Improved Rehabilitation Walker
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Introduction
Neuroworx® is a nonprofit organization that offers rehabilitation to patients who have suffered spinal cord injuries (SCIs). A key piece of equipment used in this rehabilitation process is a TheraGait™ Gait Trainer (Figure 3). This gait trainer does not meet all of the needs of the Neuroworx® therapists and patients.

Problem Statement
The current rehabilitation walker used lacks key functions needed by the Neuroworx® therapists in order to rehabilitate their patients. These functions include a single-sided height adjustment system, a bilateral adjustment system, movable grips, anti-scissor walking system, and a therapist seat.

Design Requirements
• Support a 300 lb Patient
• Easily adjustable vertical and horizontal systems that lock
• Single-sided height adjustment system
• Movable grips/armrests that are ergonomic/comfortable for patient
• Directional locking wheels
• 60-70lbs walker weight without seat

Methods
To calculate the size of the frame needed, along with the range of adjustability for the bilateral adjustment system was found using ergonomic principles and tables. These values allow adjustment range from the 5% female to the 95% male in terms of height and width. This method allows for 95% of all patients to theoretically be accommodated.

Solidworks was used to find the stresses placed on the sliding channels (3), specifically the lower channel which had holes drilled to create 0.6” adjustability increments (Figure 2). A simulation was also performed on the bilateral adjustment system (Figure 4) to determine if the aluminum tubing would support the weight of the patient.

Results
Based on the Solidworks simulations the material chosen performs to the desired specification to support a 300lb patient. Fiberglass C channels were initially used instead of square aluminum tubing but due to significant torsion while trying to raise the height of the arm rests required a material change.

The square aluminum tubing is light enough that it does not sacrifice the lightweight requirement of the upper frame while still giving increased resistance to torsion and bending due to aluminum’s material properties exceeding those of the fiberglass.

Fully Assembled Improved Rehabilitation Walker Details: Figure 1

Frame (1)
The frame was constructed from fiberglass, and steel Unistrut® C channels along with square aluminum tubing. These materials were selected in combination to support the patient while still remaining light weight. Unistrut® C channels have numerous standardized attachment sections which made assembly easier.

Directional locking wheels were attached the walker which while locked only move in a single direction, otherwise they can rotate and move freely. Single direction movement allows the therapists to guide the patient without the patient being able to move the walker bilaterally if they stumble.

Height Adjustment System (2&3)

US General® trailer jack (2) which can lift and support 3500 lbs was modified to achieve single sided adjustment. The trailer jack is self locking due to a bevel gear system inside. The original handle was replaced with a hand wheel which offers ergonomic benefits to the user.

The sliding channel section (3) opposite of the trailer jack uses both fiberglass and steel Unistrut® in combination with Unistrut® rollers to provide

Bilateral Adjustment System (4)
The bilateral adjustment system allows for patients of different sizes to be accommodated by the use of aluminum tubing. The system is adjusted by rotated the aluminum tubing, which can be locked when the desired position is achieved.

Moveable Grips/Armrests (5)
Promoting arm movement in combination with leg movement accelerates patient rehabilitation. Fiberglass C section along with steel rollers (Unistrut®) were used to allow the armrests to move forward and backward with the motion of the patient’s arms.

Anti-Scissor Walking System (ASWS)
Patients who suffer from SCIs often perform an action during rehabilitation known as scissor walking. This is the act of crossing one’s legs as they walk. Multiple Elastic cords were used to allow for adjustable ranges of tension due to patients having varying degrees of scissor walking.

Therapist Seat
When a patient is being rehabilitated two therapists assist the patient; one pushing the walker for the patient, the other in the front of the walker to oversee the movement of the patient’s gait. The therapist seat allows for the therapists a more ergonomic position while assisting the patient.