JOMI CURRENT ISSUES FORUM

CT-GENERATED SURGICAL GUIDES AND FLAPLESS SURGERY

Editor's Note: *Current Issues Forum* provides the opportunity for invited individuals with expertise and experience to express their opinions on selected current topics of interest in the field of oral and maxillofacial implants. The comments expressed herein represent personal opinion, factual material, or experience-based information provided by the contributors and do not represent positions of Quintessence Publishing Company or the *JOMI* editorial staff. Suggested topics for consideration, as well as responses to the participants' contributions, are solicited from our readers.

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Stephen F. Balshi, MBE, *received his undergraduate degree in Biomedical Engineering from the Catholic University of America, Washington, DC. He was awarded a master's degree at the School of Biomedical Engineering, Science and Health Systems at Drexel University, Philadelphia, Pennsylvania, with a published thesis on the stability of Brånemark implants and immediate function. He is the chief operating officer of CM Ceramics USA, the first branch of the international CM Ceramics dental laboratory in North America, located in Mahwah, New Jersey. CM focuses on the rehabilitation of the fully edentulous, utilizing state-of-the-art CAD/CAM technology. He is also the director of research for Prosthodontics Intermedica at the Institute for Facial Esthetics in Fort Washington, Pennsylvania. He has been published in several refereed journals including JOMI. He has lectured at national and international meetings, including meetings of the Academy of Osseointegration, the American College of Prosthodontists, and the International College of Prosthodontists on immediate function, computer guided surgery, and CM Ceramics' folio of fully edentulous restorations.*

Treatment planning using 3-dimensional computerized tomographic (CT) scans was developed not only to improve the accuracy of implant placement but also to accelerate the treatment protocol. Our experience with computer-guided surgery has been extremely favorable. Our first patients treated with this protocol (October 2003)[1] experienced the use of a surgical template and a flapless surgical technique for implant placement. Following the removal of the template, a definitive screw-retained prosthesis was placed on adjustable abutments. The first group of patients received prostheses constructed with carbon fiber frames. Later that year, subsequent patients were restored with a robotically milled titanium framework.

The early experience with computer planning and clinical delivery determined that the technology provided exceptional accuracy. However, following the delivery of the definitive prosthesis, some patients requested esthetic changes requiring alteration or rebuilding.[2,3] Both our experience with implant-supported bone-anchored prostheses, particularly in the maxillary arch, and the desire to have patients restored with ceramic teeth led to a protocol change in the prosthetic delivery system. Our most recent experience (the last 3 years) has provided insight and data regarding the surgical and prosthetic protocols, in addition to optimal patient management.

We have determined that the accuracy of the computer-guided system permits the delivery of a screw-retained provisional restoration on traditional abutments rather than the adjustable abutments designed for the protocol.[4] The provisional prosthesis allows the clinician and the patient the freedom to make functional and esthetic changes once the patient becomes accustomed to the fixed prosthesis and is no longer wearing a removable denture.

The Guided Surgery protocol was initially developed for the fully edentulous patient. It has advantages for partially edentulous patients as well; in particular, patients requiring implants in the posterior mandible. The computer-guided system allows the clinician to place the implants on either side of the inferior alveolar canal with a high margin of safety. Our experience has also included the use of postoperative cone-beam CT scans to validate the position of the implants and verify that the surgical planning and clinical execution were identical.

The use of guided surgery for the placement of zygomatic implants has opened an entirely a new world for the treatment of severely atrophic maxilla. This immediate loading treatment with full-flap surgery was historically very invasive. Our initial experience with the minimally invasive guided zygomatic approach required the use of the Teeth In A Day protocol for connecting the zygomatic abutments to the prosthesis.[5] With the recent refinement of the guided zygomatic technology (hardware and software), definitive abutments can be applied and a prefabricated screw-retained prosthesis can be delivered with precision to both traditional regular-platform Brånemark implants and bilateral Brånemark zygomatic implants.

Advantages

Considering the advances with computer-guided implant surgery, the benefits to patients and doctor are

1. A significant decrease in clinical time required for the surgery
2. The enabling of a flapless approach, with no sutures required
3. Minimal invasiveness, resulting in little if any swelling and an easy recovery
4. Accuracy of implant placement relative to vital anatomic structures
5. Immediate function with a prefabricated, non-removable screw-retained prosthesis
6. The availability of CT datasets for radiographic analysis and diagnosis for pathology or anomalies

Disadvantages

Disadvantages of computer-guided surgery are minimal. There is a significant learning curve with the software and clinical applications. Although the technology is predictable and successful, there are many areas where extreme caution must be taken. Otherwise an implant could be improperly placed or it might be impossible to connect the prosthesis. There are also the added expenses for the patient of the CT scan and surgical template hardware.

Conclusion

In conclusion, computer-guided surgery is extremely advantageous for both the clinician and the patient. It provides efficient bone-anchored prosthodontic rehabilitation with minimal patient discomfort and with a clinical success rate equal to other immediate-loading protocols.

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