

Product Design Specifications

MRI Exercise Device

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Function

This Project is designed to develop a device to allow researchers to observe blood vessel diameter, along with middle cerebral arterial velocity, of a patient during steady-state exercise. In order to observe these conditions, Magnetic Resonance Imaging (MRI) must be used, which limits the materials and mechanics of the device. In particular, we plan to construct a device that allows a patient to maintain upper body stabilization during continuous exercise while inside the MRI machine.

Client Requirements

- The device has to be MRI-safe
 - It cannot contain ferromagnetic materials
 - Has to fit on MRI bed
- Withstand frequent use
- Provoke a raised heart rate for an extended period of time
- Fit a wide range of patient heights
- Minimize head and upper chest movement

Design Requirements

1. Physical and Operational Characteristics

- Stability:* Device must minimize head and upper body movement, while legs are free for peddling/cycling movement.
- Life in Service:* Ideal for the device to last 3 or more years with frequent use.
- Operating Environment:* The device will be used in an MRI machine, so no ferromagnetic materials (containing iron, cobalt or nickel).
- Size:* The device must fit on the MRI bed; Board has to accommodate individuals between 5'4" and 6'4" tall.
- Exercise:* The device should allow for steady-state, dynamic exercise for a period no shorter than 8 minutes, generating a heart rate of 120-130 beats per minute.
- Versatility:* Device must accommodate
- Ergonomics:* Device should be comfortable, allowing a wide range of motion for lower body, while minimizing strain on hips and ankles.

2. Production Characteristics

- Quantity:* One prototype should be constructed.
- Target Production Cost:* Up to \$1000.

3. Miscellaneous

- Customer:* The primary customers are our clients; their main concern is to observe arterial diameter changes in patients during continuous dynamic exercise.
- Competition:* There are current MRI exercise devices, however, the one known brand is very expensive. Our goal is to greatly reduce the production cost, while maintaining function.