

# Achilles Tendon Repair Bio-Tape Applicator

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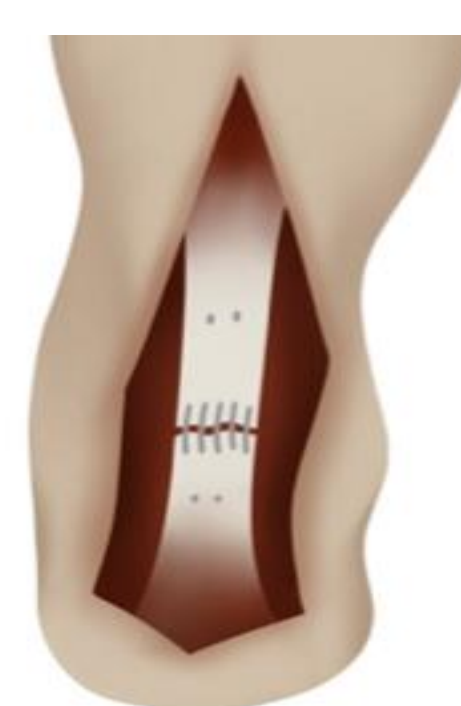
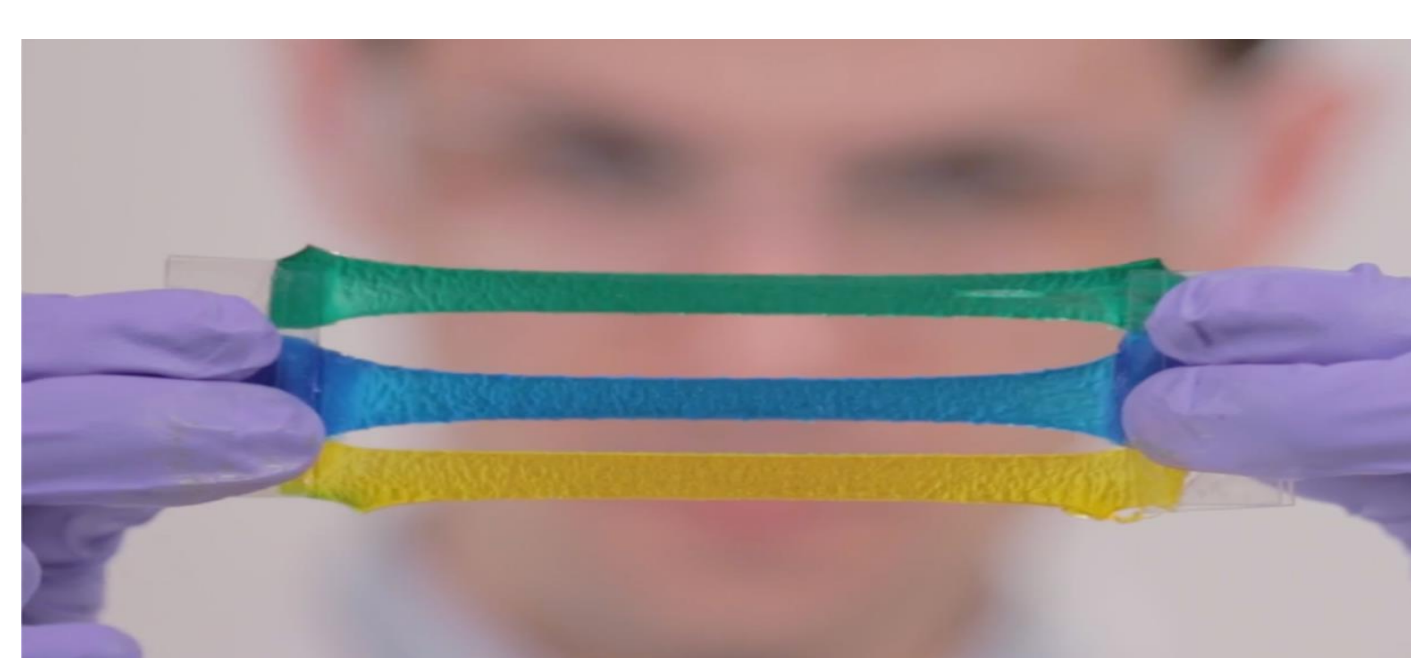


