Background

- CHOP initiated project
  • Effects of exercise on bone-density
  • Study of pre-teens suggests correlation

- Other gauges of activity
  • Surveys are unreliable
  • Force plates impractical

- Peak force on foot is of particular interest for researchers
Solution-Pediatric Dynamometer

- In-shoe device to measure force
- Measure force using PVDF sensors
- Store data for subsequent analysis
Design of the PD

Finished
• Electronics and programming

Unfinished
• Integrated design of PD

Requirements for the design:
• Accurately measure force within 5%
• Be inconspicuous to the user
• Inexpensive and easy to produce
Basics of the PD Design

Mechanical Stress → Proportional Tensile Strain
Strain → Proportional Polarization
Polarization → Proportional Charge

Observing the generated voltage allows us to determine an unknown mechanical stress.
Potential Ideas
Testing

Periodic Motor
• Motion simulates walking
• Weight and foot simulate force

Scale
• Measure applied force, voltage
• Create sporadic forces

(above) A simulation used to test designs.

(left) Scale used to measure applied force on design
Design Results

General design established!

- uses “bridge” design
- accuracy
- comfort
Future Work

Modeling techniques to optimize design

- Width of steel
- Height of Supports
- Elastomer Stiffness
- Placement of PVDF
- Support Material
- Size of PVDF
Summary

• CHOP: Method needed to study bone growth and development of children.

• Conclusions can be drawn from an analysis of physical activity.

• Designs were tested throughout the summer research.

• Bridge-like design works best, but not accurate enough.

• Future work needs to optimize design, material properties.
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