

Egyptian Prosthodontic Association (EPA Newsletter)

Screw Performance: An Important Factor in Implant Success



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Implant-supported restorations are well-established treatment options and have evolved to a standard of care in dental medicine. The possibilities of achieving a successful, functional, and stable treatment outcome have increased with the evolution of implant surfaces and designs, prosthetic components, clinical techniques, and dental materials. One of the important decisions in implant prosthodontics is the choice of the connection type of the final restoration to the implant via either screw or cement-retained. While the use of cement-retained implant-supported prostheses provides an aesthetically pleasing and mechanically sound result, removal of excess cement can pose a challenge, with failure to remove it without loss of superstructure. Screw retention avoids this problem, while allowing for better control of oral hygiene and retrievability if the need for repairs arises. ⁽¹⁾

With screw-retained restorations, the abutment may be separated from the restoration (two-piece) or combined as one piece. ⁽¹⁾ Screw-retained restorations are designed to be screwed either directly onto the implant or onto a screw-retained

(Multi-unit Abutment). ⁽¹⁾ The clinician's capacity to understand and appropriately manage prosthesis retention screws is the success key in screwed implant supported prosthesis. In this respect, dentists have truly become modern-day oral engineers. ⁽²⁾

Abutment Angulation effect on screw retained restorations

High rates of clinical complications involving the fixation screw occur, especially in single-unit restorations. ⁽³⁾ Ideally, dental implants should align with masticatory forces, but clinical conditions may require the placement of an implant in a non-optimal position, creating the need for an angulated prosthetic abutment. The angulation allows the use of screw-retained restorations in the esthetic zone by avoiding a buccal screw access point. The angulated screw channel (ASC) provides the option to place the screw access hole anywhere between 0° to 25° (Figure 1). Changes in the angulation between the screw head and screwdriver can affect screw torque and final preload. Extreme angulations above 30° may affect screw



Fig. 1: Angulated Screw Channel (ASC) (In courtesy of Hein et al ³⁾)

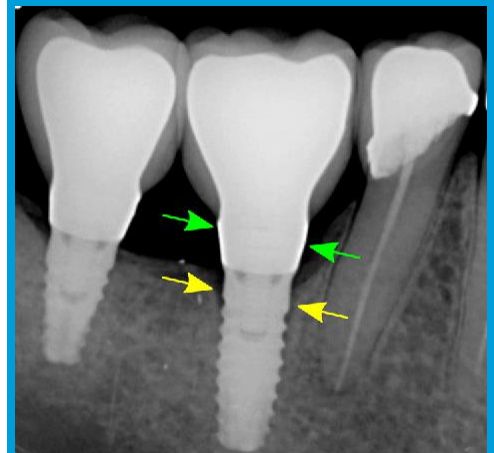


Fig. 2: Abutment Screw loosening (In courtesy of Xu et al ⁶⁾)

performance and be clinically relevant in areas of high occlusal stress. ⁽³⁾

Unfortunately, screws may loosen over time, which can lead to disturbances in transfer and distribution of applied occlusal forces, screw or implant fractures, and the formation of microgaps at the implant-abutment interface, allowing bacterial leakage. Screw loosening in both prosthesis and abutment screws increases as abutment angulation increases. ⁽⁴⁾

Screw Loosening and Abutment Screw Preload

Screw loosening may also be due to insufficient clamping force, screw settling, biomechanical overload, off-axis centric forces, prosthesis misfit, differences in screw material and design, and finally hex height and implant diameter (**Figure 2**). Screw settling will occur shortly after screw tightening; therefore, retorqueing the screw 5 minutes after initial torqueing and again after one month is recommended. Practitioners need to bring patients back on a regular basis for follow-up at 1, 3, 6 and 12 months after placement, then annually. ^(5,6)

The term “preload” refers to the force with which an abutment is loaded onto the implant with an abutment screw.

To achieve sufficient clamping force the screws should be torqued 50% to 75% of their yield strength, so it is imperative that all screws be tightened to manufacturers’ specifications and recommended tightening torque using a torque control wrench in the initial phase of screw tightening. Exceeding the elastic limit leads to plastic deformation of the screw, resulting in a decrease of preload and, ultimately, screw fracture. The recommended torque value is provided by manufacturers based on different implant design factors with an average of 35nCM torque. ⁽⁴⁾ It was found that gold screws can be tightened more effectively than titanium ones and therefore, will provide better retention. ⁽⁵⁾

Real-life Use of Torque Wrenches

Screw loosening remains the most frequently reported prosthetic complication with screw-retained implant prostheses. An often-overlooked question is whether clinicians use or follow industry standard guidelines when using tools designed to optimize screw tightening. The answer to this question is that few practitioners actually calibrate their torque wrenches (**Figure 3**). ⁽⁷⁾



Fig. 3: Calibrating Straumann wrench and torque (In courtesy of Wadhvani etal ⁷⁾



ISO standards call for torque-limiting devices to be calibrated **every 12 months** or **5000 cycles**, with more frequent calibration for tools that are overloaded or if ambient conditions during use and storage are exceeded. That describes most torque wrenches used in dentistry, given the negative effects of cleaning and heat sterilization. A torque wrench out of calibration may over-deliver or under-deliver the recommended torque, increasing the likelihood of a negative outcome. ⁽⁸⁾

Clinical research in implant dentistry has mostly focused on implant survival, with only a small amount of attention paid to the occurrence of technical difficulties with implant components or restorations. ⁽⁹⁾ It is crucial to think about the mechanical stability of implant-supported restorations if long-term stability is required. Screw-retained implant-supported fixed restorations treatment option in fixed implant prosthodontics is a reliable and effective choice, especially for implant-supported long-span FPDs, full-arch FPDs, and cantilever FPDs.

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