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## Background

Achilles tendon ruptures occur in about 1 million athletes annually in the U.S.  
Surgical repairs result in lost elasticity and strength due to scar tissue build up caused by suture stress  
**Partnered with Dr. Freedman from the Wyss Institute**  
Biotape aids in elasticity retention and decreased scar tissue when applied **after** suture repair  
Decreases stress on sutures and promotes healing



## Existing Solutions & Limitations

Current solution = **manual application** of the tape utilizing forceps with no standardized method  
Application can be difficult

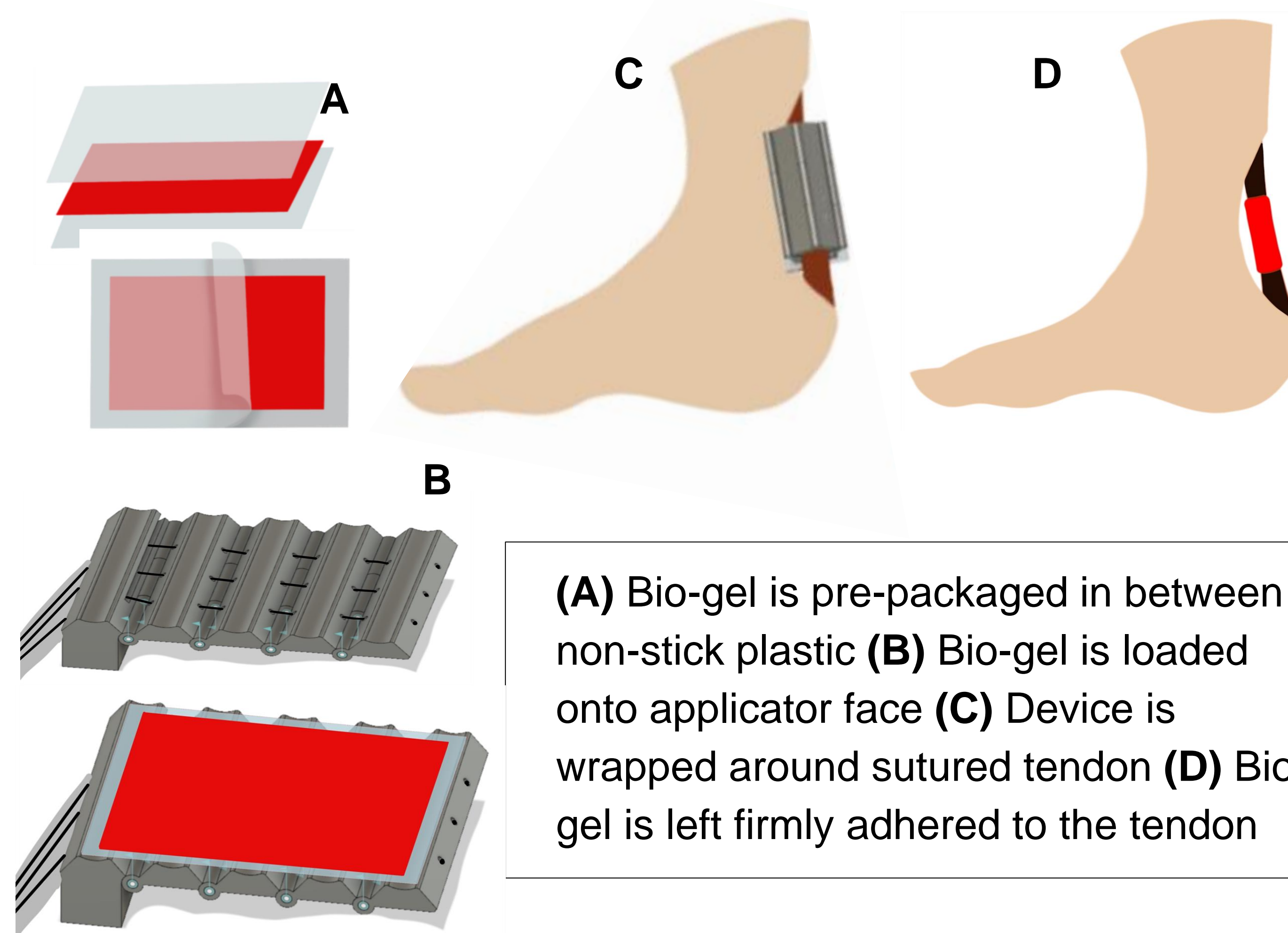
**Limitation = No existing application device**

