

Biologically designed prosthesis

Tony Aherne, Annika Meyer and **Stuart Aherne** discover the benefits of a biologically designed prosthesis when restoring a trauma case in the aesthetic region

In the early days of implant dentistry there was an emphasis on surgically driven implant placement – but unfortunately, the chosen site of implant placement was sometimes difficult to restore.

With the evolution of the science over time and the development of more sophisticated 3D analysis and planning tools, this has led to the 'backward planning' approach. This prosthetically driven way of defining the ideal site for implant placement ruled out most of the anatomical, functional or aesthetic surprises during the treatment and made the overall clinical procedure much simpler.

The biologically designed prosthesis offered technical advantages and a reduced risk of biologic complications. Superstructures can now be designed to allow the best possible cleansability by the patient and good access during maintenance therapy. Thus, 'crown down' planning found wide acceptance, and tools and techniques that follow this approach have improved and developed.

The following case presentation involves the replacement of a fractured central incisor and will demonstrate how straightforward it is to follow this concept of building restorations naturally and, in this case, without major investment in planning tools. There are two fundamental criteria for this concept:

- Respect of given structures when placing the implant
- Work with screw-retained full contour, one-piece crowns, whenever possible.

Case presentation

A 23-year-old male patient presented with trauma to the upper left central incisor as a result of a contact sport injury. The fracture line extended about 5mm below the cervicoenamel junction, leaving less than one-third of the tooth in the bone, and thus the



Figure 1: Fracture of the upper left central incisor



Figures 3 and 4: Atraumatic tooth extraction was possible with conventional instruments in this case as patient was young and the tooth was vital

tooth had a hopeless prognosis (Figures 1 and 2). The tooth was extracted atraumatically (Figures 3 and 4) with preservation of the architectural structure of the soft and hard tissue; the implant bed could be easily prepared along the axis of the extraction socket, the alveolus being the guide for the drilling process (Figures 5 and 6). This immediate placement of the implant into the extraction socket is only possible in those cases where the wound is not infected or sore and if the bone quality is enough to guarantee good primary stability of the implant.

Another precondition for immediate implant placement is an intact alveolar socket and the absence of bone loss or ridge deformations. This is provided that the extracted tooth has a desirable position and alignment. An added advantage of immediate implant placement is a reduced number of procedures. In this case, we found ideal conditions to prepare the implant bed: the buccal plate was thick and complete, and nutrition of the wound was good (Figure 5). The axis and inclination of



Figure 2: Line too deep to be restored conventionally



the implant was controlled (Figure 6) and the chosen implant was conditioned chairside to achieve a superhydrophilic surface, which has proven to improve the bone to implant contact in immediate implantation (Calvo Quirado) therapy (Figure 7).

Biomaterial (Cerabone) was added buccally and around the coronal parts of the implant (Figure 8). The addition of biomaterial into the gap between implant and buccal shield is optional, when the gap between buccal shield and implant is small (less than 2mm) (Akimoto et al, 1999; Botticelli et al, 2003).

It was decided to add biomaterial to improve the level of marginal bone-to-implant contact (Araújo, Linder, Lindhe, 2011) and provide support for the peri-implant soft tissue. The implant was covered with a gingiva former (2mm height) and left to heal transgingivally for eight weeks. The area was provisionalised with a removable denture. The standard procedure would be to work directly with a screw-retained provisional: the slight pressure on the

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Figures 5 and 6: The implant bed could be easily prepared along the axis of the extraction socket, the alveolus being the guide for the drilling process



Figure 7: Implant placement with superhydrophilic surface, which has proven to improve the bone to implant contact in immediate implantation



Figure 8: Biomaterial around the freshly placed implant



Figure 9: The implant integrated well; papilla-like structures were well preserved

implant-surrounding soft tissue can be controlled better and revised easily so as to custom guide the tissue individually.

The implant integrated well; papilla-like structures were well preserved (Figure 9). A provisional crown was fitted chairside (Figures 10 and 11) to further develop the natural gingival cuff (Figure 12). A final impression was taken after a further four weeks and soft tissue model poured up (Figure 13). The lab fabricated a full contour crown (Figures 14 and 15). The screw piece access hole could be placed purely on the palatal aspect. The palatal parts of the crown were fabricated in metal as the patient had a very heavy occlusal contact (Figure 16). This did not have a negative impact on the integration and aesthetics of the crown (Figure 17).



Figures 10 and 11: A provisional crown was fabricated chairside



Figure 12: Note the development of the natural gingival cuff



Figure 13: Soft tissue model after four weeks of temporisation



Figure 14: Final crown on soft tissue model



Figure 15: One-piece crown fabricated on the basis of a titanium base

Benefits of one-piece crowns

One-piece crowns are defined by no separation of abutment and crown. These crowns are cemented under 'controlled conditions' in the lab to avoid any uncontrollable margins in the clinics. They can be cemented in lab onto the conventional standard abutment, eg, a titanium base, and thus be fabricated by CAD/CAM.

Other methods of fabrication is of a standard abutment, which is castable and can be designed and veneered individually or, alternatively, an individual abutment that can be veneered directly.

Full contour crowns screw-retained are seen as the most favourable suprastructure as they offer the patients and dental practice the optimal situation for proper hygiene and implant maintenance.

Besides the positive effect of cleansability of the superstructures, these one-piece crowns offer additional advantages, which limits the amount of possible biological and technical failures, and therefore extends the longevity of the implant (Bäumer, Zuhr, Hürzeler, 2015). On the one hand, this means that with screw-retained restorations cement remnants and their biologic risks can be avoided (Figure 18). On the other hand, technical failures like chipping of the



Figure 16: The small head of the implant abutment screw facilitates a purely palatal position of the screw channel



Figure 17: Fully integrated one-piece crown, which shows healthy soft tissues and a natural appearance



Figure 18: Peri-implantitis and eventual loss of implant associated with excess cement

superstructures can be easily revised.

It is now accepted that in times of increased awareness of peri-implantitis, screw-retained one-piece superstructures have become more attractive. The capabilities to design biologically driven implant restorations depends on the possibilities that the implant system offers to the practitioner. For example, a small screw head is very desirable. It is obvious that this influences the aesthetics of the restoration as the size of the screw head defines the size of the screw channel. Another advantage is that a small screw channel leaves more space for adequate design of the crown. The lab technician can then avoid bulky,

oversized abutments and still has more free space to fulfill the requirements of the veneering material such as cusp support and a functional occlusal profile.

There are, of course, cases in which a screw-retained restoration may not be suitable, eg, if anatomically challenging situations may have led to a challenging implant placement and axial divergences are not easy to solve. With careful planning, the level of the cementation margin can be defined correctly – in a way the cementation process can be well controlled to prevent perimplantitis (Figure 16). Additionally, a minimised screw channel can help to solve the situation more easily.

The case in this article demonstrates that the crown could be screwed in without any problem as the emergence profile of the crown had been well developed with the help of the provisional crown. Proper oral hygiene and preventive measures can now be performed with this favourable suprastructure.

Additionally, the peri-implant tissue is easily accessible so that probing to diagnose mucositis and peri-implantitis is possible at an early stage. 

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