

# Kinesthetic Latticed Programmable Tape for treatment of patellofemoral pain syndrome



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## Significance.

Patellofemoral pain affects over **3 million patients a year**, especially women and young adolescents.<sup>1</sup>

**25% of athletes** with patellofemoral pain stop participating in sports.<sup>2</sup>

## Challenge.



Current methods:  
**Kinesthesia (KT) Tape (left)** & **McConnell Taping (right)**

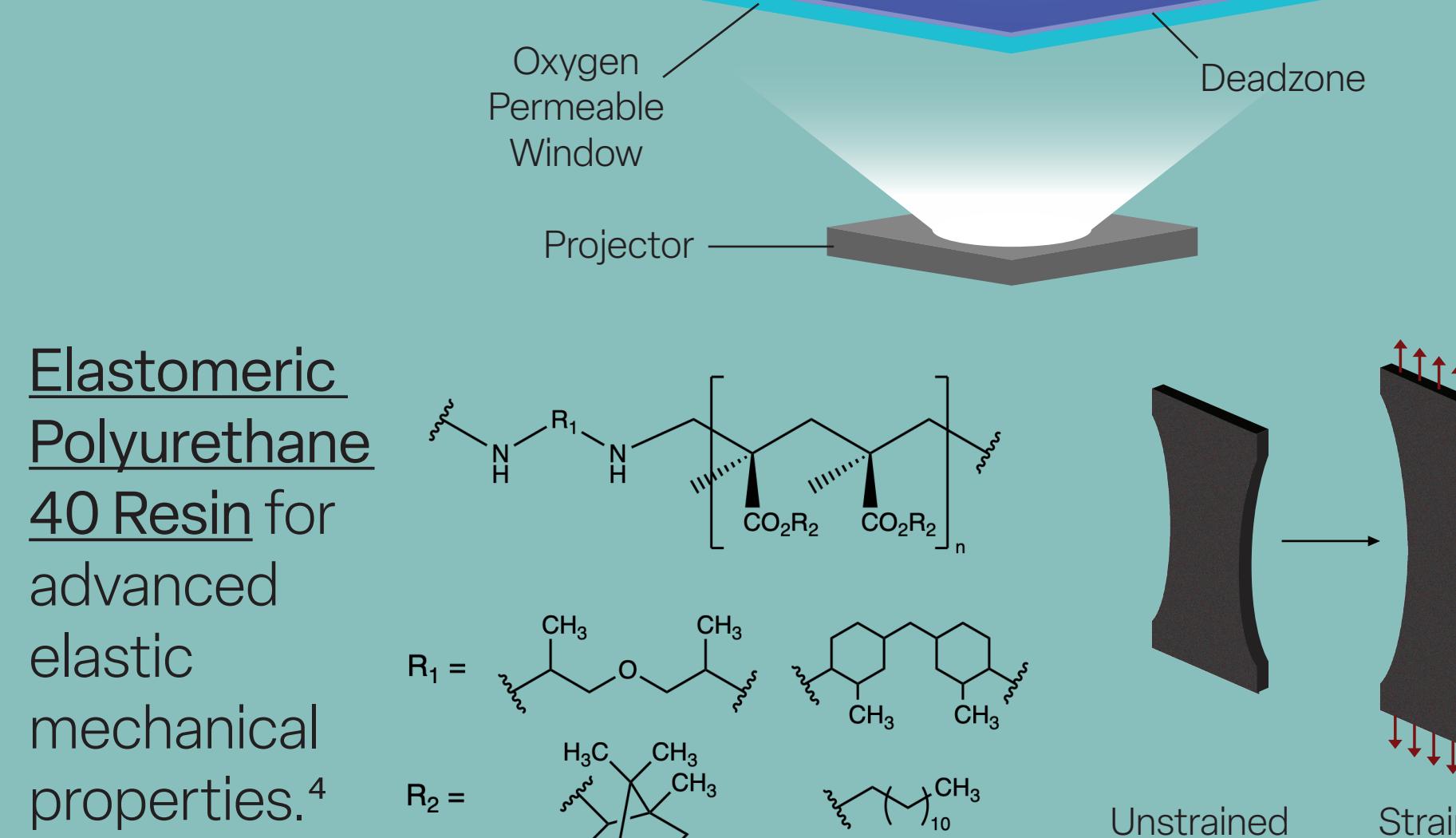
### Current Challenges:

