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A Rehabilitative Engineering Application Using a Shock Absorbing Crutch Tip.

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Disclosure – Anthony Spatorico

No relationships to disclose.

Shock Absorbing Crutch Tip - Collaborators

University of South Carolina

Professor Anthony Reynolds - ***Molinaroli College of Engineering***

Professor Joshua Gray - ***Molinaroli College of Engineering***

Professor Geoffrey Graybeal - ***Darla Moore School of Business***

Professor Amanda Ward **-** ***Arnold School of Public Health***

- Physical Therapy - "Patient Testing"

University Of Pittsburgh

Dr. Brad Dicianno - ***Director, Physical Medicine and Rehabilitation***

- Formal Clinical Trials - Spina Bifida Patients

Shock Absorbing Crutch Tip

Question: Does a Shock Absorbing Crutch Tip have the potential to reduce fatigue and muscle strain for individuals that require the long-term use of crutches for mobility e.g. spina bifida, muscular dystrophy, spinal injuries? This study explores the possibility through:

- Engineering Perspective.
- Medical Efficacy.
- Patient Comfort.
- Value Proposition.

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Executive Summary

- **Prototype Design**
  - **Phase I - Analytical Testing**
    - **Work of compression – Force times Displacement.**
    - **Jerk - Change in acceleration with time.**
    - **Impulse - Change in Momentum with Time.**
    - **Peak Force – Max value in Force vs. Time Curve.**
    - **Yank - Derivative of Force with Time.**
  - **Phase II - Patient Trials**
    - **Arnold School of Public Health, USC (Physical Therapy)**

