A Novel Clinical Application of 3D Interactive Virtual Reality Technology in Pediatric Patients with Spinal Pathology

James Andrew Stadler MD; Malie K Collins MS; Samuel Henry Cheshier MD, PhD; Michael S. B. Edwards MD, FACP, FACS; Gerald A. Grant MD

Department of Neurosurgery, Stanford University

CNS 2017 ANNUAL MEETING BOSTON, MASSACHUSETTS OCTOBER 7–11, 2017

Introduction

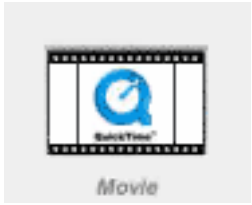
Rapid technological advances have recently allowed immersive, interactive, 3D virtual reality (VR) experiences. These technologies have already shown benefit for patient engagement, surgical planning, and education.1,2 Pediatric spine patients face challenges associated with their unique pathologies and anatomic considerations in dynamic and growing spines3. We share our institutional experience using VR in a series of pediatric patients with spinal pathologies.

Methods

A multimodality, immersive VR system was used to interact with 3D imaging reconstructions in four pediatric patients with complex spinal pathology. Patient-specific CT and MR imaging was combined as available for demonstration of bony and soft tissue anatomy. The underlying pathologies included spondylolisthesis, paraspinal sarcoma, and two osteoblastomas. The VR experience was incorporated into discussions with patients and families, and it was used for surgical planning, education, and intraoperative orientation. Immediate feedback was obtained from patients and their families about the patient experience as well as members of the surgical team to learn about the enhanced educational experience.

Results

Introduction of a VR experience in clinical, operative, and educational settings was universally well-received. All four patients and their families reported improved understanding of the pathology and surgical plan and were more engaged in the treatment plan. The surgical team members reported subjective benefit for surgical planning. All cases successfully met surgical objectives, with appropriate spondylolithesis correction and complete resection of all tumors, including en bloc resection of a multilevel paraspinal and vertebral sarcoma with clear margins. Video reconstructions of these VR experiences further show the potential in these areas.



Conclusions

We observed excellent feedback regarding an immersive VR system from patients, families, and surgeons when this technology was applied to pediatric patients with complex spine pathologies. Further research and development is warranted to quantify the benefits of VR in this population.

Learning Objectives

By the conclusion of this session, participants should be able to:

1) Describe the current state of 3D interactive virtual reality technology

2) Recognize the potential benefits of 3D VR technology for pre-operative consultations

3) Describe the benefits of this technology for surgical planning and education

References

1) Rehder R, et al. "The role of simulation in neurosurgery." Childs Nerv Syst. 2016 Jan;32(1):43-54.

2) Pelargos PE, et al. "Utilizing virtual and augmented reality for educational and clinical enhancements in neurosurgery." J Clin Neurosci. 2017 Jan;35:1-4.

3) Bohm PE, Arnold PM. "Simulation and resident education in spinal neurosurgery." Surg Neurol Int. 2015 Feb 26;6:33.