

Group 21: Robotic Soft Tissue Assessment

Checkpoint Presentation

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Dr. Lee Akst, Dr. Chris Razavi



Overview

- Project Summary
- Progress
- Timeline
- Dependencies



Project Summary

- Assess and prove through expert analysis that robotic assisted laryngeal surgery is more effective than mere manual surgery

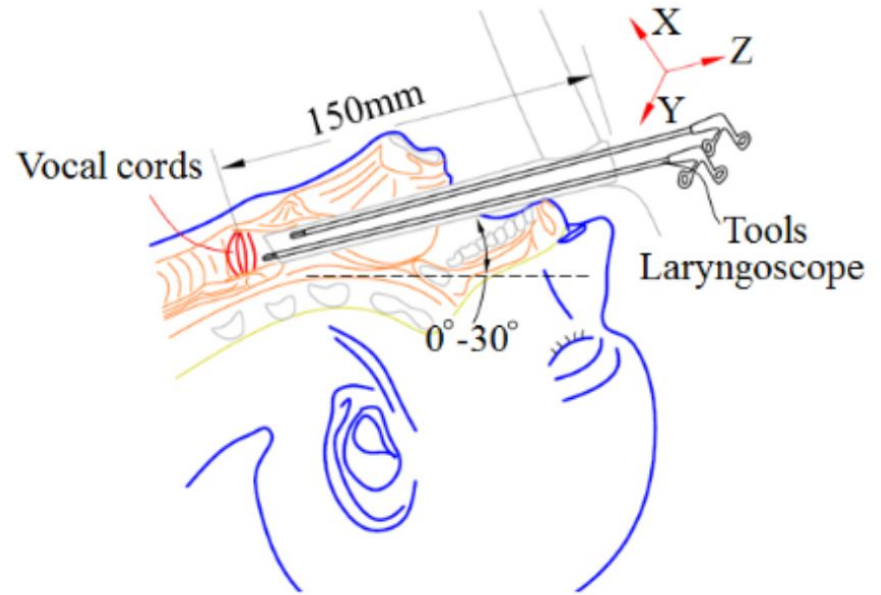
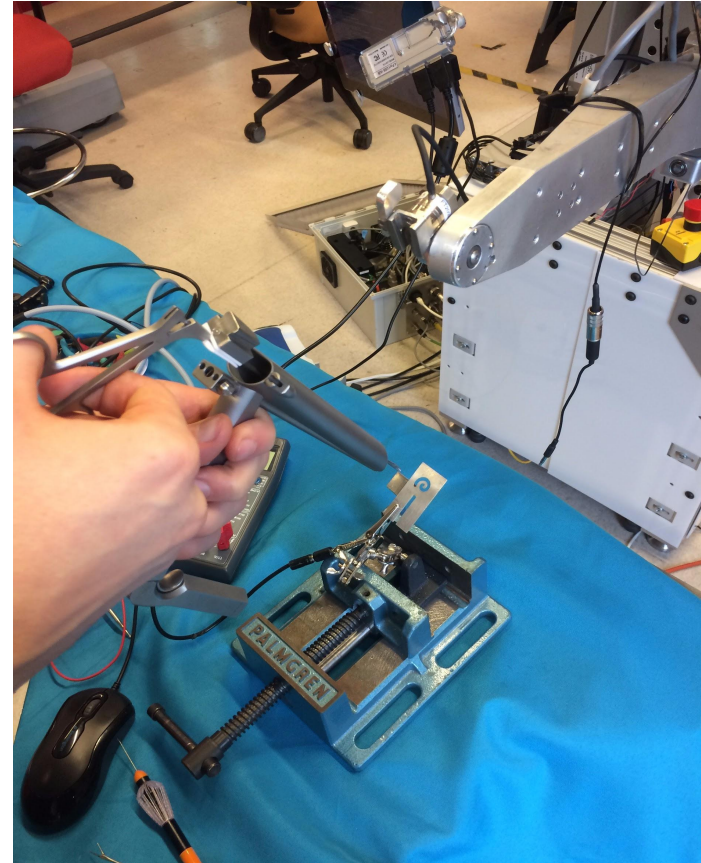


Figure 1: Microlaryngeal Phonosurgery

Project Summary

- Use GALEN robot to assist in the laryngeal cyst removal surgery in animal larynx to mimic real surgery



In discussion with mentors

Option 1:

