Comprehensive Research Experience for Medical Students
Summer Research Program 2019

Supervisor/Project Information Form
Due February 20 2019 by email to crems.programs@utoronto.ca

Supervisor Name: Michael Hardisty

Project Title: Virtual Surgical Simulator for Spine Surgical Decompression Procedures

Hospital/Research Institution: Sunnybrook Research Institute

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Field of Research (2 keywords): Orthopaedic Surgery, 3D simulation

Department: Department of Surgery, Division of Orthopaedics, University of Toronto. Physical Sciences Platform, Sunnybrook Research Institute

School of Graduate Studies Appointment (IMS, LMP, IHPME etc)? No

Brief Project Description (‹300 words):

Background: Surgeries aimed at decompressing neural elements remain a mainstay of spinal surgery. The skill set required to effectively carry out decompression surgery include both manual dexterity and the ability to process advanced imaging into a conceptual 3D model. Given the potential for neural complications, there exist significant barriers to residents and fellows obtaining adequate experience performing spinal surgery in the operating room; this presents an opportunity to apply virtual simulation tools.
Objective: Develop and evaluate an open-source virtual surgical simulator for spinal decompression as a teaching tool for the training of orthopaedic and neurosurgical trainees.
Methods: We have built a custom step-wise spine surgical simulator within 3D Slicer (open-source software for medical image visualization and processing). The procedural steps include fusion of CT and MRI data, bone and soft tissue segmentation, vertebrae identification, surgical planning, surgical field simulation, virtual laminectomy, pedicle screw placement (start point, screw size, and trajectory), spinal decompression by hard and soft tissue resection, and review. The simulator will be integrated into existing resident competency-based curriculum and fellowship instruction at the University of Toronto through direct interactions and rounds.

Significance: This investigation will result in a well characterized freely accessible tool for simulating spinal decompression surgery. The tool has the potential to improve the quality of

surgical training and decrease the time needed to gain competency with relevant knowledge gained prior to entering the OR.

Student Role: The student will improve the functionality of the simulator, translate the simulator to clinical staff, and develop an instructional case library. The student will ensure that case specific challenges are simulated and define the ideal virtual procedural outcomes. This will involve collaborating with both spine surgeons, specifically, Dr. Joel Finkelstein as well as engineers at the research institute. The student will test the software with residents and fellows.