- **Results and Conclusions.**
- **Limitations.**
- **Future Studies.**

Shock Absorbing Crutch Tip

Phase I - Prototype design and evaluation

Crutch Tip - Closed Cell Foam

- Latex Free Formulation
- Large Diameter Base
- Light weight
- Durable

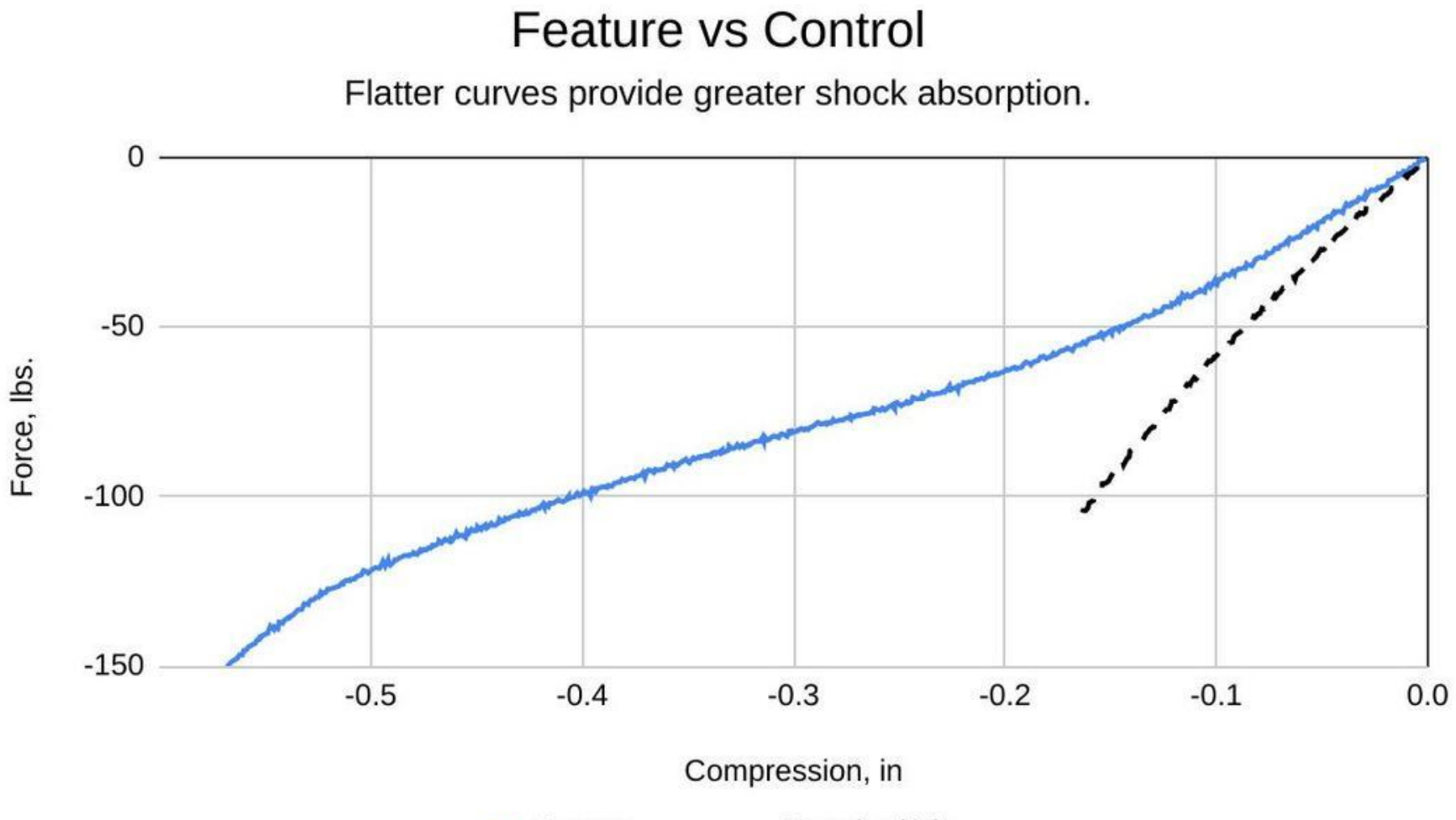
Easy to Install

Hooke's Law: F=-kx

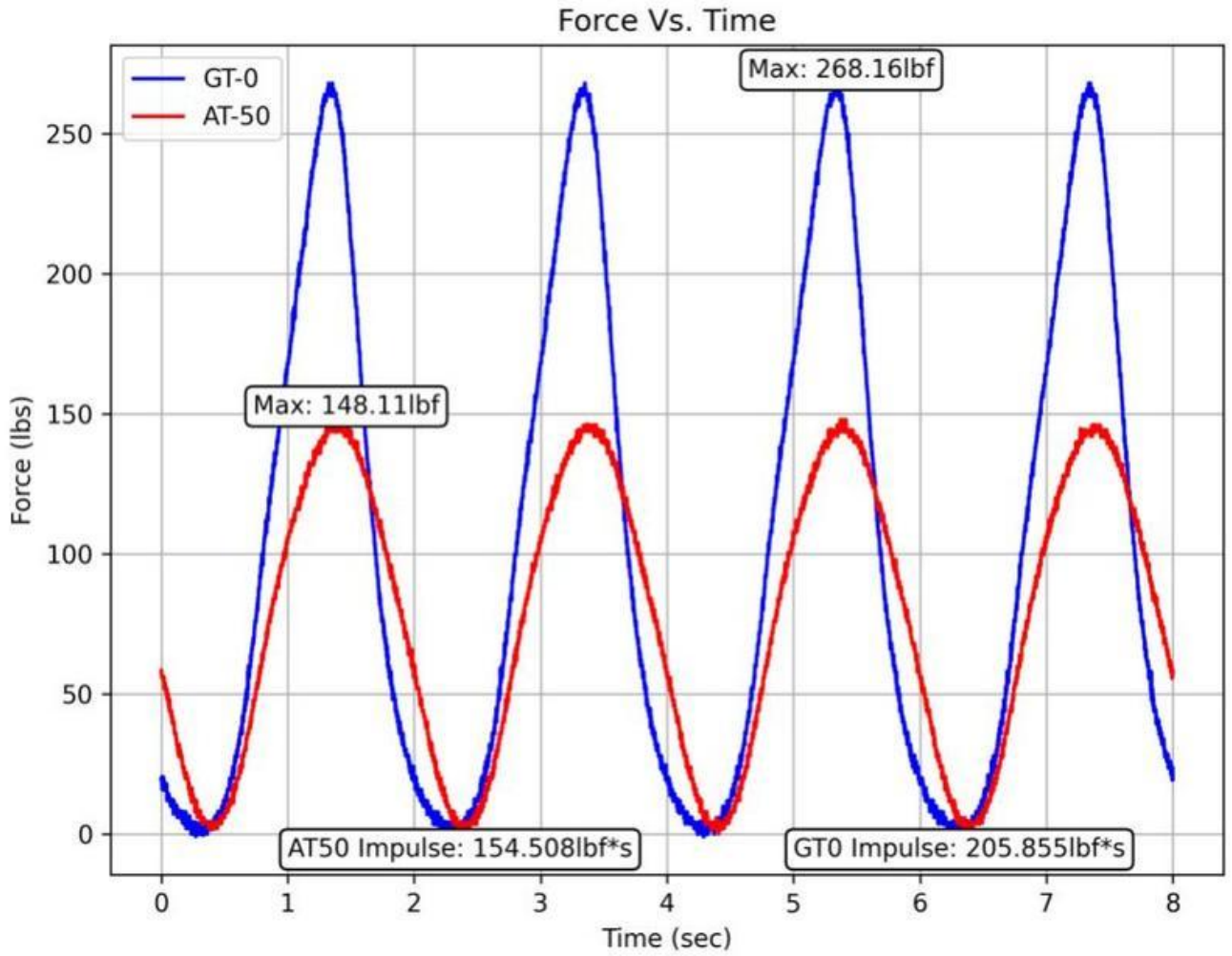
Helical

Wave

Compression Curve: Force vs. Displacement

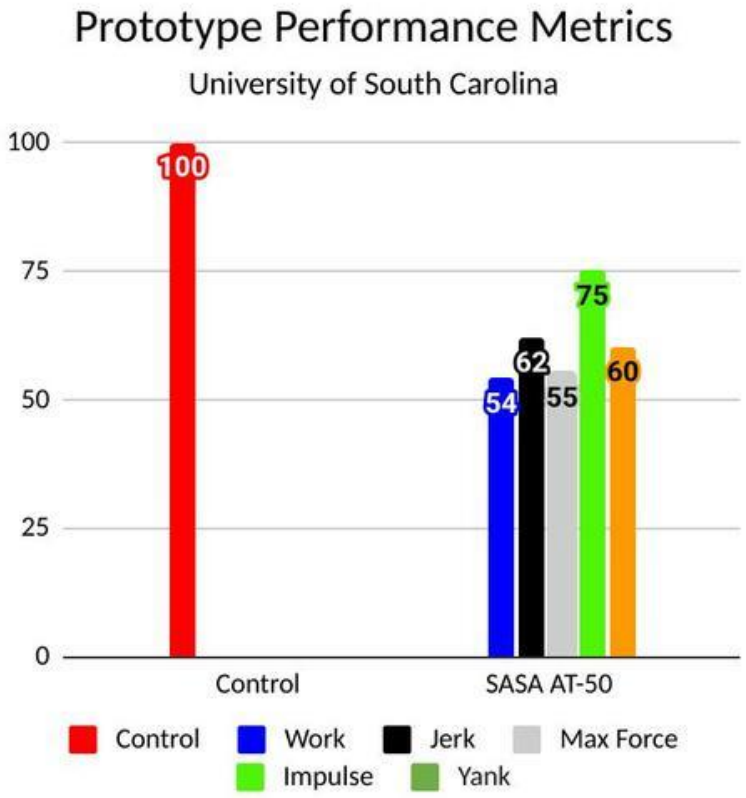


Compression Curve: Force vs. Time



Shock Absorbing Crutch Tip - Results

Prototype exhibits shock absorbing properties from an engineering perspective.



- **YES, 5 metrics evaluation.**
- Medical Efficacy. **Probably, patient trials underway.**
- Patient Comfort. **Positive response in all cases.**
- Unique Design. **US Patent 11,712,394** (8/1/2023)

Work - Force X Distance
Jerk - Change in Acceleration with Time.
Max Force - Peak magnitude in Force/Time curve.
Impulse - Change in Momentum-Time curve.
Yank - the Time derivative of Force.

Limitations – Laboratory Studies

- All tests performed in vertical, “Z”, direction.
- Controlled, “Idealized” conditions.
- Results offer insight, subject to “patient” evaluation.

Future Studies

Engineering - computer modeling to optimize design.

PHASE II - Arnold School of Public Health (**Physical Therapy**).

- 10-meter walk.
- 3-stair climb/descent.
- Comfort index.

Thank You

If you have comments, questions, or would like additional information, please contact:

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