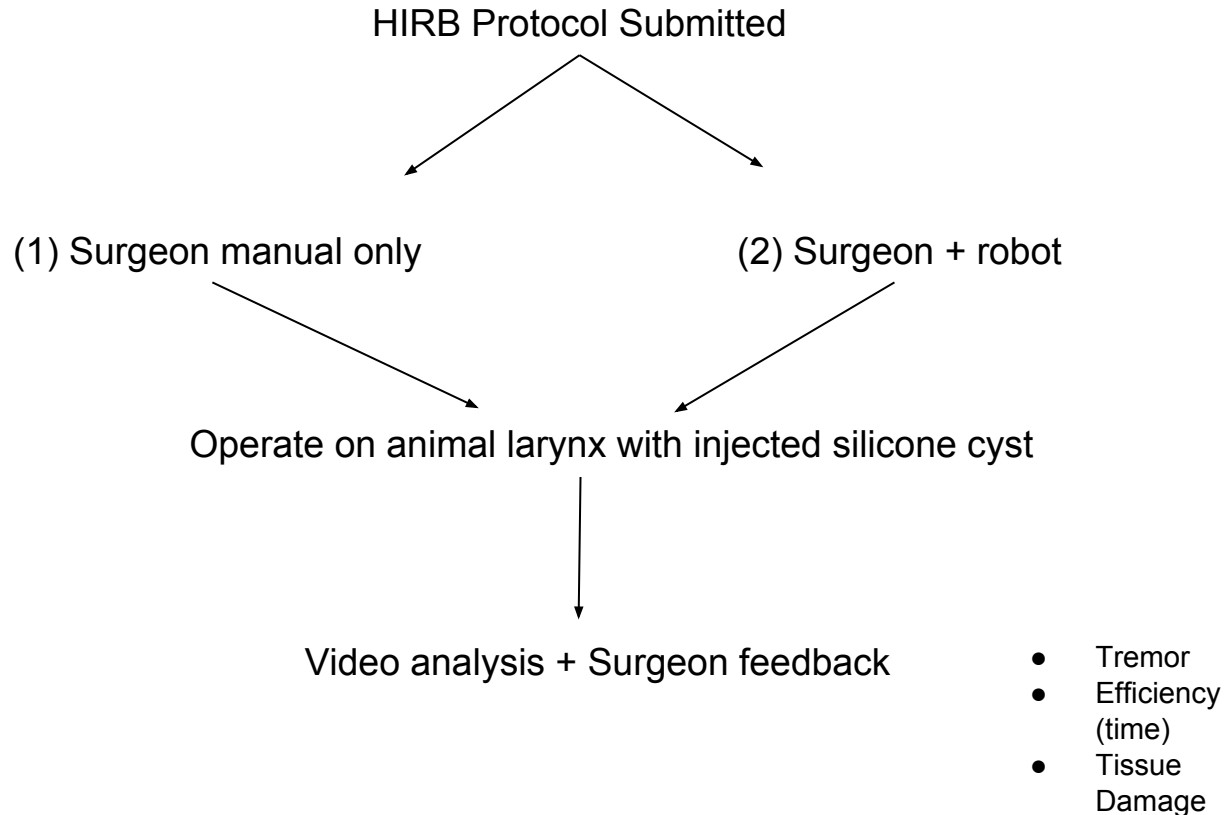
- Subjective analysis of surgery on animal larynx

Option 2:

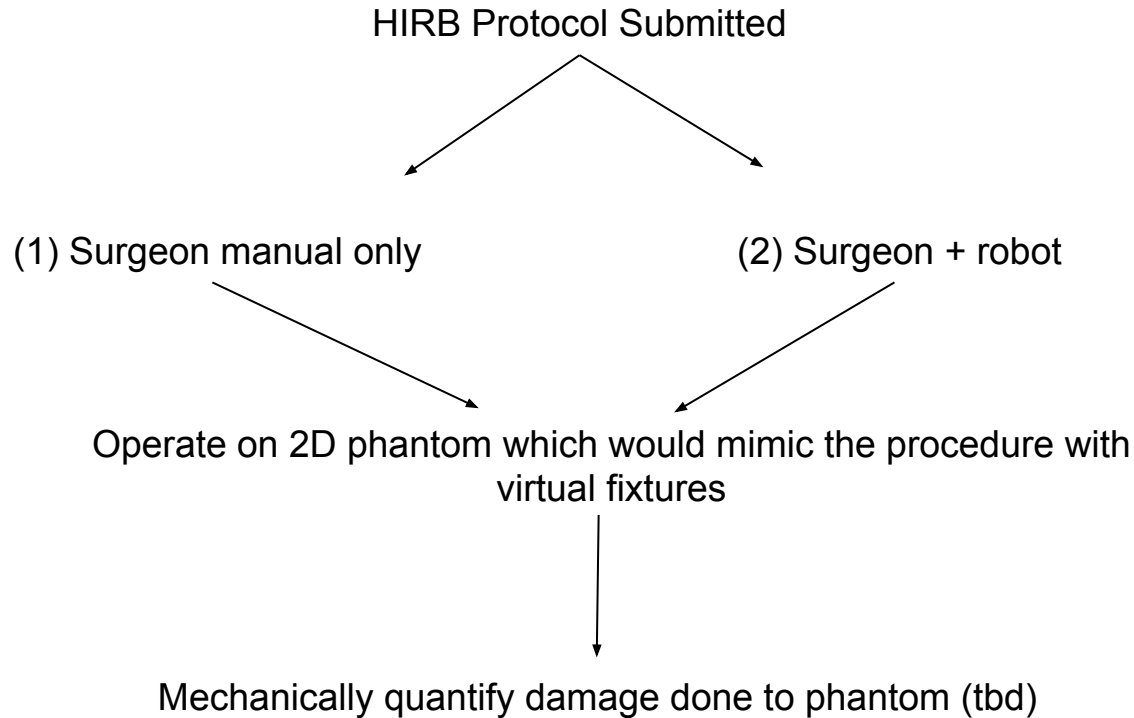
- Virtual fixture approach on 2D model to mimic a laryngeal surgery



