OUTLINE OF PROGRESS REPORT

Literature Review

Review of Ear Surgery

* Define the natural challenge inherent in trying to perform a delicate task in a small space
* Current approaches
  + Comparison Microscope vs. endoscope
    - Introduce these approaches as two distinct methods to solve the challenge described in the first bullet point
      * Microscope involves cutting away tissue to achieve space and sight lines
      * Endoscope involves going through the natural orifice etc.
  + Highlight and conclude with the benefit of endoscopic approach as it reduces invasiveness but is still a new development in the field
* Endoscopic ear surgery
  + Define the approach in detail
  + Possibly discuss specific procedures
  + Review of instruments used in endoscopic ear surgery
    - Comment on how the instruments used in TEES are taken from those available in microscopic surgery
    - Rigid, straight and curved
    - Limited access since there are regions viewable from the endoscope that the instruments can’t reach
    - Explain what specifically is limiting about the rigid instruments
      * What anatomy is “getting in the way”, where are the collisions occurring
    - Few commercial instruments exist specifically designed with TEES in mind
  + Still a young field where new advancements in instruments may be able to improve the capability and further reduce invasiveness
    - Hint at what improvement could be made to the instruments: An instrument which could vary its tip curvature may allow for access to anatomy that current instruments cannot achieve.
* Review of existing solutions to provide improved reach while minimizing invasiveness
  + Concentric tube approach
  + Not really any others? What about that paper from Kyle a while back mentioning the dVRK?
  + Imply that there are limitations with these solutions which motivates the development of a new tool, specifically a manual one, with TEES in mind

Objective/Hypothesis:

* Phase 1
  + Determine the desires of the surgeons
* Phase 2
  + Develop a new instrument to address the defined needs of the surgeons
* Hypothesis:
  + The development of a new instrument will improve a surgeon’s capability (reach) compared to existing instruments
    - Make sure this hypothesis is within the scope of your project and something you could directly test/reflect on at the end of the project

Methods:

* Phase 1: The survey
* Phase 2: Design of the tool
  + From the needs survey, a tool that can access regions viewable by the endoscope but not reachable with existing tools would add significant benefit
  + This could be achieved through the use of a tip that can take on varying levels of curvature through the surgeon’s control while in the operating field. The instrument’s design can be broken into two components: tip and handle

Tip Design

* + - Notched-nitinol tube joints provide the capability of achieving this
      * Justify the reason for selecting this joint type

Handle Design

* + - Design decisions relating to handle design
  + Defining the joint parameters of the tip
    - Mention your approach and conclude with the parameters, if this section is very brief could just put it up with the design

Results:

* + Instrument evaluation criteria

OUTLINE OF EMBC SUBMISSION:

identify that there is a need (cite my paper that has identified the need - reachability) -> prove that the tool addresses the need which is a new problem to be solved for this type of surgery - there are no other solutions -> test with the coloured targets

1. Introduction:
   * Microscopic vs endoscopic
   * Benefits of endoscopic
   * Limitations in current instruments
     1. Can’t reach, suction with other functionalities, laser fibre orientation
   * Steerable instruments
   * Wrist
2. Instrument design
   1. Tip design
   2. Handle design
   3. Functionalities
      1. reach
      2. suction
      3. laser fibre
3. Validation Testing of the Instrument

\*this can be done by Dr. James, Dr. Cushing, Dr. Pothier (??) and Gavin who would be co-authors -> don’t need REB

* 1. Reach
  2. Suction
  3. Laser fibre

1. Discussion: