Thigh Walker: Assistive Mobility Device for Pediatric Patients with Lower Limb Injuries

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Need

User and Problem

- Children under the age of 7 are unable to use crutches due to underdeveloped motor coordination
- Parents are required to carry around the child as the limb should not bear weight

Current Limitations

- Crutches- not able to be used by the targeted age group
- Walkers - inability to use stairs

Objective

Create a device that is height adjustable, portable, lightweight, able to be used on different floor types and stairs, and able to bear the full weight of the user

Existing Solutions

Crutches

Pediatric Walker

Gait Trainer

Walking Belt

Design Inputs

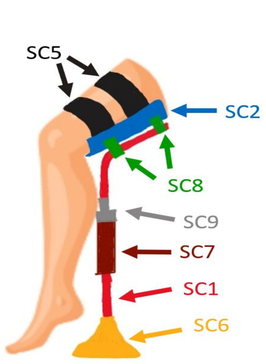
Constraints

Device Weight	Dimensions	Knee Angle
< 6.58 lbs	61.7 x 44.2 x 23.6 cm	< 15°

Requirements

Friction	Stair Ability	Load	Adjustability
μ ≥ 0.202	17.8 x 27.9 cm	> 515.47 N	100.1 - 130.7 cm

Prototype



SC1
- ¾" OD Metal Tubing
- Main Support of Device

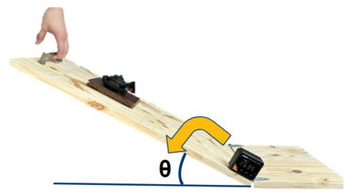
SC9
- Adjustable Clamp
- ¾" Tube → 1" Tube

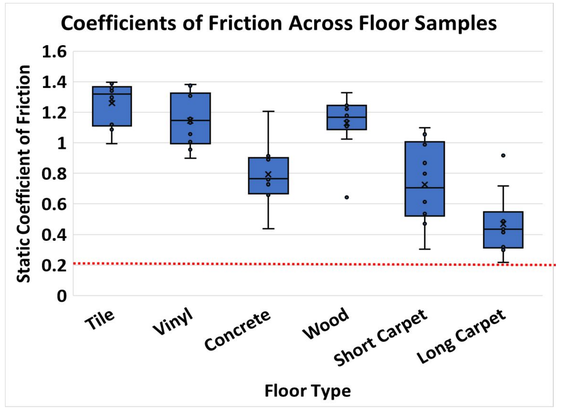
SC6
- 60° Bending Base Joint

Verification/Validation

Friction Testing

- Evaluate coefficient of friction at slippage
- Two-tailed t-tests show $\mu_s \neq 0.202$
- Confidence intervals infer $\mu_s > 0.202$





Geometric Modeling

- Study human geometry required to traverse the stairs with a side swing
- Make calculations and drawings by hand
- Passing Criteria
  - Forward hip angle < 120°
  - Side hip angle < 50°

Component Load Bearing

- Ensure device bears weight of children at various heights
- Apply weight of child to test deformation
- Passing Criteria
  - No deformation at < 515.47 N

Conclusion and Impact

- Developed a novel device that allows kids with leg injuries to move on their own
  - Restoring independence to children
  - Reducing burden of caretakers
  - Improving overall standard of health care

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References:

[1] Loh et al., 2020