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Augmented Achilles Tendon Rupture Repair for Mechanical Stability and Promotion of Healing

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Problem:

- Achilles Tendon rupture only repaired using suture techniques
- Re-rupture/Suture failure rate of 5%
- Ruptures often caused by sudden, forceful motions and/or fatigue loading

Objective: Design a solution that improves mechanical stability of a sutured Achilles tendon



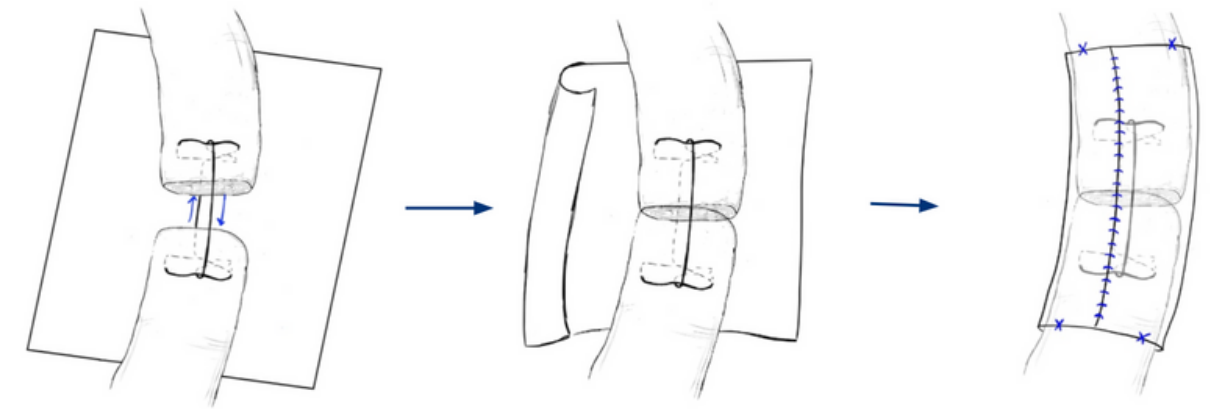
Requirements:

- Distance between ends of torn tendon:
 - 0.5mm < 1mm
- Mechanical properties:
 - must be greater than just sutured
- Procedure duration:
 - 30min. ≥ 1 hour

Solution:

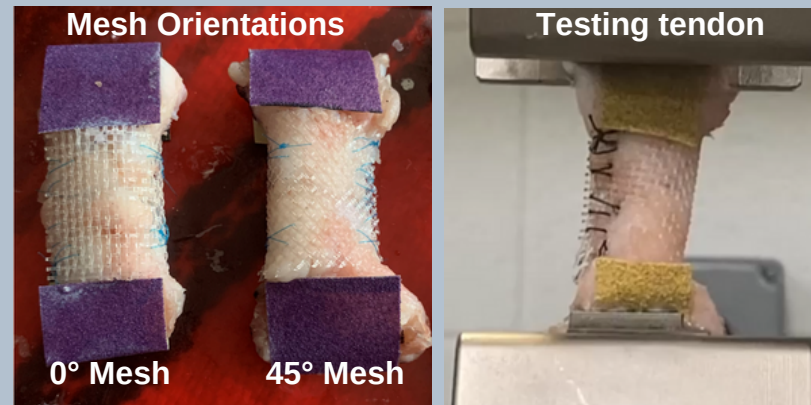
Synthetic wrap material to increase mechanical stability

1. Suture ends proximal, nylon mesh can be seen behind the tendon
2. Nylon mesh is then wrapped around sutured tendon
3. Wrap is stitched closed on itself and anchored at the top and bottom of the tendon



Testing:

- Tensile testing: load to failure
 - Control group: just sutured - **no wrap**
 - Experimental groups: 2 different **mesh orientations** (degrees rotation)



Results + Impact:

1-way Anova
 $\alpha = 0.05$

Source	SS	df	MS	F	Prob>F
Columns	3.34117	2	1.67058	4.39	0.067
Error	2.28533	6	0.38089		
Total	5.6265	8			

Post-hoc 1-tailed t-test (equal variance)
 $p\text{-value} = 0.05/3 = 0.0167$

t-test	Stiffness
group 1 - 2	0.2323
group 1-3	0.0466
group2-3	0.1254

- Statistical analysis shows enough evidence for further exploration into project
- Results indicate that design can increase mechanical properties of tissue and is worth perusing

Future Plans:

- Increase sample size
- Further tests including other characteristics of textiles (pore size, thread thickness, material, etc.)