- **No effect** in increasing muscle strength
- **Difficult** application
- **Poor** adhesive properties

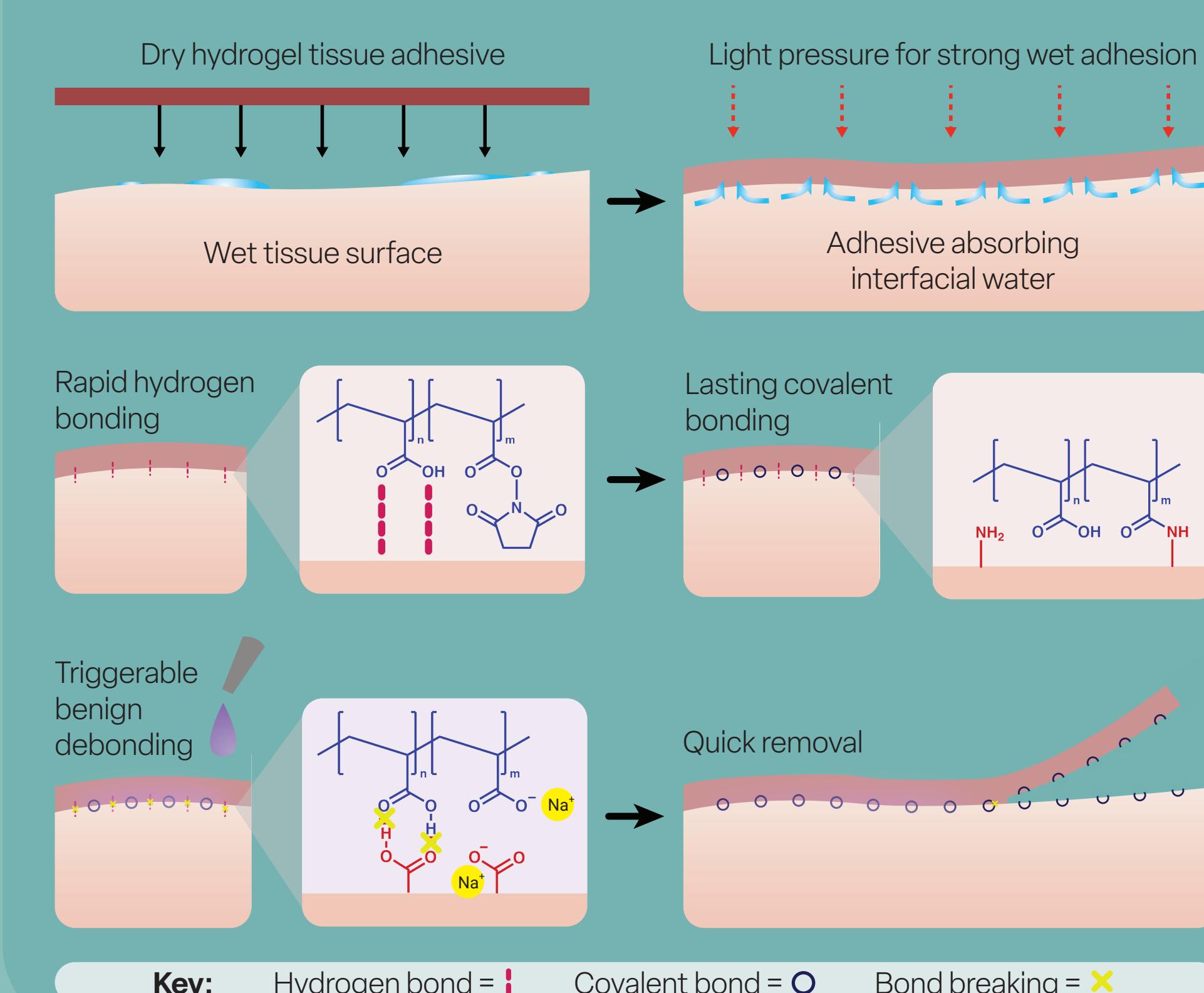
## Methods.

