

Gait Trainer with Treadmill

Team Members:

Meghan Kaminski - Team Leader

Isabelle Counts - BSAC

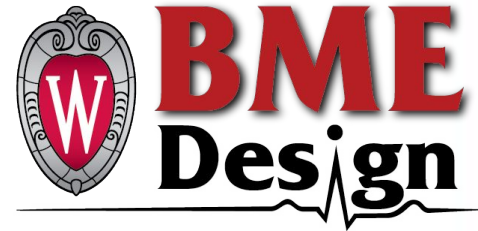
Jacki Szelagowski - Communicator

Kalob Kimmel - BWIG

Navya Jain - BPAG

Client: Amanda Pajerski and Nicole LaBonte

Advisor: Dr. Megan Settell



Overview

- Client Description
- Problem Statement
- Background Research
- Competing Designs
- Product Design Specifications
- Preliminary Designs
- Design Matrix
- Conclusion
- Future Work



Client

Amanda Pajerski: Occupational Therapist -
Continuum Therapy

Patient: Neurological Disorder prone to seizures





Problem Statement

- Gait trainers are used to assist and support those with mobility impairments.
- Due to the weather, it is difficult to utilize the gait trainer outside in the winter.
- Lack of access may lead to significant damage to physical and mental health.
- Utilizing a treadmill during the imperfect weather conditions would allow for increased mobility and less drastic damages to the overall health of the client.



Background Research

- The Ictal phase of a seizure correlates with electrical seizure in the brain. Symptoms include loss of consciousness, lack of movement, and tremors.[1]
- Walking provides those with mobility impairments increased physical and mental health.[2]
- Rifton Gait Trainer has a harness and the forearm supports users weight[3]
- The Horizon T101 dimensions 71" x 34" x 57" [4]

Competing Designs

- Body-Weight Support Treadmill Gait Training System
 - Sling and harness control to reduce bearing capacity[5]
 - Electrical point control operation[5]
- LiteGait 4 Home
 - Adjustable overhead straps and harness design[6]
 - Attachments available to include versatility of device[6]
 - Detached from treadmill[6]



Figure 1. Body-Weight Support Treadmill Gait Training System



Figure 2. Body- LiteGait 4 Home



Product Design Specifications

Design Constraints and Specifications

- Support client for 15 minutes at 1-3 mph increments
- Follow ADA ramp recommendations[7] and FDA requirements
- Emergency unlocking procedure in case of a seizure
- Withstand the force of a 30 year-old-woman with the approximate weight of 174.9 lbs[8]
- Withstand various temperatures[9] and last for 10-15 years[10]
- Compatible with the Rifton Pacer Gait Trainer 2022[3]
- Budget: \$500



Design 1: Evaluation

- Benefits:
 - No permanent adjustments to treadmill and gait trainer
 - Gait trainer secure to treadmill to allow client safety while walking
 - Less chance of failure due to size and bulkiness
 - Less attachments to treadmill
 - Ease of fabrication
- Constraints:
 - Difficult to remove from treadmill
 - Difficult attachment to treadmill
 - Bulkiness in size



WISCONSIN

MADISON

1848

1848

1848

1848

1848

1848

1848

1848

1848

1848

1848

1848

1848

1848

1848

1848

1848

1848

Design 2: Ramp and Tracks Disconnected Design

- 3 separate pieces
- Raised and lowered areas on tracks for wheel alignment
- Tracks attach to treadmill at various points with screwable C-Clamps
- Ramp screws into and out of tracks

