Research Device to Measure Suture Force During Syndesmotic Repair

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Milan Ghodasara[1], Matthew Czaja[1], Dimitri Dogias[1], Ankit Patel[1]
Dr. Sorin Siegler, PhD[2], Dr. Thomas Sherman, MD[3]

Drexel University School of Biomedical Engineering, Science and Health Systems

Need

5,300 syndesmotic repair procedures done **nationally** in 2020[1]

TightRope tension during use is not understood

Syndesmotic over compression is present in 52% of TightRope procedures[2]

Objective: Develop a **research** device for *in situ* TightRope tension measurement

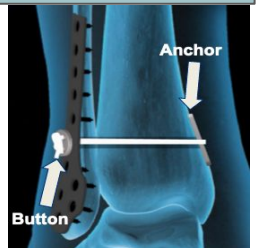

Figure 1: TightRope Implanted

Design Inputs

Requirement 1 (R1): Must measure compressive force between **80N and 140N**

Requirement 2 (R2): Must measure tension in ankle ROM, **65° to 75°** in the sagittal plane

Constraints: TightRope Integration, No Anatomical Obstruction

Solution

Solution Statement: 3D printed device mounted to medial tibia, houses load cell & provides anchor point for Tightrope

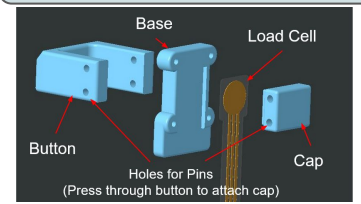

Figure 2: Assembly Components

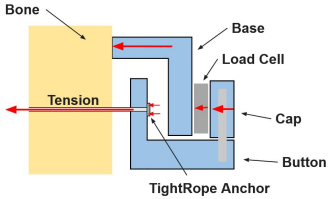

Figure 3: Force Diagram

Testing Results

Compression (R1): Read force during implant tightening

Pass: >210N

Result: 210N

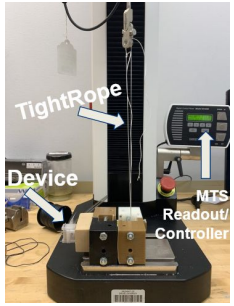

Figure 4: Test Setup for VT1

Range of Motion (R2): Compare force in ROM between ankle model and ADAMS model

Pass: p > 0.05

Result: p = 0.81*

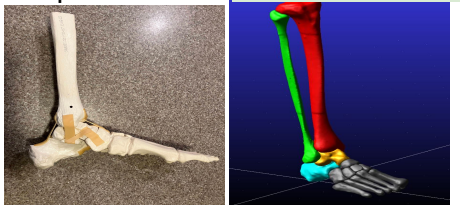

Figure 5: Ankle/ADAMS Model for VT2

Limitations:
- Accuracy of sensor
- Quality of physical model

Innovation

Quantification of **forces** within the TightRope both **before** and **after** implantation

Societal Impact

Force measurements **benefit researchers** to **develop** further fixation devices

Future Plans: Mount solution on cadaver leg for studies

References

[1] *Syndesmosis repair featuring the syndesmosis tightrope® XP implant system*. Arthrex. (n.d.). Retrieved March 12, 2023, from https://www.arthrex.com/ja/resources/video/Oxd5AmA1dEa97wFqvDENPw/syndesmosis-repair-featuring-the-syndesmosis-tightrope-xp-implant-system

[2] Haynes J, Cherney S, Spraggs-Hughes A, McAndrew CM, Ricci WM, Gardner MJ. Increased Reduction Clamp Force Associated With Syndesmotic Overcompression. *Foot & Ankle International*. 2016;37(7):722-729. doi:10.1177/1071100716634791