**Screw retention as a prosthetic concept**

**Keywords** abutment screw, biologic long-term complications, cementation, cement remnants, implant position, implant prosthetics, peri-implantitis, peri-implant mucositis, screw retention, technical long-term complications

The early days of implantology were characterized by “surgically oriented” implant placement. Later, the concept of “prosthetically driven implant placement” was established, which offered technical advantages and a reduced risk of biologic complications by optimizing the implant position through backward planning, which allows superstructures to be designed to allow the best possible cleanliness by the patient and in maintenance therapy. Besides the positive effect of cleanliness of the superstructures, the possibility opens up of choosing one’s preferred method of retention. Screw-retained superstructures have become more attractive due to the development of novel implant prosthetic components. These improvements have meant that cement residues and their biologic risks can be avoided, leading to a reduction of long-term technical complications. Overall, the “prosthetically driven implant placement”, along with screw-retained restorations, leads to a simplification of the overall clinical procedure.

**Prosthetically driven implant placement as a biologic advantage**

For a long time, a common concept in implantology was “surgically oriented implant placement,” in which the available bone was the decisive factor for the implant position. Yet, in many situations, this approach led to prosthetic and biologic compromise. In the early days of implantology, prosthetic concerns were considered secondary; the concept of “prosthetically driven implant placement” or “backward planning” was quickly established once the importance of the prosthetic value was fully realized. The implant – being a replacement for the former root – had to be placed strategically to create the best conditions for the superstructures, including their ability to be properly cleaned. The availability of practicable three-dimensional (3D) imaging methods and innovative navigation systems proved to be beneficial, as these allowed the desired implant position to be achieved with high precision.

With an increasing awareness of peri-implant diseases and their risks (which are exacerbated by unfavorable implant–prosthetic restorations), the prosthetically driven direction is favored for avoiding biologic complications. The aim is to optimize the implant position and angulation to create the best possible prerequisites (cleaning and probing) for long-term success, and for reducing possible biologic complications. Backward planning is done with prosthetic goals that are created considering biologic demands. In cases with optimal implant position from a prosthetic point of view, not only do
If acceptable to the patient, a removable implant-supported denture with Locators and telescopes is preferable because probing and cleaning is much easier (Fig 6). High soft tissue cuffs in the molar area should be avoided to simplify the implant impression and prevent difficulties in follow-up care (Fig 7). If necessary, the flap can be thinned to a thickness of 2 to 3 mm during implant placement or uncoverage (Figs 8 to 10).

The “biologically correct” implant position not only has a positive effect on the superstructure’s ability to be cleaned, it also allows the clinician to choose a preferred type of retention. The goal of a low complication rate should be the prime consideration when choosing the type of retention. The decision regarding cementation or screw retention of a superstructure is based on relevant differences of risk. For example, cement residue in the peri-implant soft tissue presents a significant risk for biologic complications. In cases where complications have occurred, the discovery on aftercare radiographs of excess cement around the implant crowns is not uncommon (Fig 11). If cementation is chosen despite the risk, it is important to use individual abutments that offer the ideal positioning of the cement gap, as well as cementation protocols using retraction cords.

When peri-implant mucositis or peri-implantitis are diagnosed, cement residue should always be considered as the possible cause. Any excess cement that remains, on which a biofilm can form, causes an increased probability of peri-implantitis. In an investigation by Wilson, 42 patients with symptoms...
of peri-implant disease were examined using dental endoscopes. In 81% of the patients, cement residue was found, which presumably played a role in the pathogenesis. Thirty days after the removal of the excess cement, signs of inflammation were absent in 74% of the patients. In other studies, a similarly high degree of affected cases reported the presence of cement residue. In systematic reviews comparing cement versus screw-retained implant reconstructions, bone loss over 2 mm occurred more often in the group with cemented reconstructions. Additionally, the frequency of biologic complications, especially of fistulas and suppuration, was significantly higher overall. Even though there are few published studies on this topic, it should be noted that cement
Advantages prosthetically

While optimal conditions for cleansability around implants can be achieved through adequate superstructure design, other factors remain challenging. For example, placing implants in a way that allows for screw-retained restorations remains complicated in the esthetic zone or in anatomically demanding situations. Besides the 3D implant position, adequate screw retention also depends on the implant components, especially the design of the abutment screw.

