MRI Stabilization Device
Design Team

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BME 4950

Needs Assessment and Solutions

• Air-inflatable or memory foam materials
• MRI compatibility:
  • Needs to be fabric
  • Cannot be metal
• Possible designs:
  • Full body suit – only inflate the parts of interest
  • Individual sleeve, neck brace, leg sleeve, etc.
  • Specialized design for patients that move involuntarily: babies, children, epileptic patients
• Why does movement during an MRI matter?
  • Accurate alignment of internal registration points
• Need to figure out the maximum movement allowed in order to still obtain accurate images and avoid reimaging
• Important to note: MRIs for individual parts available – aka you don’t have to undergo the lay-down, tube MRI in order to get an MRI done over your hand for example
• This device will not only restrict physical movement, but it will also serve as a mental reminder to the patient not to move

Research

Why is the restriction of motion during an MRI scan important?
“Motion artifacts result from excessive patient movement during the data acquisition phase and typically cause the signal to be misregistered during reconstruction. Misregistration in effect disperses portions of the image, causing overlap between regions or loss of portions of the image altogether. Therefore, imaging features not only become blurred but also may appear as superimposed ghosts on adjacent or regional voxels” (Ali et. al., 2013)
The prevalence of voluntary patient motion during MRI scans and the associated costs:
“A total of 192 completed clinical examinations were reviewed. Significant motion artifacts were identified on sequences in 7.5% of outpatient and 29.4% of inpatient and/or emergency department MR examinations. The prevalence of repeat sequences was 19.8% of total MRI examinations. The base-case cost estimate yielded a potential cost to the hospital of $592 per hour in lost revenue due to motion artifacts. Potential institutional average costs borne (revenue forgone) of approximately $115,000 per scanner per year may affect hospitals, owing to motion artifacts (univariate sensitivity analysis suggested a lower bound of $92,600, and an upper bound of $139,000)” (Andre et. al., 2015)

Progress

Items Planned
- More research
- Order components needed for preliminary prototype
- Meet again with sponsor
- try to determine total cost of final project
- Start working on prototype

Accomplishments
- Very productive meeting with sponsor
- developed strategy for development
- discussed business opportunities associated with project
- began to think about material use
- gained understanding of ultimate project needs

Areas of Difficulty
- Limited human resources since our team only has 3 members
- Difficulty of being held to 2 different grading standards in terms of mech e and BME
- Unreasonable expectations by Mech E department for prototype considering difficulty of biomedical device building
- lack of understanding by mech e department

Meetings
- Team meeting with Dr. Walker and our sponsors
- Incredibly productive
- So happy to have such a great sponsor who cares so much, looking forward to working with her/ getting to know her better

New Resources Needed
- Materials for building and testing equipment for pressure
Feedback from Design Instructors
• There needs to be a better understanding by Mech E department of how BME projects are structured and why they cannot be held to the same deadlines as Mech E projects

Biggest Discoveries
• Amazing need for such a product and how much money, time, and energy it could save for patients, providers, and hospitals

Log of Hours
• 16 hours – Researched more on technology, and compiled a document of goals, objectives, needs, and information regarding pressure and materials, etc., reached out to sponsors, held group meeting to discuss first prototype
• 5 hours – Ryan Rothstein
  Reached out to sponsors, met to generate ideas
• 5 hours – Patrick Wieckowski
  Met to generate ideas
• 8 hours – Christina Senia
  Researched more on technology, and compiled a document of goals, objectives, needs, and information regarding oxygen concentrators, solar cells, etc.

Funds
  • N/A

References