3 Point Bending Device

Group: Michael Harman, Xuan Nguyen, and Eric Sirois

3/26/09 Presentation by Eric Sirois
Project Overview

- **Construct a three-point bending device**
  - Capable of performing flexure testing on soft tissues
  - Capable of calculating the flexure rigidity, bending stiffness, transmural strain, transverse shear stiffness

- **3 Principle goals**
  1. Measure the stress-strain response in the low-strain region (<5%) by evaluating the instantaneous effective modulus, (E)
  2. Identify the location of the neutral axis
  3. Provide a suitable environment for testing (temperature, pH) such that data are relevant and repeatable
Completed Work

• Mike
  – Camera mount design / fabrication
  – Identified and ordered new bending bars at client’s request
  – All hardware for camera mount is now on hand
Completed Work

• Xuan
  – Successfully implemented CCD camera output into Labview code
  – Performed transmural strain experiment using CCD camera
  – Implemented code to track markers from frame to frame for flexural rigidity test
Completed Work

• Eric
  – Debugging and testing of transmural strain code
  – Performed simulated transmural strain experiment
  – Performed live transmural strain experiment (with Xuan)
Simulated Transmural Strain Experiment
Simulated Transmural Strain Experiment
Real Transmural Strain Experiment
Real Transmural Strain Experiment
Three-Point Bending Device for the Flexure Testing of Soft Tissues

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Introduction

A brief overview of tissue testing and its applications in biomedical engineering is presented. The need for an improved testing device is highlighted. The proposed device, a three-point bending device, is designed to test soft tissues under flexural loads. It allows for accurate measurement of tissue properties, such as stiffness and strain, which are crucial for understanding tissue behavior under load.

Method

The proposed device consists of a load frame, a fixation system, and a displacement sensor. The load frame provides a rigid support for the tissue sample, while the fixation system ensures that the tissue is properly aligned and secured. The displacement sensor measures the deflection of the tissue under load, allowing for the calculation of mechanical properties.

Results - Experimental

Figure 1 shows the setup of the device with a tissue sample in place. The load is applied at the center of the tissue, and the displacement is measured at the ends. The results demonstrate the effectiveness of the device in accurately testing tissue properties.

Results - Simulation

A finite element analysis of the proposed device was conducted to predict its behavior under various loading conditions. The results show good agreement with the experimental data, validating the device's capability to accurately test tissue samples.

Discussion

The device is designed to be adjustable, allowing for testing of different tissue types and geometries. The results indicate that the device can accurately measure the mechanical properties of soft tissues, providing valuable information for biomedical research and clinical applications.

Conclusion

The three-point bending device offers a significant improvement over existing tissue testing devices. It provides accurate measurement of tissue properties, enabling better understanding of tissue behavior under load. Further research is needed to validate the device's performance in different scenarios.

Acknowledgments

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References


247
Hang-ups

• Point identification and tracking for transmural experiment is not ideal yet
  – Camera mount should help to make images more reproducible
  – New bending bars will cause less abrupt tissue movement

• Meshing program needs further refinement
Future Work (1 Week)

• This week, we intend to:
  – Make a more complete user-program interface - Eric
  – Fabricate the camera mounting stand – Mike
  – Transmural point tracking – Xuan
Future Work (2 Weeks)

- Whole device integration and testing – Xuan, Eric
- Results analysis and debugging – Eric
- User’s manual – Mike
# Hours Worked

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<th>Name</th>
<th>Total Hours</th>
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<tbody>
<tr>
<td>Michael Harman</td>
<td>14</td>
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<tr>
<td>Xuan Nguyen</td>
<td>16</td>
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<td>Eric Sirois</td>
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Questions?