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 site. 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 clinical precision and deviation and an angulation error of less than 5 percent. 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 procedure involved in placing implants under dynamic computer navigation.
The position of the implant is repro-
duced from the surgical guide on which
the virtual implant placement per-
formed in the preoperative cone beam CT
scan and hence does not allow intra-
operator modification of the implant po-
sition9,10. With the static systems, the
planned implant location is usually fixed.
The dynamic approach refers to the use of a
surgical navigation system that reproduces
the virtual implant position directly from com-
peted volumetric tomographic data and al-
 lows intra-operative changes of the im-
plant position17-20. A significant advantage
of this navigation is the universal appli-
cability of any implant system that can work
with this technology.

The present dynamic navigation systems
require a new implant to be present for
the placement of the jaw marker, and hence it makes difficult
in cases of edentulous arches. The initial
high cost of the system is also a deter-
rent.

Static guided navigation implant
placement, on the other hand, does not af-
fected by small changes in position
by the surgeon. If the surgeon feels
that the position needs to be altered
by even a minute degree, the guide
will have to be removed during the sur-
ery making the virtual surgery a
very purpose of using one. Further, using
a static guide renders the surgeon
blind to the surgical site, who has
aid to rely entirely on the accuracy
of the splint which is manufactured
outside the surgical site, and it is
es, and hence makes it difficult
to make intra-operative changes to
the guide. A significant advantage
of this navigation is the universal appli-
cability of any implant system that
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dynamic of navigation systems
require a new implant to be present
for the placement of the jaw
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in cases of edentulous arches. The initial
high cost of the system is also a deter-
rent.

4. A software which co-ordinates
the navigation guide system (Fig. 3).
The software is designed specifically for the
planned and CAD/CAM-guided im-
plant surgery on plastic models.1,18

5. Van de Weige G, Teagueh W, Ver-
cruysen M, Coucke W, Tenmanerm R,
Naestem K. Accuracy of virtually
planned and CAD/CAM-guided
implant surgery on plastic models.

6. Otan O, Turkulizam I, Ensay A, Re-
McGlymph EA, Rosenstiel St. Civi-
l patterns of maxillary and mandib-
l anomalies based on stereolithic surgical
imaging of the maxillary arch.

7. Nasstrom K. Accuracy of virtually
planned and CAD/CAM-guided
implant surgery on plastic models.

8. McGlumphy EA, Rosenstiel St. Clini-
oral and maxillary arch: 2 papers.

9. Verriers M, Coucke C, Coucke
W, Naert J, Jacobs R, Quirynen M. The accuracy of guid-
ed surgery via maxca-supported stereolithic surgical tem-
plates in the hands of surgeons with little experience. Clin Oral Implants
Res. 2015;46(4):419-94.

10. Van de Weige G, Teagueh W, Ver-
cruysen M, Coucke W, Tenmanerm R,
Naestem K. Accuracy of virtually
planned and CAD/CAM-guided
implant surgery on plastic models.

11. McGlymph EA, Rosenstiel St. Civi-
l patterns of maxillary and mandib-
l anomalies based on stereolithic surgical
imaging of the maxillary arch.

12. Buser D, Wittneben J, Bornstein
MM, Grutter L, Chappuis V, Belser
UC. Stability of contour augmenta-
tion and esthetic outcomes of im-
plant-supported single crowns in the
esthetic zone: 3-year results of a prospec-
tive study with early im-
plant placement post-extraction.

12, 15, 16, 17, and 32-5.

14. Buser D, Wittneben J, Bornstein
MM, Grutter L, Chappuis V, Belser
UC. Stability of contour augmenta-
tion and esthetic outcomes of im-
plant-supported single crowns in the
esthetic zone: 3-year results of a prospec-
tive study with early im-
plant placement post-extraction.

15. D’Haeze J, Achtenh D, Wismeier
12, 15, 16, 17, and 32-5.

16. Brief J, Edinger D, Hasfeld S. Eeg-
and computer-aided template-guided implant insertion for maxillary sing-
el tooth replacement. Clin Oral Im-

17. Casap N, Burch G, Swensen G,
Rosahl S. Navigated versus computer-
derived implant insertion for maxillary sing-
el tooth replacement. Clin Oral Im-

18. Brief J, Edinger D, Hasfeld S. Eeg-
and computer-aided template-guided implant insertion for maxillary sing-
el tooth replacement. Clin Oral Im-

19. Buser D, Halberts S, Hart C, Born-
stein MM, Grutter L, Chappuis V, et
al. Early implant placement with si-
malluraneous guided bone regenera-
tion following single-tooth extrac-
tion in the esthetic zone: 12-month results of a prospective study with 20 con-
2009;80(9):152-62.

20. Buser D, Wittneben J, Bornstein
MM, Grutter L, Chappuis V, Belser
UC. Stability of contour augmenta-
tion and esthetic outcomes of im-
plant-supported single crowns in the
esthetic zone: 3-year results of a prospec-
tive study with early im-
plant placement post-extraction.

Y, Kan Y, Tanaka M, et al. A com-
puter-aided template-guided implant
placement system: prospective study.

22. Casap N, Burch G, Swensen G,
Rosahl S. Navigated versus computer-
derived implant insertion for maxillary sing-
el tooth replacement. Clin Oral Im-

23. Brief J, Edinger D, Hasfeld S. Eeg-
and computer-aided template-guided implant insertion for maxillary sing-
el tooth replacement. Clin Oral Im-

24. Brief J, Edinger D, Hasfeld S. Eeg-
and computer-aided template-guided implant insertion for maxillary sing-
el tooth replacement. Clin Oral Im-

25. Brief J, Edinger D, Hasfeld S. Eeg-
and computer-aided template-guided implant insertion for maxillary sing-
el tooth replacement. Clin Oral Im-

26. Brief J, Edinger D, Hasfeld S. Eeg-
and computer-aided template-guided implant insertion for maxillary sing-
el tooth replacement. Clin Oral Im-
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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, Gupsik 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 diseases 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 suitable site. Usually the anterior maxilla and mandible present the greatest challenges, as the long axis of the implant often projects through the proposed incisal edge or even facial to the final restoration (Fig. 2a). Occasionally, when the surgeon places the implant in a compromised site—or the implant is inappropriately placed—the traditional screw-retained implant restorations may seem to provide more of a challenge than a solution (Fig. 2b).

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). With the ability to alter the screw 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 puts an end to the onslaught of cement fluid pressure and unset chemicals from the cement material. It also gets rid of the potential for foreign bodies being pushed around the implant site, which can jeopardise implant health (Fig. 4). 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 at the soft tissue emergence site.

Mechanical stability

CAD/CAM utilisation (Fig. 6a–c) allows for optimised screw access site planning and the machining 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 these 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 implants as a result.

Structural components

Titanium alloy abutments provide the most accurate fit with machining tolerances readily controlled. Aesthetic wise, i.e. the release of titanium metal into the peri-implant tissues from the 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 symbiosis of engineering ingenuity and biocompatible materials, and allowing for the combination of good aesthetics and excellent health.

References


Figs. 2a & b: The anterior teeth present a challenge to the screw-retained restoration unless an Angulated Screw Channel (ASC) abutment is used (a). In cases where the surgical placement is less than ideal, the ASC may help limit further compromise to the site (b).

Figs. 3a–c: The screw access from Figure 2a has been redirected using the ASC abutment and crown (c). cates a placing natural appearance thanks to a screw-retained implant restoration (c).