Screw-retained implant crowns
Technical solutions for challenging situations

Two options are available for retaining implant-supported crowns: cement or screws. For decades, dentists have filed and shaped teeth to enable them to act as abutments before restoration with fixed partial dentures, retained with dental cements. Because of their familiarity with this process, most dentists originally preferred to cement crowns on to implant abutments. However, this approach has several shortcomings.

Numerous scientific papers have been published showing key benefits of the screw-retained option, backed up by long-term clinical experience. In response, manufacturers have developed advanced tools to compensate for screw access holes in non-ideal locations. Some of the reasons screw-retained implant crowns are preferable are:

- There is no possibility of applying excess cement, which can cause peri-implant infections (1, 1a)
- Screws provide an easy, safe and non-invasive method for removing the crown if necessary
- They enable convenient try-ins. By contrast, pressure from the mucosa may make it hard to leave the crown in a fully seated position if it is not screw-retained
- Improved implant connections and abutment screws have made screw loosening a relatively rare phenomenon, providing screws are used according to the manufacturer’s recommendations. Screw-retained crowns also show fewer complications compared with cement-retained alternatives (2, 3, 4)
- Smart implant connection designs have allowed abutment screws to become smaller, meaning screw access holes can also be smaller. This reduces the potential weakening effect of the occlusal access hole on the final reconstruction and also helps avoid aesthetic problems. Some manufacturers offer special screwdrivers with screw head geometries that allow major tilting of the screwdriver. Regular screwdrivers may also be carefully modified to allow tilting (although to a lesser extent) (5)

One major disadvantage inherent in the screw-retained system is the need for an access hole. In cases where the implant can be placed in an ideal prosthetically-driven way, access holes are positioned in the middle of the occlusal surface in the posterior areas, and in the palatal concavity in the front tooth region. Screw heads are first protected with Teflon tape, then the access hole is filled with a composite (6). From a technical point of view, good stability can be achieved, and since the composite filling is located at an aesthetically uncritical region, patient acceptance is very high. If a re-intervention is required, quick and non-destructive access to the screw is easy to achieve.

Implant surgeons often face situations where there is a bone defect around the implant. Even though GBR procedures allow many of these defects to be addressed effectively, it is not always possible to place the implant in such a way that the screw access holes will be located in an ideal position. One approach to this is the use of angulated abutments. These can compensate for the technical problems associated with implants which are not placed in an axially ideal way. However, they have several disadvantages. Apart from their greater technical complexity and cost, the risk of recession is increased because of the greater pressure they place on the submergence profile of the soft tissues. Aesthetically, this often leads to exposed abutment surfaces. In addition, when using screw-retained crowns, secondary screws must be used with lower preloads, increasing the risk of screw loosening. Therefore, angulated abutments are currently the option of last resort and are only recommended when all other options have been ruled out. Where possible, one-piece implants (also known as soft tissue level implants) are used in the posterior region to avoid the need for a separate abutment. For anterior teeth, there are situations when both a one-piece and a two-piece implant will offer specific advantages. Both types are suitable for use with one-piece crowns which can be directly fixed to the implant body with abutment screws, avoiding the need for secondary screws (7,8).

The following cases illustrate reconstructive concepts which enable screw-retained implant crowns to be used in less favourable situations.

Case 1

This case demonstrates the intentional and carefully planned tilting of lower posterior implants towards the lingual side.

Even though a panoramic CT scan showed more than sufficient vertical bone, the cone beam CT, as well as the intraoperative view, demonstrated a major lingual concavity and inclination of the alveolar bone in the rear mandible. Upright installation of the implants would have required a vertical bone augmentation. The combination of difficult access and an unfavourable soft tissue situation were key reasons to avoid this approach, therefore minimising the risk of surgical complications. By tilting the last two implants lingually, the need for GBR was avoided. Additionally, the screw access holes could be located close to the middle of the lingual surface. A PFM reconstruction was made with the framework directly connected to the soft-tissue-level implant system (Thommen Medical, Switzerland).

As one regular diameter and two small diameter...
implants were used, the restorations were splinted for optimal mechanical resistance. In general, angulated abutments should be avoided in a case like this because of their unfavourable submergence profile, which increases the likelihood of recessions, along with the potential risk of imprecision when used with multiple splinted crowns. However, in this case the location of the screw access holes and their small diameter due to the small abutment screw offered by this system outweighed these risks. In addition, the framework provided excellent support for the associated occlusal loads. To achieve the high precision necessary, the impression copings were first bonded together with a low-shrinkage resin (GC Pattern Resin, GC, Japan), then separated and rebonded, and a pick-up impression technique was used.