For a long time, screw retention was thought to be obsolete because of the esthetics of the large access hole, as well as the reduced stability of the ceramic superstructures. Cementation seemed to be more attractive from a technical point of view, especially compared to older screw systems. Convincing advantages were that fabrication was easier and cheaper, esthetics were higher as no access hole was present, the “passive fit” was more desirable, and there were fewer incidents of screw loosening and of the abutment screw loosening within the implant.

However, screw design has since developed, and these disadvantages have been corrected in modern implant systems. Today, systems are available with
much smaller abutment screws (Fig. 12), and which, according to the clinical experience of the authors, do not have an increased fracture probability. The smallest screw, which has been on the market since 2002, has a diameter of only 1.85 mm at the screw head (Thommen Medical, Grenchen, Schweiz). Due to this minimal size, the diameter of the access hole in the occlusal surface of the superstructure can be smaller, which is noticeable in routine clinical use. Even in the anterior region, predictable screw-retained restorations can be achieved when navigation templates are used for palatally oriented implant positioning (Figs 13 and 14).

The small size of the abutment screw has advantages even after implant placement. The chairside...
fabrication of an acrylic resin immediate provisional is much easier because the provisional abutment is smaller, resulting in adequate space for the provisional crown (Figs 15 to 17). Therefore, the peri-implant soft tissue can be formed early (Figs 18 and 19), and patient comfort can be increased by eliminating a removable provisional. Grinding of the provisional abutment is also omitted, which saves time. Meanwhile, the surgeon receives immediate feedback about the position and angulation of the placed implant, and can estimate if screw retention of the permanent crown will be possible (Figs 20 and 21).

With screw retention as a routine technique, a one-piece concept using biocompatible materials such as zirconia can be put into practice. The separation of abutment and crown is no longer required, and the usual cement margin at the crown–abutment interface is also omitted (Fig 22). Due to this, the risk of cement residue is no longer a concern, since (besides the implant–abutment interface) a second microgap does not exist that would allow unimpeded biofilm formation. It is also much easier to solve technical complications in the aftercare. As chipping of the veneer is one of the most common technical complications, the uncomplicated removal of the superstructure for repair is important. Furthermore, the reduced diameter abutment screws have advantages for the dental technician. On the one hand, more space is available for the ceramics in the superstructure, and esthetics are not as influenced by the occlusal access holes as they were in earlier days (Figs 23 and 24). On the other hand, when implants are placed in the ideal position and at the ideal angulation, a mesostructure can be omitted. There are esthetic advantages if an abutment is not required in the construction of the removable dental prosthesis (RDP), as more space is available for the framework and veneering; this is not only a techni-
cal advantage, but allows more freedom for design. The separation of an occlusally screw-retained RDP is easier, as the dental technician can veneer directly onto the framework without concern for a minimal distance between the separation and the abutment (Fig 25). The possibilities for a truly esthetic creation seem to be more favorable with the use of screw retention (Figs 26 and 27).
Conclusion

Nowadays, screw retention presents attractive restorative possibilities thanks to modern prosthetic components. The improvement of implant design and implant surfaces, as well as the development of strategies to treat peri-implantitis, are the focus of many scientific investigations. While these aspects still play an important role, it is worth considering the importance of other characteristics of implant systems, such as their prosthetic components. Through these considerations, not only can long-term complications be reduced and advantages gained in the aftercare, but the simplification of the clinical procedure can be achieved.

References

MASTERYFUL.

THE PROVEN IMPLANT-ABUTMENT CONNECTION:
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