### Additive Manufacturing

Continuous Liquid Interface Production for personalizable lattice design.<sup>3</sup>



### Tissue Adhesives<sup>5,6</sup>



## Mission & Aims.

We developed:

### Kinesthetic Latticed Programmable (KLaP) Tape

- a personalizable kinesthesia hydrogel patch.
- adheres with easy and fast application.

### Aim 1: Develop a novel hydrogel kinesthesia tape.

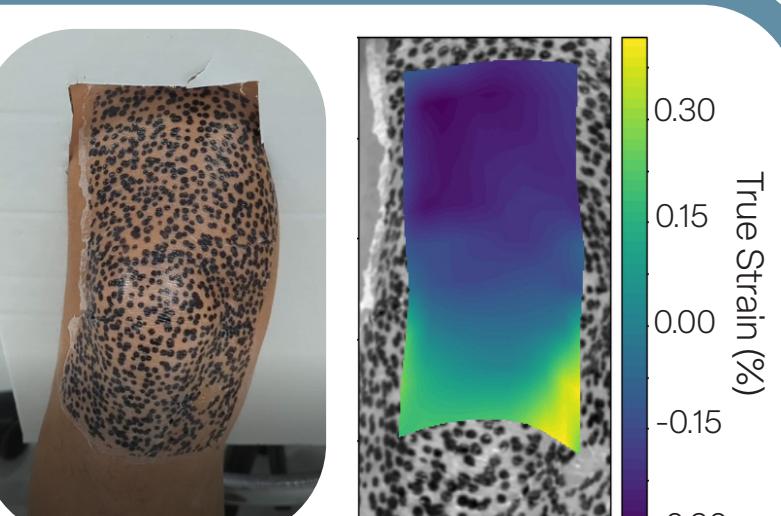
- i) strong adhesion to skin.
- ii) high flexibility and stretchability.

### Aim 2: Optimize tape to treat patellofemoral pain.

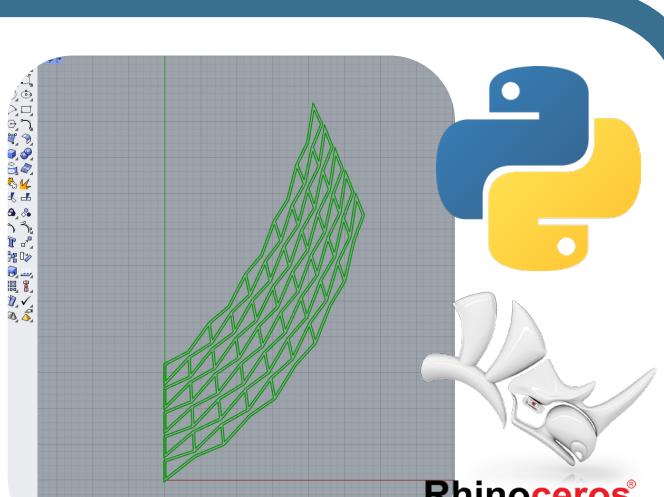
- i) optimize mechanical properties & increase ease of use.
- ii) develop lattice via parametric design.

## Design.

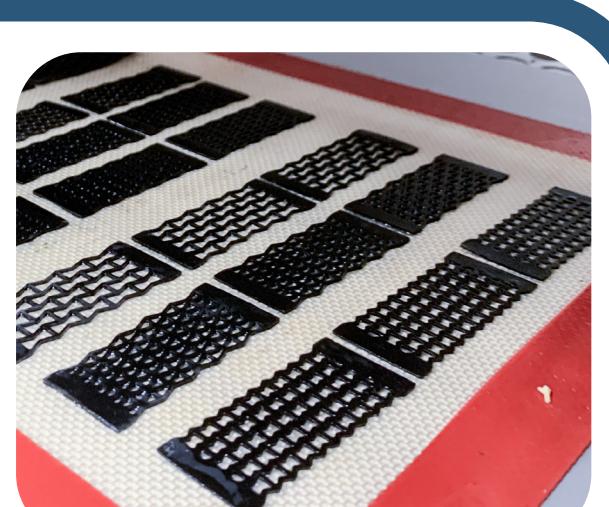
Digital image correlation (DIC) to calculate skin strain of knee



