Opinion Article
Volume 10:S8, 2021

Advances in Robotics & Automation-Open Access

ISSN: 2168-9695 Open Access

General Principles of Computer-Assisted Surgery

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Introduction

The creation of an accurate model of the patient is the most important component of CAS. This can be accomplished using a variety of medical imaging technologies, such as CT, MRI, X-rays, and ultrasound, among others. The anatomical region to be operated must be scanned and uploaded into the computer system in order for this model to be generated. A variety of scanning methods can be used, with data fusion techniques used to combine the datasets. The ultimate goal is to create a 3D dataset that accurately replicates the geometrical situation of the region's normal and pathological tissues and structures.

CT scanning is preferred over MRI because MRI data sets are known to have volumetric deformations that can lead to inaccuracies. An example data set could be a collection of data compiled from 180 CT slices that are 1 mm apart and have 512 by 512 pixels each. The contrasts of the 3D dataset (with its tens of millions of pixels) provide detail of soft or hard tissue structures, allowing a computer to differentiate and visually separate the different tissues and structures for a human. In order to realign the virtual dataset against the actual patient during surgery, image data from a patient will frequently include intentional landmark features.

In the placement of dental implants, new therapeutic concepts such as guided surgery are being developed and implemented. Prosthetic rehabilitation is also planned and carried out in tandem with surgical procedures. The planning steps are in the foreground and are carried out in collaboration with the surgeon, dentist, and dental technician. Patients with edentulous jaws, either one or both, benefit from shorter treatment times. Even when dentures are constructed according to correct anatomic morphology, conventional denture support is frequently compromised in edentulous patients due to moderate bone atrophy.

The patient and the existing prosthesis are scanned using cone beam computed tomography. Furthermore, the prosthesis is scanned on its own. Glass pearls of a specific diameter are inserted into the prosthesis and used as reference points for future planning. The resulting data is analysed, and the implants' positions are determined. Using specially developed software, the surgeon plansthe implants based on prosthetic concepts while taking anatomic morphology into account. After the surgical part has been planned, a CAD/CAM surgical guide for dental placement is built. The mucosal-supported surgical splint ensures that the implants are precisely placed in the patient. At the same time, the new implant-supported prosthesis is being built.

Using the data from the previous scans, the dental technician creates a model that represents the situation after the implant placement. The prosthetic compounds, known as abutments, have already been manufactured. The length and inclination can be customised. The abutments are attached to the model in a position that takes into account the prosthetic situation. The precise location of the abutments is recorded. The prosthesis can now be made by the dental technician.

The surgical splint's fit has been clinically proven. The splint is then secured with a three-point support pin system. Irrigation with a chemical disinfectant is recommended prior to the attachment. The pins are inserted through sheaths that run from the vestibular to the oral side of the jaw. Ligament anatomy should be considered, and decompensation can be achieved with minimal surgical interventions if necessary. The template's proper fit is critical and should be maintained throughout the treatment. Regardless of mucosal resilience, bone fixation achieves a correct and stable attachment.

Conclusion

Hence it is concluded that the sleeves embedded in the surgical template are now the only way to gain access to the jaw. The mucosa is removed by inserting specific burs through the sleeves. Every bur used has a sleeve that is compatible with the sleeves in the template, ensuring that the final position is achieved but that no further progress in the alveolar ridge is possible. The following procedure is very similar to traditional implant placement. Drilling and expanding the pilot hole the implants are finally placed with the help of the splint. The splint can then be removed. The abutments can be attached and connected to the implants at the defined position using a registration template. To avoid any discrepancy, no fewer than two abutments should be connected at the same time. The parallel positioning of the abutments is a significant advantage of this technique. A radiological control is required to ensure that the implant and abutment are properly positioned and connected. Abutments are then covered with gold cone caps, which represent

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Received: December 07, 2021; **Accepted**: December 21, 2021; **Published**: December 28, 2021

secondary crowns, in a subsequent step. Rubber dam rings can be used to isolate the transition of the gold cone caps to the mucosa if necessary.

How to cite this article: Homes, Yolanda. "General Principles of Computer-Assisted Surgery." *Advances in Robotics & Automation* S8 (2021) : 016.