Virtual Surgical Tools for Planning Craniofacial Surgery

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BACKGROUND

Craniofacial surgeons use CT and MRI images to plan their surgery for a variety of craniofacial deformities. The process of surgical planning is based on visual inspection of these images and the patient exam. A system that would enable the surgeon to perform various osteotomies, measurements, manipulations of bony fragments and visualization of the results in a virtual environment prior to surgery would allow for customized surgeries, optimal results and reduced operating time. In addition, such a tool would be beneficial for teaching unusual and difficult procedures that are encountered only at major referral centers.

PURPOSE

The development of a computerized surgery planning system that incorporates available patient data into a realistic 3-dimensional virtual environment.

METHODS

Custom software was developed, to transform patient CT and MRI data into high quality 3 Dimensional images of bones and soft tissues. These images were incorporated into a virtual environment consisting of a custom made 3D display technology, consisting of a high end CRT Sony projector and a back-projection screen. A user wearing tracked shutter glasses is able to view 3-D models that appear as realistic objects floating in front of the screen. Interaction with the images is accomplished using a dataglove, enabling natural hand gestures to be used for the manipulation of virtual objects. A selection of surgical instruments was digitized using a 3D laser scanner. The surgeon is able to interact with this 3-D environment for preoperative planning as well as teaching. Application of soft tissue modeling techniques allows the soft tissues to conform to the underlying...
RESULTS

We were able to develop 3-dimensional high quality soft tissue and bony images from existing CT scans. A virtual reality surgical environment was also developed, allowing the surgeon to use these images in order to better understand the problem and "practice" the proposed procedure. This system has been applied for a group of select patients with difficult congenital malformations. With further development we anticipate the use of this system routinely for most of the patients.