To fill the access holes, the screw head was first covered with a Teflon strip, then filling composite was added. The veneering ceramic was etched in the lab to provide an excellent bond between the crown and the composite.
Case 2

This case illustrates the technical and aesthetic compensations that were used to address the unfavourably long axis of an upper anterior implant that had been placed alio loco.

The implant (Straumann Bone Level, Switzerland) had been placed in the aesthetic area in an alio loco position, with the result that the screw access was located in the middle of the buccal aspect of the crown. A veneered zirconia crown was chosen as the reconstruction, which allowed the placement of an aesthetically perfect composite filling using the porcelain etching technique. The following layering technique was used: a Teflon strip to cover the screw; etching and silanization of the veneering ceramic; an opaque dentine layer; and an enamel composite portion.

Fig. 2-1: Impression coping in place.
Fig. 2-2: Incisal view of crown.
Fig. 2-3: Buccal view of crown.
Fig. 2-4: Final clinical situation.

Case 3

The previous cases were characterised by access holes in the buccal or oral aspect of the crowns. The non-optimal location of the access holes meant that the restoration could be designed in a mechanically and technically optimal way. By contrast, this case demonstrates the advantage of using monolithic ceramics bonded to a prefabricated titanium substructure in order to provide more options for the placement of the screw access channel.

In this case, two implants (Thommen Medical, Switzerland) were placed so that they were tilted slightly outwards. This was necessary because of a deep vestibular concavity. The access holes were at the incisal tip of these first bicuspids. In traditional crowns with a high-strength core made out of gold alloy or zirconia covered with weaker veneering ceramics, the veneering material would not be stable enough to incorporate an access hole in a pointy situation like this. Therefore another approach was indicated, and a prefabricated and modified titanium base was used. The crown was made out of high-strength lithium disilicate glass ceramics and was adhesively bonded to the substructure outside the mouth (Panavia 21 OP, Kuraray, Japan). Due to the small abutment screws, a reasonably narrow screw channel could be incorporated (this approach is only feasible with traditional large abutment screws if the crown is very large). Since the major part of the crown consisted of glass ceramics which have quite similar optical characteristics to composites, a composite coverage of the access hole was easily achieved. This was invisible to the patient and stable enough to withstand the forces applied to it. Again, the screw head was covered with a Teflon strip and the glass ceramic was etched to provide an excellent bond between crown and composite.

Fig. 3-1: Location of screw access hole.
Fig. 3-2: Glass ceramic crown bonded to Ti base with screwdriver in place.
Fig. 3-3: Implant crown in place.
Fig. 3-4: Final radiograph.
Case 4

This case describes a technique for converting a fixed partial denture which was originally cemented into a screw-retained version.

The implants had been placed several years previously and a significant peri-implant infection had since developed. The bridge had been made elsewhere so it was not clear whether it would be possible to remove it. The practitioner succeeded in breaking the cement by applying strong impacts at the interdental area transmitted by a crown removal tool (Coronaflex, KaVo, Germany). The abutments were then removed and an impression was taken. Next, the dental technician drilled access holes into the buccal side of the bridge and cemented the abutments extraorally into the removable partial denture. It was thus converted into a screw-retained and therefore predictably removable RPD. The most anterior implant needed to be removed, and the two distal ones underwent a flap surgery and implantoplasty. Since the bridge could now be easily removed for this step, surgical access was optimal, which is crucial for the success of such procedures.
Case 5

This case describes the use of a modified screwdriver to allow the screw access channel to be tilted.

This implant had been in function for many years with a cemented crown. However, pus on pressure was present, and the crown, which had always been too short, required an intervention. The removal of the cemented crown proved to be very difficult. During the process it needed to be cut into several parts, resulting in total destruction. Unfortunately the dentist who had placed it had bonded all the parts together, including the abutment screw. The lack of preload obviously caused the suppuration. When taking the impression it became clear that the access hole would need be situated exactly at the incisal edge, so a simple screw-retained reconstruction was not going to be possible. Due to the small dimensions of this lateral incisor, the best option was to design an angled access hole in combination with a specially modified square-cut screwdriver, enabling up to 25 degrees of angulation. Although this worked very well, it must be pointed out that a measure like this can sometimes lead to technical difficulties if the crown needs to be removed again. Also, the head of the screw requires more space to enable the tip of the screwdriver to be positioned properly.

Conclusion

An implant-supported crown should always be screw-retained rather than cemented. This can, however, lead to challenges where implants have been placed non-ideally. Nonetheless, a variety of approaches are available which provide technical solutions to using screw-retained reconstructions in these non-ideal settings, as illustrated in this article. Careful 3D planning must always be conducted before placing any implant in order to allow the simplest and thereby most effective technical design and avoid unplanned technical challenges. Such an approach will minimise complications and maximise efficiency in the long run.

References

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