactory removable dental prosthesis in the maxilla. Teeth 11 to 23 were still present, but severely damaged periodontally. A fixed restoration was requested. The high mobility grade of the teeth would not permit a stable anchoring of a new dental prosthesis. Therefore, following a discussion with the patient, extraction of the teeth and immediate implant prosthetic restoration was planned in accordance with the SKY fast & fixed concept.

**Planning**

As a planning base, a situation model was initially produced (Fig. 2). This was digitalised in the laboratory scanner (D800, 3Shape) and an STL data set was created. In order to validate the implant positions, the two-dimensional X-ray image only yielded limited information about the available bone (Fig. 3). A three-dimensional image (DVT) was therefore compiled, without a scan template being required for this.

Thanks to the allocation of space for the anatomical structures, a detailed analysis of the jaw was now possible. Using the planning software (coDiagnostiX, Dental Wings), six implants were planned in the local bone based on the visualisation of the anatomical structures and the digital set-up (ideal position of the prosthesis; Fig. 4). By angling the distal implants, anatomically vital structures were circumvented and augmentation measures avoided.

The angle of the implants is between 30 and 45 degrees for the SKY fast & fixed concept. In addition to the individual surgical components, special prosthetic superstructures are integrated in the complete concept. A drilling template for the navigated implant insertion and a temporary restoration were created from the planning software for the immediate restoration (Figs. 5 & 6). In order to guarantee accurate positioning in the mouth, both objects were designed with a palate, whereby the temporary dental prosthesis is produced with target fracture sites, in order to guarantee a palate-free design of the screwed bridges (Figs. 7 & 8).

**Implantation and immediate restoration**

At the time of the surgical procedure, the existing teeth were extracted atraumatically and six implants (blueSKY, bredent medical) were inserted with the help of the drilling templates. The implants were in-
inserted in a primary stable manner with a torque of between 30 to 45 Ncm (Fig. 9). The abutments were applied and the area sutured. The pre-fabricated temporary restoration was inserted without an impression needed. The palate provided support in order to ensure the reliable referencing of the mouth. The temporary restoration was bonded with the abutment for a tension-free intraoral fit (Qu-resin, bredent medical), lined and the bridge was then processed and produced (Figs. 10 and 11).

**Manufacture of the final restoration**

The postoperative progress was free of problems. The patient was able to participate in social activities without restriction during the healing phase. Osseointegrated implants and stable hard- and soft-tissue conditions were seen after three months. Following a pick-up impression, the temporary restoration was removed and the implant situations were modelled using an individual tray (Figs. 12–14). A screwed restoration was also planned for the final dental prosthesis. The framework made from non-precious-metal alloy (NEM) should be veneered using a high-quality composite material. In order to give the aesthetic design ample space, transverse screwing (bolting) of the dental prosthesis with the implants was considered. In principle, a restoration screwed onto implants places a high demand on the framework fit. In complex restorations of this type, this involves a considerable challenge in the production procedure. Due to the implant’s rigid bond with the bone, even a low amount of force can cause considerable displacement of the implants.

The highest level of precision is required from both the dentist and the dental technician. Digital manufacturing technologies come into play here. These offer a perfect framework fit and a high material quality—the icing on the cake is that production is also efficient. In the CAD software, the data relating to the pick-up impression is superimposed on the data relating to the implant master model (matching) and a framework is constructed in a smaller anatomical crown shape. In the software, the bonding elements for the transverse bolting were integrated in the framework (Figs. 15–17). CAM milling of the NEM framework was carried out in the laboratory’s own high-performance milling machine. The thread for the transverse bolting was then incorporated within the cavity incorporated in the bridge framework (Fig. 18).

A framework try-in in the mouth confirmed that this was the perfect fit. The individual veneering of the restoration was carried out using pre-fabricated veneers (novo.lign, bredent medical). The veneers were fixed to the framework with a dual-hardening adhesive and the individual fine touches were added with a veneer plastic (crea.lign, bredent medical).
multiple-layer veneers (high-impact PMMA composite) and the light-curing composites support the simple manufacture and the individual, aesthetic characterisation. In order to achieve efficient progress, the cushioning properties against chewing pressure of the composite are combined, which are important to consider, particularly in implant prostheses.

Insertion and aftercare
The bridge was fixed using the prosthetic copings (SKY uni.cone transverse prosthetic coping) and bolt- ing in the practice. As this was carried out as three- point fixation, tilting or rotation of the dental prosthesis can be ruled out. Thanks to the slightly inclined position of the bolt screw, the prosthetic coping is “pressed” onto the abutment platform without showing a gap once it is tightened. This elegant type of fixation combines high-quality aesthetics with a tension-free position. The “screw channels” are located in the palatine region of the cervical area, which does not lead to any aesthetic or functional impairments. Following final fitting, the functional, aesthetic and periodontal hygiene factors were subjected to a final check and the patient was discharged from the practice with an aesthetic, fixed restoration (Figs. 19 & 20).

The superstructure was designed in such a way as to ensure optimal hygiene was guaranteed. The patient was given comprehensive instructions in this regard. An important pre-requisite for the long-term success and therefore for a stable periodontal situation is aftercare in the practice. For the first year after treatment with an implant, in particular, a continuous, specific recall system is recommended. The patient had a consultation in the practice every three months. Once the superstructure was removed, professional cleaning and disinfection of the components of the dental prosthesis was carried out. The peri-implant soft tissue remains exemplary to date (Fig. 21).

Summary
The success of a total concept such as SKY fast & fixed is based on a coherent procedure. From the surgical components to the prosthetic materials—the philosophy is to combine the components in an optimal manner. This requires a high level of cooperation between the practice and laboratory, which can be experienced more intensively and effectively in the digital workflow. Various concepts are offered for the final prosthetic restoration and the individual details are therefore taken into consideration. In order to rule out an aesthetically compromising solution, in this case orthograde screwing of the dental prosthesis—screw channel emerging occlusally—was avoided. A normal bond was achieved in the region that was not visible by means of transverse bolting. The access to the bolting, which was easily achieved, made it possible to easily remove the dental prosthesis in the practice.

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