Option 1 Details



Option 2 Details



HIRB Protocol

- Submitted draft
 - Received feedback from Dr. Akst and Dr. Taylor
 - Meeting with Dr. Taylor and Yunus between 10-11am to edit IRB
 - Phone call with Dr. Akst for final advice/touchups at 3:30pm on Friday
 - Submit Final IRB version on Friday EOB



More on HIRB

- 4 participants
 - 2 surgeons
 - 2 students
 - We believe two would be a good sample for each category
 - We also would like 2 students since we believe they would be less experienced, and may add more variability to our data



Updated Deliverables

Minimum

- I. Study design for surgery, data collection and analysis ✓
- II. Questionnaire design for tremor, efficiency (time), and tissue damage ✓
- III. Videotape of surgical experiments on animal vocal cord conducted by experts with and without robotic assistance
- IV. Results and analysis of the questionnaire filled by experts

Expected

- I. Simple video analysis algorithm using Matlab/Python to quantify tremor in vocal cyst removal surgery videotape
- II. Videotape of surgical experiments on animal vocal cord conducted by med students with and without robotic assistance
- III. Results and analysis of the questionnaire filled by experts
- IV. Results of tremor analysis in all videotapes using the algorithm

Maximum

- I. 3D virtual fixture algorithm developed for the robot using C++
- II. Study design for conducting robotically-assisted surgery with virtual fixtures
- III. Videotape robotically-assisted surgical experiments with virtual fixtures on the phantom conducted by experts
- IV. Comparison of questionnaire and tremor analysis results of non-assisted, robotically-assisted with no virtual fixtures, and robotically-assisted with virtual fixtures surgeries on the phantom



Updated Timeline

UPDATED SCHEDULE	Feb W4	Mar W1	Mar W2	Mar W3	Mar W4	Mar W5	Apr W1	Apr W2	Apr W3	Apr W4	May W1	May W2
Minimum												
Plan Presentation	█											
Design experiment procedure	█	█										
Discuss experiment options w/ experts		█	█	█	█	█						
Prepare and submit HIRB forms					█	█						
Project Checkpoint Presentation						█						
Setup expert meetings							█					
Conduct surgery with experts								█				
Conduct questionnaire on surgery								█				
Analyze survey results								█				
Expected									█	█	█	
Develop quantitative tremor analysis algo									█	█		
Conduct surgery with med students									█	█		
Conduct questionnaire on surgery									█	█		
Quantitative analysis of the video of surgeons and med students										█		
Analyze survey and quantitative results										█		
Maximum										█	█	█
Setup expert meetings										█		
Develop VF algorithm											█	
Conduct surgery with experts											█	
Compare results with past experiments											█	
Prepare Poster												█
Project Final Presentation												█



Updated Dependencies

Dependency	Resolution
Use Matlab for video hand tremor analysis	Add a different colored dot on surgical equipment
Mock OR access	Access granted
Receive HIRB approval	In-progress: Submit on March 31
Procure animal larynx for experiment	In progress: Email sent to Yunuscan Sevimli
Get experts to conduct experiment Apr W2	In progress: Request sent to experts
Get med students to conduct experiment Apr W3	In progress: Request email to be sent on Apr W1
Get experts to conduct experiment May W1	In progress: Request email to be sent on Apr W2
Get permission to experiment with animals	Meet with Yunuscan Sevimli
ROS background for virtual fixture algorithm	Meet with Paul Wilkening



References

Jensen JB, Rasmussen N. Phonosurgery of vocal fold polyps, cysts and nodules is beneficial. *Dan Med J*. 2013 Feb. 60(2):A4577. [Medline] .

Stanković P, Vasić M, Djukić V, Janosević Lj, Vukasinović M. Vocal fold masses removal--the sub epithelial micro flap technique. *Acta Chir Iugosl*. 2008;55(4):43-7.

Schweinfurth, J., MD. (2016, March 21). Vocal Fold Cysts Treatment & Management (A. D. Meyers MD, Ed.). Retrieved February 21, 2017, from <http://emedicine.medscape.com/article/866019-treatment#d13>

D. Aarno, S. Ekvall, and D. Kragic. Adaptive virtual fixtures for machine-assisted teleoperation tasks. In Proc. *IEEE Intl. Conf. on Robotics and Automation*, pages 1151-1156, 2005.

