Advancing levels of precision in dental implants through computer navigated surgeries

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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 has become 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 surgery instrumentation can result in less than 2 mm of cervical and apical deviation and an angulation error of less than 5 percent. However, implant placement with or without any guide results in significantly more error than either guiding modality. This article is an attempt to explain the instrumentation and procedure involved in placing implants under dynamic computer navigation.

Features of the Neoss ProActive® Surface

Surface roughness and hydrophilicity are essential to the absorption of proteins and biomolecules onto implant surfaces thereby facilitating healing and bone formation.

Neoss has utilised Electroetching on titanium surfaces to increase hydrophilicity and maximise the penetration of blood and its components onto the implant surface.

Proven clinical evidence and design of Neoss Implants

Produced with Commercially Pure Titanium (Grade IV), ProActive Implants have a low surface roughness flank designed to reduce marginal bone loss. At the same time, higher surface roughness of the threaded body of the implants optimises stability and osseointegration.

The universal Thread Cutting and Forming (TCF) design of the implant ensures suitability for all bone qualities. The secondary cutting face provides additional efficiency in dense bone. Threads extend to the tip of the implant ensuring excellent stability.

Proven clinical experience

A randomly selected population of 100,000 implants was sampled from the Neoss warranty registry and statistical analysis indicated a 3 year cumulative survival rate of 98.2%. Of the 1.8% of failures, the major aetiological factor were smoking, a combination of poor bone quality, bone quantity and immediate loading.

The etched, blasted and treated ProActive Implant surface stimulates bone to form more rapidly and with a greater strength at the implant interface. ProActive Implants surpassed the performance of competitor implants in in-vivo removal torque tests.

In the first published study of ProActive Implants, they recorded a 100% success rate after one year of placement in non-bone grafted patients and 98.3% in bone augmented patients. In the same study group of patients, marginal bone loss of 0.4 mm was recorded at one year.

Studies have consistently shown outstanding survival rates and retention of marginal bone levels.

With five implant diameters, two implant designs and just one connection, the Neoss Implant system provides both surgeons and restorative dentists the greatest possible freedom and flexibility without compromising in performance or success. All prosthetic components in the Neoss System are compatible with both the ProActive Straight and ProActive Taipered implants providing a choice of implant at the time of surgery.

NeoLoc® connection

NeoLoc® is the unique Neoss implant to abutment connection that offers the advantages of a remarkably strong and tight connection, proven long-term clinical success, high levels of bone preservation, optimal flexibility for restoration, and the ‘one connection’ concept. Neoss engaging abutments have deformation lugs which minimise rotational movements and secures a distinct seating.

Crytalic® abutment screws are 30% stronger than gold screws in static strength testing thus facilitating a high clamping force between the abutment and implant offering an additional 10% resistance to fracture during long-term clinical function.

Warranty data over many years has demonstrated an unparalleled low fracture rate with less than one fractured implant per 10,000 implants.

References:

10. Since its foundation in 2000, Neoss continues to innovate and invest in product development research, design, manufacturing and selling products of the highest quality which offer market leading functionality. Following double-digit growth in 2010, Neoss sites as a pioneer in dentistry, with ever-growing clinical evidence that delivers long term and exceptional patient results. The expansion and success of the company can be credited to the success rates of Neoss’ products, which are guided by the company ethos of intelligent expansion and success of the company, which offer market leading functionality.
Flowchart

Instrumentation and Workflow

Dynamic guided navigation works on the principle of tracking two markers in their positional relationship to each other. One marker rests on the patient's teeth and is usually teeth supported. This marker is placed on the patient's teeth, usually on the opposite side (for example, if the implant is placed in the lower right quadrant, the marker is positioned in the lower left quadrant) using a thermoplastic resin to be able to reproduce the same position during surgery. A cone beam CT scan is taken with this marker in position in the patient's mouth. The digital image plans the placement of implants in a virtual treatment planning software, that is usually included in the dynamic navigation machine (Fig. 1). Since there is no need to manufacture a physical guide, the surgery may be scheduled as early as the next day. On the cone beam CT scan, the second marker is fixed to the surgical hand-piece according to manufacturer recommendations. The marker in the hand-piece and the marker in the patient's mouth are calibrated in position to each other as well as to the proposed position of the implants. This is done using a special software for the navigation guide system (Fig. 3). In the future, a dynamic navigation guide system has the following essential parts:

1. A hand-piece attachment/ marker
2. A jaw attachment/ marker
3. Cameras and sensors to record and monitor the position of markers/bones during surgery
4. Software which coordinates the navigation guide system. A static guide system is less as compared to using a static navigation system that reproduces the virtual implant placement per se.
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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, Pauletto, Gapski and others reported that cement excess was problematic, then Wilson’s study established a positive relationship between excess residual cement and peri-implantitis. 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 tends to be 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 connective tissue.

With all implant-to-abutment connections, the optimised pass-through site to be planned, then machine fabricated.

The benefits of the ASC abutment system are numerous, reflecting a multitude of synergistic mechanisms and biocompatible materials, and allowing for the combination of good aesthetics and excellent health.

References

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