Preventing Disuse Muscle Atrophy in Bedridden Children

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Disuse muscle atrophy, the decay and loss of muscle due to inactivity, can lead to a 10% decrease in mean muscle fiber cross sectional area within four days of limb immobilization\(^1\). This poses a significant problem for hospitalized, bedridden children as it impedes their ability to recover and return to normal life. Current muscle atrophy prevention methods can be expensive and inefficient; for example, nurses commonly flip over and move their patients, but this does little to prevent strength decay.

A way to prevent muscle atrophy in children under long-term hospital stay to preserve walking capabilities and maintain patient self-efficacy and well-being.

Must-Have:
- Can be used on bedridden patients
- Easy to administer (<1 hour teaching session)
- Adjustable size settings (can account for height difference of 4 + or - 2 feet)
- Adjustable difficulty (example: 0 to 25 pounds of force)
- Trains muscle groups used for walking (hamstrings, quadriceps, calves)
- Enjoyable to use (rewards patients in a tangible way)

Nice to Have:
- Administerable by patient (user does not need outside aid)
- Comfortable
- Lightweight (<10 lbs)
- Non-injury specific use (can be used with little focus on)
- Universal settings (can be used by anyone, regardless of height or difficulty)
- Trains finer or smaller leg muscles (improves balance of patient)

Electrotherapy Units
- Fairly low cost
- Ineffective without physical activity
- Uses shocks to stimulate muscles

Concept Analysis

Braking-Resistance System

Sticker Dispenser

System Block Diagram

Because prototyping is still in progress, the effectiveness of our device is yet to be determined. However, we are optimistic as recent studies have shown that early exercise is beneficial to hospitalized patients, even those under critical care\(^2\). While the rowing machine worked as expected, moving forward, we hope to add more complex systems to our rowing machines, including electromagnetic resistance and data tracking. Designs such as these would help increase the user's ease-of-use and feedback.

References

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