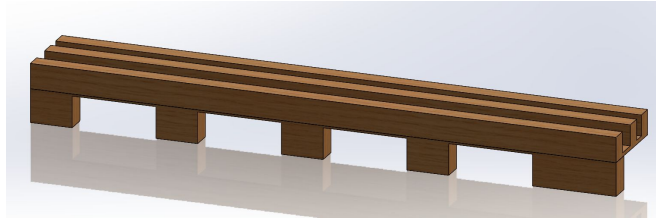


Figure 5. Side view of track



Figure 6. Ramp portion of design

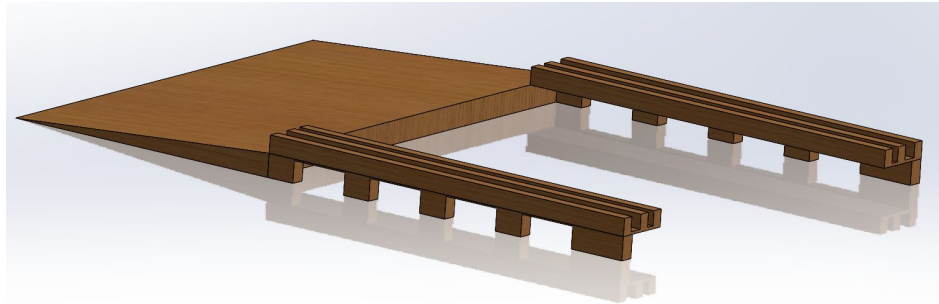


Figure 8. Ramp and Tracks Disconnected Design



Figure 7. C-Clamp used for attachment

Design 2: Evaluation



- Benefits
 - Easy to Install & Uninstall
 - Easily Maneuverable (3 separate pieces)
 - Tracks can be left on treadmill when not in use
 - Saves Space
 - No permanent adjustments to treadmill or Gait Trainer necessary
 - Keeps Gait Trainer securely on treadmill
- Constraints
 - Requires ramp to be attached & detached everytime treadmill is used
 - Slightly more difficult to fabricate

Design 3: Altered Gait Trainer

- Large wheels extend outward from current gait trainer to fit around the treadmill base
- Wheel attachment is screwed into current gait trainer base
- Larger radius of wheels will raise and support entire gait trainer to hover slightly above treadmill belt.
- Attachment made out of the same materials of steel and aluminum as current gait trainer

