Introduction

In the past two decades alone, simulation training in the healthcare field has grown exponentially. Simulation-based medical education offers numerous advantages that can change the scope of medical education. The advantages include creating a safe, controlled learning environment, increasing the level of proficiency of performing a specific task, and bridging the gap between traditional and clinical education methods. Historic simulators were created to provide realistic patient feedback, to perform a specific task, or to prompt different clinical cases. Mixed-reality simulation was created at the Radiosurgery and Biomechanics (RIB) lab at the University of Florida (UF), combining historically created simulators to provide a combination of written notes, images, and visual cues that are critical to success in the medical field. The mixed-reality simulation was used to train the users in the virtual reality platform to track the lumbar spine model so that the virtual reality platform can track the relative positions of the physical model to the virtual x-ray generator. In this setting, the user was placed inside the virtual reality platform to track the lumbar spine model so that the virtual reality platform can track the relative positions of the physical model to the virtual x-ray generator. The user was then able to perform the task with the assistance of the virtual reality platform.

Materials and Methods

Anatomical Target Model. The mixed-reality LP simulator combines a 3-D, patient-specific physical model with a virtual reality platform. To create the 3-D, patient-specific physical model, a patient’s computed tomography (CT) and fused magnetic resonance imaging (MRI) scan of the lumbar spine was obtained. The patient was placed in a vacuum bag to create a cast of the patient’s lumbar spine. The cast was then removed from the patient, and the cast was scanned for anatomical detailing. The CT scan of the patient was used to contour the structures of interest included the lumbar spine, including L3, L4, and L5 vertebral bodies, as well as the iliac crest.

Future Work

The first generation LP mixed-reality simulator functions as expected with the haptic and visual feedback for medical students to practice LPs. Future work includes creating a second generation model, design and develop a set of pediatric models, and design and conduct a statistical analysis. The second generation model will be redesigned to allow for the anatomical target model to be replaced by different fatty soft tissue, different radiographic properties, and different anatomical anomalies. Patients with scoliosis, spinal tumors, and spinal deformities may be simulated by changing the patient’s anatomical profile. The mixed-reality technology will also be used to create a more realistic experience by providing haptic feedback as the user performs the LP. The mixed-reality simulator will be used to train medical students in the performance of LPs. The mixed-reality simulator will also be used to train medical students in the performance of LPs.