by Dr. Stefan Holst, Germany

Nobel Biocare does not develop individual products but entire solutions that provide fully functional, natural-looking, long-lasting results. In order to ensure long-term clinical performance, safety and cost-efficiency for everyone involved in the treatment process, each Nobel Biocare component has been designed to fit and function perfectly with its related components. Together, they produce a finely tuned system.

When assessing any implant-supported restorative solution for a patient, one has to keep in mind that the entire system under consideration is only as strong as its weakest link. The performance of each specific component depends not only on the quality and design of the component itself but also on its interface with the rest of the restorative system. Consequently, each component should not be evaluated on its own. Clinically relevant conclusions can only be reached when a component is tested within the system of which it is a part. Dr. Stefan Holst, Vice President of Implant Systems and Research at Nobel Biocare: “Clinically relevant conclusions can only be reached when a component is tested within the system of which it is a part.”

We at Nobel Biocare study systems from their initial design to long after delivery to the end-user, the patient. We develop and scrutinize engineering and manufacturing processes, and we carry out quality assurance, clinical research and post-market surveillance. Only with this approach can we be certain that the system will function safely and reliably for many years to come.

The very definition of synergy
The whole is greater than the sum of its parts

Parameters that influence long-term performance

Computerized simulation tools, such as finite element analysis, and biomechanical testing in the laboratory have served to identify parameters that can impact the performance of an implant system. These parameters include joint compression (the force that acts at the implant-abutment interface under loading conditions), preload (the tensile force keeping the components together) and the friction coefficient (which depends on the surface materials that are in contact with each other).

Other significant parameters include the force that the patient exerts on the system by chewing (masticatory force), as well as the length of the contact between the abutment and the implant, as well as when using a clinical connection implant—the angle of the abutment. A small change in any of these parameters—even one not visible to the eye—can lead to extreme load and stress conditions that result in system failure.

Precise fit for joint stability

The interface between the implant and abutment is critical for joint stability. Manual adjustment of a cast or the use of a substitute abutment can alter the contact angle and contact length. Such an undefined contact situation on the implant steel, but may also have an impact on performance-relevant parameters.

Preload, the force that holds the components together

Preload is defined as the tensile force created in the clinical screw as the result of screw tightening. It is generated by the application of torque to the screw, although only a fraction of the torque force is stored as preload when the screw is inserted at the recommended torque. Fully manual screw insertion is likely to result in lower torque and, consequently, suboptimal preload. Insufficient preload leads to increased relative motion between the system components, and this can contribute to screw loosening and/or component failure. Conversely, preload values that are too high can result in component fracture.

Optimized to the last detail

Nobel Biocare abutments are delivered with a dedicated clinical screw that has been optimized for the implant-abutment system it is a part of. Depending on the abutment, connection type and platform size, screws come with or without a surface coating. The choice of coating and the coating type all affect the preload. For example, with a diamond-like carbon coating, screws marketed under the TorqTite brand show higher preload values compared with screws that have a standard titanium surface. Nobel Biocare provides an appropriate screw type for every implant-abutment connection, ensuring a tight and stable fit for long-term performance.

Avoid substitutes, minimize patient risk

If substitute components are used, the parameters governing system performance are no longer controlled. Consider maximum joint compression—which defines the load that the implant collar can bear—as an example. A substitute may result in a force that is higher than the allowed maximum, causing the implant to fracture. To prevent such catastrophic results, the peak forces have to be distributed in a controlled way. This can only be achieved by using high-quality, precision-manufactured components that have been designed and tested both individually and as part of the system for which they have been designed.

NOTE: Dr. Stefan Holst will be giving a presentation today as part of the main program session, titled “Prosthetic concepts—Reaching optimal esthetic outcomes with CAD/CAM solutions,” which will run from 1 to 5 p.m.

NOTE:

- Mismatching components can have severe consequences. Improper fit leads to uncontrolled peak forces, which may result in implant fracture.
- Precise fit ensures long-term performance. For conical connection implants, joint compression (F_a), friction angle (\( \phi \)), and contact length (l) variables can be defined under the TorqTite brand show higher preload values compared with screws that have a standard titanium surface. Nobel Biocare provides an appropriate screw type for every implant-abutment connection, ensuring a tight and stable fit for long-term performance.

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- The absence or presence of the surface coating and the coating type all affect the preload. For example, with Nobel Biocare Global Symposium