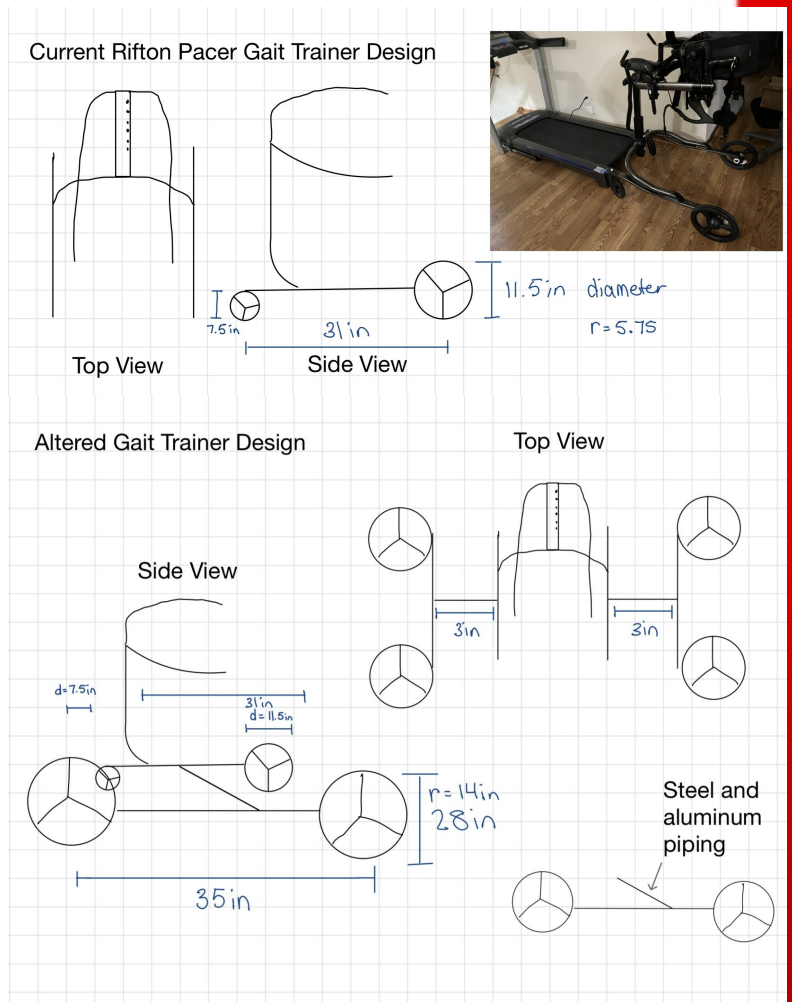


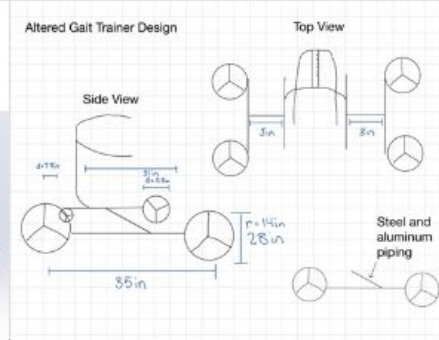
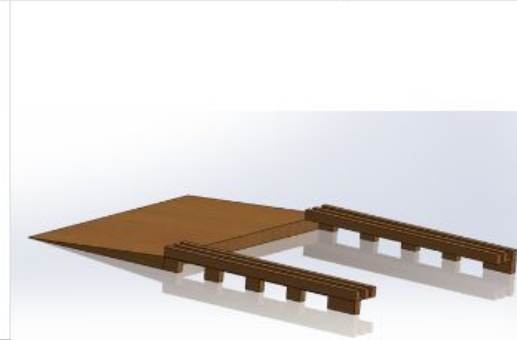
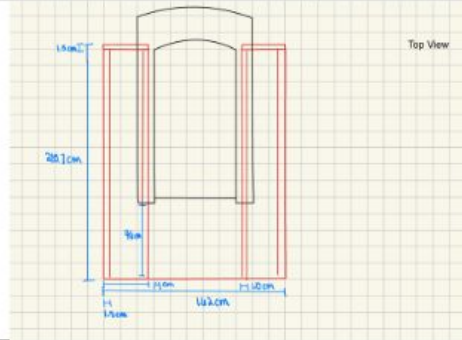
Figure 9. Altered Gait Trainer Design sketch

Design 3: Evaluation

- Benefits
 - Treadmill does not need to be modified
 - Can be used on any standard size treadmill
- Constraints
 - Difficult fabrication
 - Add threads to current gait trainer base
 - Steel tubing needs to be welded together
 - Unable to add attachment while gait trainer is in use



Design Matrix



	Design 1: Ramp and Tracks connected		Design 2: Ramp and Tracks disconnected		Design 3: Altered Gait Trainer	
Criteria (weight)	Score	Weighted Score	Score	Weighted Score	Score	Weighted Score
Safety (25)	4/5	20/25	4/5	20/25	2/5	10/25
Ease of Use (30)	3/5	18/30	4/5	24/30	2/5	12/30
Cost (10)	4/5	8/10	4/5	8/10	2/5	4/10
Ease of Fabrication(15)	4/5	12/15	4/5	12/15	2/5	6/15
Durability (20)	4/5	16/20	4/5	18/20	2/5	12/20
Sum		74/100	Sum	82/100	Sum	44/100

Table 1: Design Matrix

Conclusion

- Between the 3 designs we chose the disconnected ramp and track system
- All materials chosen must have a high yield stress and strain
 - Must withstand the weight of the gait trainer and client
 - Must have long durability
- Ease of use and durable solution
- Ease of fabrication
- Encompasses emergency unlocking procedure effectively

