Bone Breaker: Revoluntionizing Orthopedic Research

OsteoDynamics

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Mission Statement

Bone Breaker's purpose is to enable researchers in their discovery of new, innovative treatments that improve the diagnosis of bone fractures at the growth plate. As a team, we pledge to dedicate our skills and strengths to create a combination device that advances pediatric patient care.

Background

Skeletal injuries are common in children, with musculoskeletal injuries accounting for approximately 11.8 million healthcare visits annually in the pediatric population. While most fractures in children heal without complications, growth arrest following physeal fractures (~20% of all fractures) remains a significant challenge in pediatric orthopedics. This type of growth disturbance can lead to considerable deformities and often necessitates further invasive surgical intervention. Researchers currently have no method of producing consistent, reproducible growth plate fractures to study.

Device Concept and Design

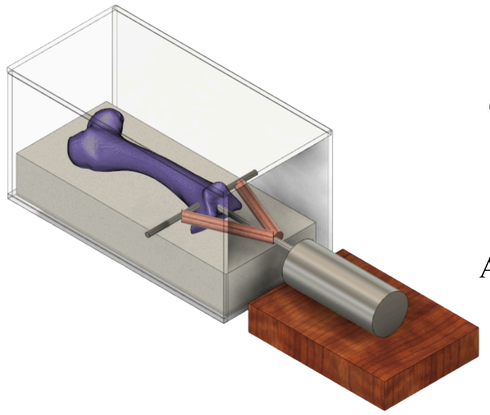

Figure 1. CAD drawing of final device concept. Consists of a pneumatic piston connected to an externally located solenoid valve and Arduino microcontroller. Pneumatic piston is connected to the femur via an interested pin.

Design Status & Future Work

Update Design Components → Cadaveric Bone Testing → In Vivo Testing → Publish Findings

Regulatory Pathway

Research device for controlled fractures

Class I (research use) or Class II (clinical use)

ISO 10993
ISO 14971
21 CFR Part 820

Virtual and Physical Prototyping

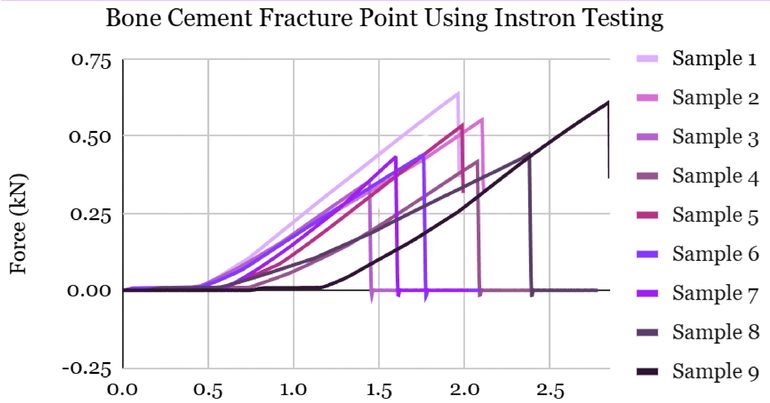

Figure 2. 3 point bend test on Instron machine fracture data. Bone cement samples created at 1cm thickness.

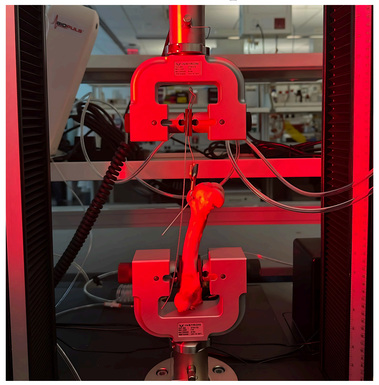

Figure 3. Instron machine configuration to perform repeat cycling to condition the bone prior to executing a yank action at a greater force. Replicates forces executed on bone when using our piston device but with higher force capabilities.

Technical Model

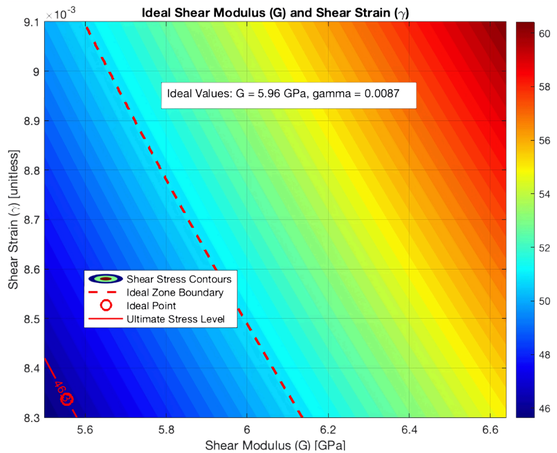

Figure 4. Heat map displaying ideal shear modulus and shear strain values to create bone fractures in the distal physis of a femur.

Validation Testing

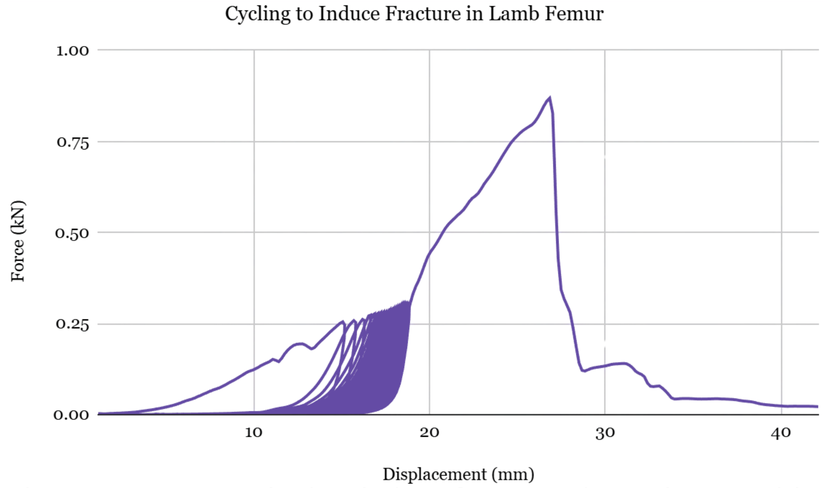

Figure 5. Force required to induce fracture when using repetitive cycling prior to yank force.

Final Product Specifications

Target Metric	Target Value
Piston Cylinder	15 - 250 psi range
Battery	12V
Piston Stroke Length	3 inches
Acrylic Covering	¼ inch thickness
Adjustability	8 - 12 inch femur range

Acknowledgements

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