PAPERS

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 surgicalplanning is based on visual inspection of these images and thepatient exam. A system that would enable the surgeon to performvarious osteotomies, measurements, manipulations of bony fragmentsand visualization of the results in a virtual environment priorto surgery would allow for customized surgeries, optimal resultsand reduced operating time. In addition, such a tool would bebeneficial for teaching unusual and difficult procedures thatare encountered only at major referral centers.

PURPOSE

The development of a computerized surgery planningsystem that incorporates available patient data into a realistic3-dimensional virtual environment.
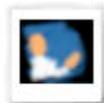
METHODS

Custom software was developed, to transform patientCT and MRI data into high quality 3 Dimensional images of bonesand soft tissues. These images were incorporated into a virtualenvironment consisting of a custom made 3D display technology,consisting of a high end CRT Sony projector and a back-projectionscreen. A user wearing tracked shutter glasses is able to view3-D models that appear as realistic objects floating in frontof the screen. Interaction with the images is accomplished usinga dataglove, enabling natural hand gestures to be used for themanipulation of virtual objects. A selection of surgical instrumentswas digitized using a 3D laser scanner. The surgeon is able tointeract with this 3-D environment for preoperative planning aswell as teaching. Application of soft tissue modeling techniquesallows the soft tissues to conform to the underlying

bony changes.

RESULTS

We were able to develop 3-dimensional high qualitysoft tissue and bony images from existing CT scans. A virtualreality surgical environment was also developed, allowing thesurgeon to use these images in order to better understand theproblem and "practice" the proposed procedure. Thissystem has been applied for a group of select patients with difficultcongenital malformations. With further development we anticipatethe use of this system routinely for most of the patients.

SLIDESHOW

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