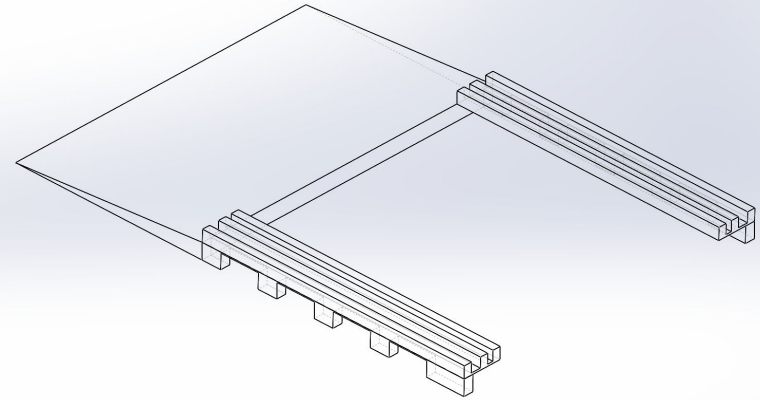


Figure 10. Ramp and Tracks Connected Design

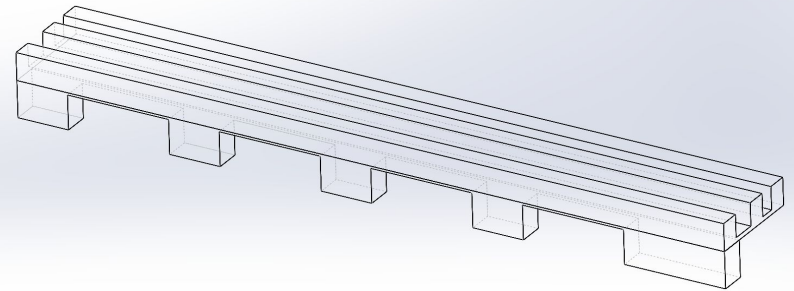


Figure 11. Track portion of ramp and tracks design



Future Work

- Finalise emergency unlocking system
- Purchase materials for ramp and tracks and begin prototyping:
 - Treated lumber[11]
 - Silicone role or rubber furniture stoppers
 - C clamp
 - Anti-slip tape
- Create and execute material durability and strength tests

Acknowledgements

Dr. John Puccinelli

Dr. Megan Settell

Amanda Pajerski and Nicole LaBonte

BME Department and Faculty



References

- [1]“What Happens During a Seizure?,” Epilepsy Foundation. <https://www.epilepsy.com/what-is-epilepsy/understanding-seizures/what-happens-during-seizure>
- [2]Pattamon Selanon and Warawoot Chuangchai, “Walking activity increases physical abilities and subjective health in people with seven different types of disabilities,” *Frontiers in Public Health*, vol. 11, Jun. 2023, doi: <https://doi.org/10.3389/fpubh.2023.1120926>.
- [3]<https://www.facebook.com/Rifton> and <http://www.facebook.com/Rifton>, “Rifton Pacer gait trainer, a durable and fully adjustable medical device.,” Rifton.com, 2024. <https://www.rifton.com/products/pacer-gait-trainers>
- [4]“Horizon T101 Treadmill | 2020 Best Buy | Horizon Fitness,” www.horizonfitness.com. <https://www.horizonfitness.com/horizon-t101-treadmill>
- [5]M. Equipment, “Professional Body-weight Support Treadmill Gait Training System,” *Physiotherapy Equipment And Rehabilitation Equipment Supplier*, Apr. 30, 2021. <https://sunshinecuring.com/gait-training-equipment/body-weight-support-treadmill-gait-training-system.html>
- [6]“LiteGait,” *Litegait.com*, 2024. <https://www.litegait.com/product/lg4home>
- [7]“U.S. Access Board - Chapter 4: Ramps and Curb Ramps,” www.access-board.gov. <https://www.access-board.gov/ada/guides/chapter-4-ramps-and-curb-ramps/>
- [8]“What Happens During a Seizure?,” *Epilepsy Foundation*. <https://www.epilepsy.com/what-is-epilepsy/understanding-seizures/what-happens-during-seizure>
- [9]“Design Considerations for Maximum Temperature per IEC Safety Standards,” Advancedenergy.com, 2021. <https://www.advancedenergy.com/en-us/about/news/blog/design-considerations-for-maximum-temperature-per-iec-safety-standards/> (accessed Sep. 19, 2024).
- [10]Rehabmart.com, “Stepless Wide Portable Wheelchair Ramps,” Rehabmart.com, 2024. https://www.rehabmart.com/product/stepless-wide-plain-portable-wheelchair-ramps-50867.html?srltid=AfmBOoqUyUqrbXVKoQONtKWT1ZY5oVrIVcunXetM77n6jFx-cF_vnCcL (accessed Sep. 19, 2024)
- [11]Brij, “What is Treated Wood? Its Advantages and Disadvantages,” *Timber Blogger*, Aug. 11, 2020. https://www.timberblogger.com/what-is-pressure-treated-wood/#google_vignette (accessed Oct. 04, 2024).



Questions?

