Proceedings of the American Association of Oral and Maxillofacial Surgeons 2015 Research Summit

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The Fifth Biennial Research Summit of the American Association of Oral and Maxillofacial Surgeons and its Committee on Research Planning and Technology Assessment was held in Rosemont, Illinois on May 6 and 7, 2015. The goal of the symposium is to provide a forum for the most recent clinical and scientific advances to be brought to the specialty. The proceedings of the events of that summit are presented in this report.

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The major themes of the summit were virtual surgery, regenerative medicine, and contemporary and future trends in the management of benign maxillofacial pathology. These themes were designed to reflect the specific areas in which oral and maxillofacial surgeons have opportunities to lead advances in diagnosis and patient care.

Virtual Surgery: The Future

The section of virtual surgery was moderated by Joseph E. Cillo, Jr, DMD, MPH, PhD, and Zachary S. Peacock, DMD, MD, and was held on Wednesday afternoon of May 6, 2015. The session focused on virtual surgical planning and validation for orthognathic and oncology surgery, 3-dimesnional (3D) printing, and surgical training in telemedicine.

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Virtual Surgical Planning

Alexander Schramm, MD, DDS, PhD (Department of Oral and Maxillofacial Surgery, Military and University Hospital, Ulm, Germany) gave a presentation on virtual surgical planning. The goal of any new surgical technique or technology is to increase the probability of achieving the procedural objective and therefore improve patient outcome. Advances in computer technology allow the surgeon to use patient data to virtually plan surgical interventions. These predetermined surgical treatment plans can be executed and then verified in the operating room. Advanced computer software permits this comprehensive approach to be used in the acute management of trauma patients.[1-3] For example, computed tomography (CT) data can be used by computer software to create separate bone segments, known as *auto-segmentation.* These bony segments can be manipulated and reduced into their premorbid positions. The simulated reduction plan can be merged with the preoperative CT scans and made available in the operating room. During the operation, the actual reduction can be compared with the planned reconstruction by intraoperative navigation and CT. More complex injuries, such as comminuted orbital fractures, can be planned with a similar technique. The uninjured contralateral bony orbit and simulated orbital reconstruction plates are used to virtually reconstruct the injured orbit. The size and position of the implant can be adjusted to provide the near-ideal reconstruction.[2] Intraoperatively, the same type of orbital reconstruction plate can be placed into the virtually planned position. The gross implant position is determined by 3D navigation, which can be performed rapidly without added radiation exposure. More precise confirmation can be obtained with intraoperative CT scanning. With this basic algorithm, the surgeon can perform complex primary or secondary reconstruction of maxillofacial injuries with more confidence of accurate reduction because the surgeon will have greater understanding of the fracture and reduction in 3 planes of space.

Furthermore, advances in the production of patient-specific implants allows for increased control of surgical planning. Rapid production of implants can be accomplished by selective laser sintering. Selective laser sintering manufactures medical implants using lasers to selectively solidify biocompatible titanium alloy particles.[4-6] The process uses patient CT scan data to control the fabrication process layer by layer. The manufacturing process is rapid, with the final patient-fitted implant available in 5 to 7 days, thus extending application to maxillofacial trauma.

Virtual Planning and Navigation Surgery for Midface Oncologic Reconstruction

Julio Acero, DMD, MD, PhD (Department of Oral and Maxillofacial Surgery, University Hospital Ramon y Cajal, Madrid, Spain) discussed virtual surgical planning in oncologic surgery. The end goal of maxillofacial reconstruction has always been to restore form and function. Currently, virtual surgical treatment planning can be used to improve the ability to attain this objective. For example, mandibular resection with immediate autogenous bone grafting and endosseous dental implant placement can be preplanned. Once the mandibular continuity defect has been defined, implant-planning software can be used to determine the number and position of the dental implants based on the prosthodontic plan, and from this plan, the position of the bone graft can be determined. The reconstruction plate's shape and other design elements, such as fixation hole position, can be designed to accommodate individual reconstruction needs. Soft tissue tumor resection is another example of where these technologies can improve patient outcomes. The ablative surgeon can use virtual planning and understand resection margins and the corresponding 3D tissue deficit. Once the defect is defined, then the surgeon can design an appropriate tissue flap to be transferred and patient-specific fixation devices. Surgical guides and intraoperative navigation allow the surgical resection to be performed accurately. This degree of preplanning makes the ablative surgery safer, resulting in improved function and therefore quality of life for patients.

Validation of 3D Surgical Treatment Planning

Brian B. Farrell, DDS, MD (Carolinas Center for Oral and Facial Surgery, Charlotte, NC) discussed recent advances in virtual surgery for orthognathic surgery. Virtual surgical planning is rapidly becoming the standard for correction of complex dentofacial deformities. Computer simulation provides tremendous preoperative insight into the anticipated dental and skeletal movements and osteotomy orientation and positioning and accurately transfers the virtual plan to the operating room. The virtual planning can provide a smoother intraoperative experience with adjunctive resources, such as cutting guides and jigs, to assist in segment orientation and templates for bone grafting contours. The pre- and intraoperative efficiency and accuracy provided with virtual surgery planning compared with traditional methods can return hours to the surgeon that can then be devoted to other professional and personal obligations.