Advancing levels of precision in dental implants through computer navigated surgeries

By Dr Shyam Bhat, India & Dr Shankar Iyer, USA

Advances in technology have enhanced clinicians' comfort and accuracy by minimizing the margin of error. We have seen a paradigm shift from using only a radiograph to using cone beam CT scans for diagnosis. A cone beam CT scan now becomes the standard of care in treatment planning for dental implants. Traditionally, implants have been placed free hand or aided by the use of static guides derived from a CT scan. Although using well-planned surgical guides have all the same advantages, they are usually bulky and do not provide adequate information regarding angulation of the drill degree of deviation from the planned position, implant delivery in a three-dimensional perspective and often precludes irrigation to the osteotomy sites. A possibility of error always exists, no matter how thoroughly the guide is planned.

Using a static surgical guide along with a specific guided implant surgical instrumentation can result in less than 2 mm of facial and apical deviation and an angulation error of less than 3°.

However, implant placement without any guide results in significantly more error than either guiding modality. This article is an attempt to explain the instrumentation and procedures involved in placing implants under dynamic computer navigation.
The position of the implant is reproduced from the virtual implant placed on the cone beam CT scan and hence does not allow intra-opera-
tive modification of the position of the implant
by the surgeon.15 The static systems, the planned implant location is usually tried using the surgical guide template by a specially designed drilling ma-
chine.16 Another static option, called Drill-stabilization is a surgical method, use specifically designed software to de-
sign the virtual drilling plan, depending on the size and location of the
ultraviolet sensitive liquid material17. Dynamic navigation systems use a surgeon
on motion-tracking technology that allows real-time tracking
of the implant position directly from computed
computed tomography-derived stereolithographic surgical tem-


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6. Van de Wiele G, Teugels W, Ver-


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The synthesis of aesthetics, health and structural stability

The advantages of using the Angulated Screw Channel (ASC) abutment system

By Dr Chandur Wadhwani, USA

There are many reasons why cement retained implant restorations gained popularity over the last few years, which can be attributed to aesthetics, ease of use and familiarity with cementation techniques. However, Paulotto, Gupsil and others reported that cement excess was problematic; then Wilcoksky's study established a positive relationship between excess residual cement and perimplantitis. Surveys on cements used for implant restorations indicated a diversity in material selection, application technique and volume. This suggested a lack of conformity and understanding of cement usage within the dental profession. To overcome the cement problem, it became evident that improved understanding was required for cement material selection, abutment design and the determination of cement margin depths. Even with the best intentions, however, residual excess cement can lead to disease, affecting the health of the implant/tissue interface and remains a dominant risk factor.

The association of residual excess cement and peri-implantitis has resulted in the need to re-examine alternatives such as the screw-retained implant crown. For many implant systems, the ability to use a screw-retained implant restoration is limited to regions where the screw access channel emerges in an aesthetically 'safe' site. Usually the anterior maxilla and mandible present the greatest challenges, as the long axis of the implant/tooth often projects through the proposed soft tissue emergence site. The ability to alter the screw access site to be planned, then machine fabricated, using a planned approach, is not an issue. The zirconia abutment, with its well-designed angulations and biocompatibility, is a suitable abutment for implant crown restorations. J Oral Maxillofac Implants. 2012 Jul-Aug;27(4):859-64.

With the ability to alter the screw access channel up to 25 degrees, it eliminates the need for cementation in the vast majority of cases like these. The ASC provides for an active synthesis of health, aesthetics, and excellent structural and mechanical abutment joint stability.

Health

With use of the ASC abutment system, cement extrusion into the fragile peri-implant soft tissues is eliminated. The ASC allows high-volume implant cleaning and polishing, which lessens the potential for foreign bodies being pushed around the implant site, which can jeopardise implant health (Fig. 3). In addition, the use of zirconia abutment superstructures in combination with titanium bases provides optimised materials for biocompatibility and health.

Aesthetics

With the ASC, the screw access channel can be projected away from high-aesthetic-risk areas and placed appropriately at a variety of different angulations. CAD/CAM design enables the restorations to be efficiently designed and quickly manufactured at Nobel Biocare's production facilities (Fig. 5). Milled zirconia is highly aesthetic, thus especially useful in the soft tissue emergence site.

Angulated Screw Channel saves the day

An innovative solution to the off-axis implant is the Angulated Screw Channel (ASC) abutment system developed by Nobel Biocare (Fig. 3). The ASC shows the screws access from Figure 2a have been redirected using the ASC abutment and crown (a & b), producing a pleasing natural appearance thanks to a screw-retained implant restoration (c).

Mechanical stability

CAD/CAM utilisation (Fig. 6a-c) allows for optimised screw access site planning and the machined fit of components provides a precise, dedicated connection, optimised for the implant-abutment joint.

As with all implant-to-abutment connections, the optimised passive fit results when surfaces are in intimate contact and forces are distributed universally. Casting abutments cannot always provide an even connection with joint contact, as they are often inadvertently damaged through cleaning and polishing, which alters the consequent fit (Fig. 7). When this occurs, the joint connection may fail with screw loosening or even failure of the implant as a result.

Structural components

Titanium alloy abutment bases provide the most accurate fit with machining tolerances readily controlled. Aesthetically, the use of zirconia metal into the peri-implant tissue from inside of the implant, is not an issue. The zirconia abutment, with its well-designed circumferential wall strength, is held through the abutment screw, optimising the ceramic's ability to withstand forces that have been seen to fracture non-titanium base abutments.

Conclusion

The benefits of the ASC abutment system are numerous, reflecting a multi-symbiosis of engineering ingenuity and biocompatible materials, and allowing for the combination of good aesthetics and excellent health.

References


Figs. 6a–c: The screw access from Figure 2a has been redirected using the ASC abutment and crown (a & b), producing a pleasing natural appearance thanks to a screw-retained implant restoration (c).