## Objective

Design a device to wrap the bio-tape around the achilles tendon, while reducing variability between surgical procedures

## Solution

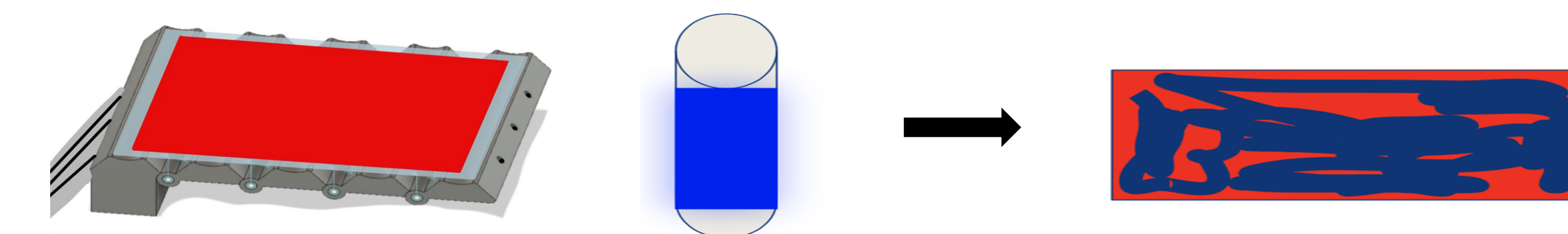
Our innovative solution combines device designs from other industries and applies them to the healthcare setting for surgical use



## Verification & Validation

### Surface Coverage Area Verification

Device wraps bio-gel around painted tendon model, paint transfer quantified via ImageJ. 90% paint transfer = success



### Dimensions Verification: via caliper

**Force Verification:** Device's generated force verified by this procedure:

- Establish upper / lower thresholds of force via manual application
- Repeat application with device, record range of generated forces
- Successful if the average generated force falls within the manual force threshold

## Conclusion

Our innovative design provides a reliable, standardized method for surgeons to apply bio-adhesive tape to the Achilles tendon, facilitating performance of the bio-gel in reducing scar tissue and retaining tendon elasticity

## Societal Impact

- Positively impacts surgical space, time, and procedures
- Marketed to an estimated 7,700 podiatric surgeons\*
- Potential use in ~8,200 achilles tendon rupture surgeries per year in the U.S.
- Decreased recovery time and post-op visits

\*Number of surgeons affiliated with the American College of Foot and Ankle Surgeons Society

## Acknowledgments

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- Dr. Freedman, Clinical Advisor
- Dr. Dougherty, Academic Advisor
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### References:

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- [2] Moore KL, Agur AMR, Dalley AF. Essential clinical anatomy. 4th ed. Baltimore: Lippincott Williams & Wilkins, 2011. [3]"Ben Freedman on Tough gel adhesives," Wyss Institute, <https://wyss.harvard.edu/news/ben-freedman-on-tough-gel-adhesives/>.
- [4] A. G. Shamrock, "Achilles tendon rupture," StatPearls <https://www.ncbi.nlm.nih.gov/books/NBK430844/>.

## Constraints

- 1.1 Time: 9 months
- 1.2 Budget: \$900
- 1.3 Intellectual Property: Designed only for the Wyss Institute's biogel
- 1.4 Use in small surgical space
- 1.5 Geometric Constraint: Tailored to pre-cut bio-gel patches

## Requirements

- 2.1 Applicator Face: Must hold 8 cm x 5 cm biogel
- 2.2 Device Properties:
  - 2.2.1: Wraps non-uniform cylinder
  - 2.2.2: Applies 1-4 min of pressure
- 2.3 Biogel Application: Bio-gel must be flush with tendon
- 2.4 Ease of Use
  - 2.4.1: Hand Held
  - 2.4.2: Easily Repeatable
  - 2.4.3: Less than 1 lb

## Working Models & Prototype