Programmable parametric design of auxetic lattices built using Rhino & Python

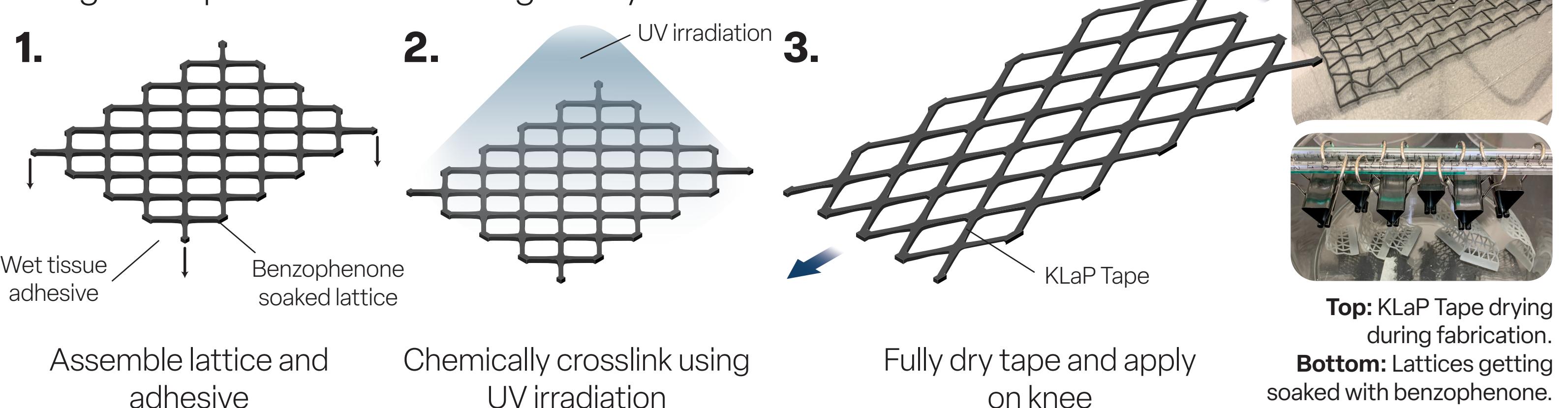


Manufacture lattice using Carbon 3D M2 printer & EPU 40 resin

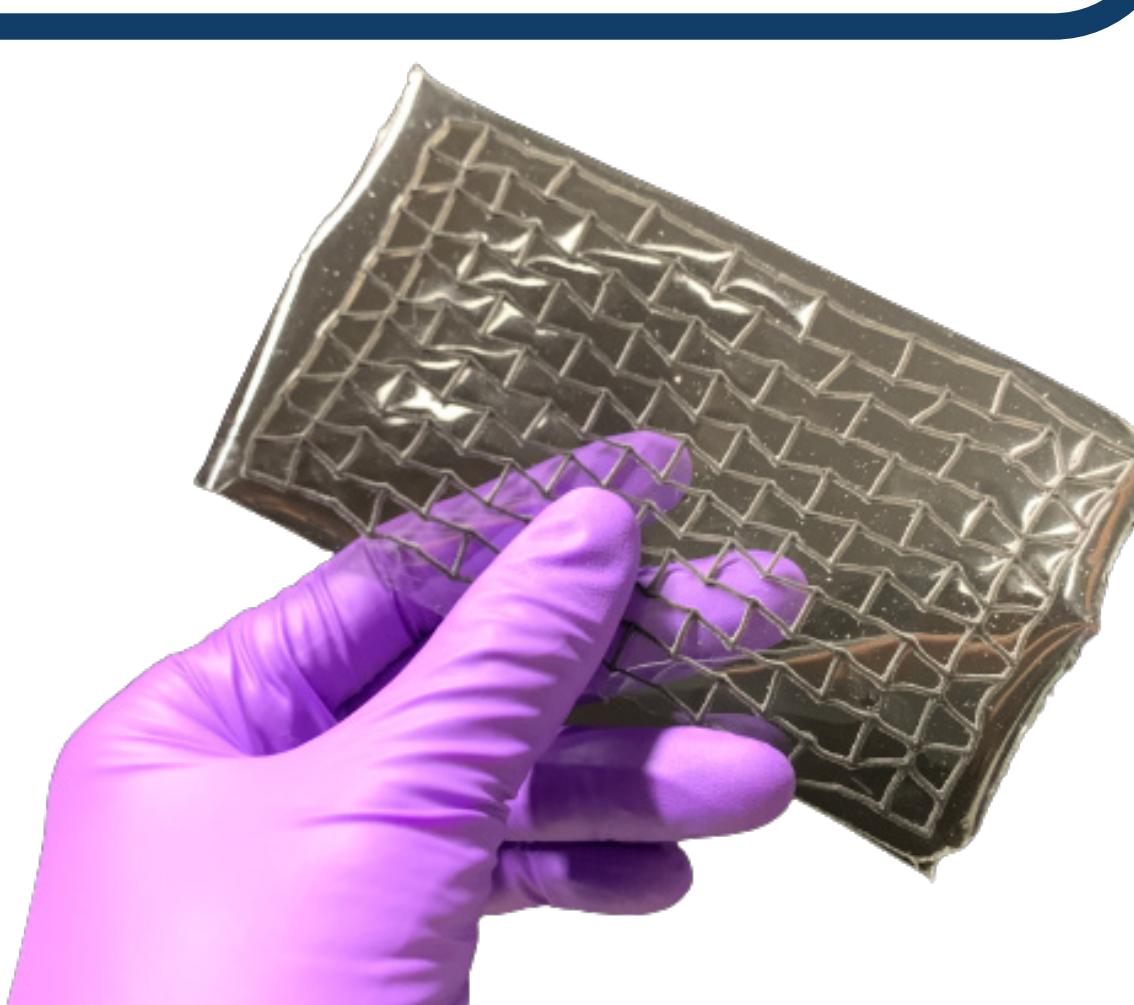
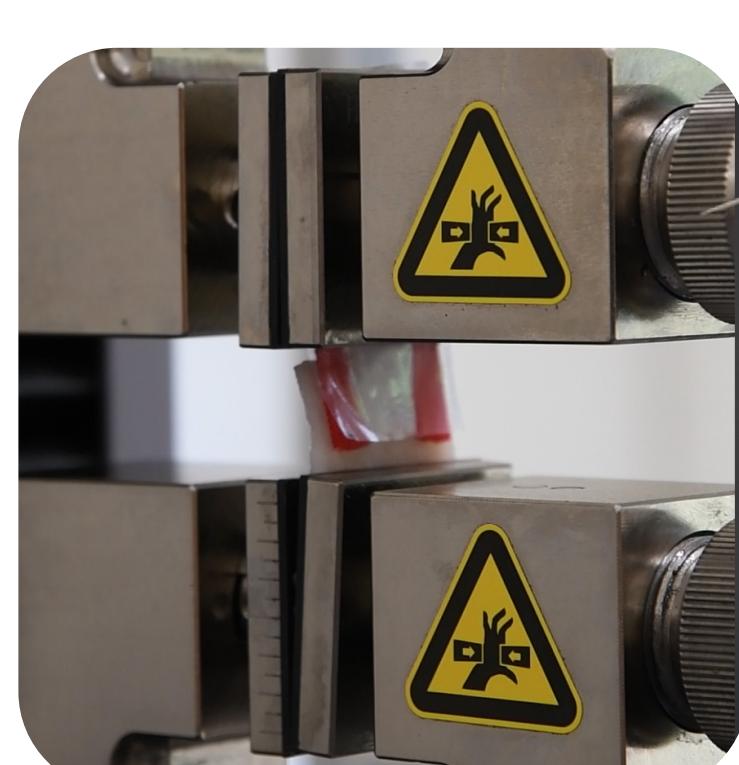


### Fabricate KLaP tape

using benzophenone crosslinking on dry tissue adhesive.<sup>7</sup>



## Future Directions.



3 Months

1 Year

Beyond

Finish biocompatibility, mechanical, adhesive characterization & parametric design.

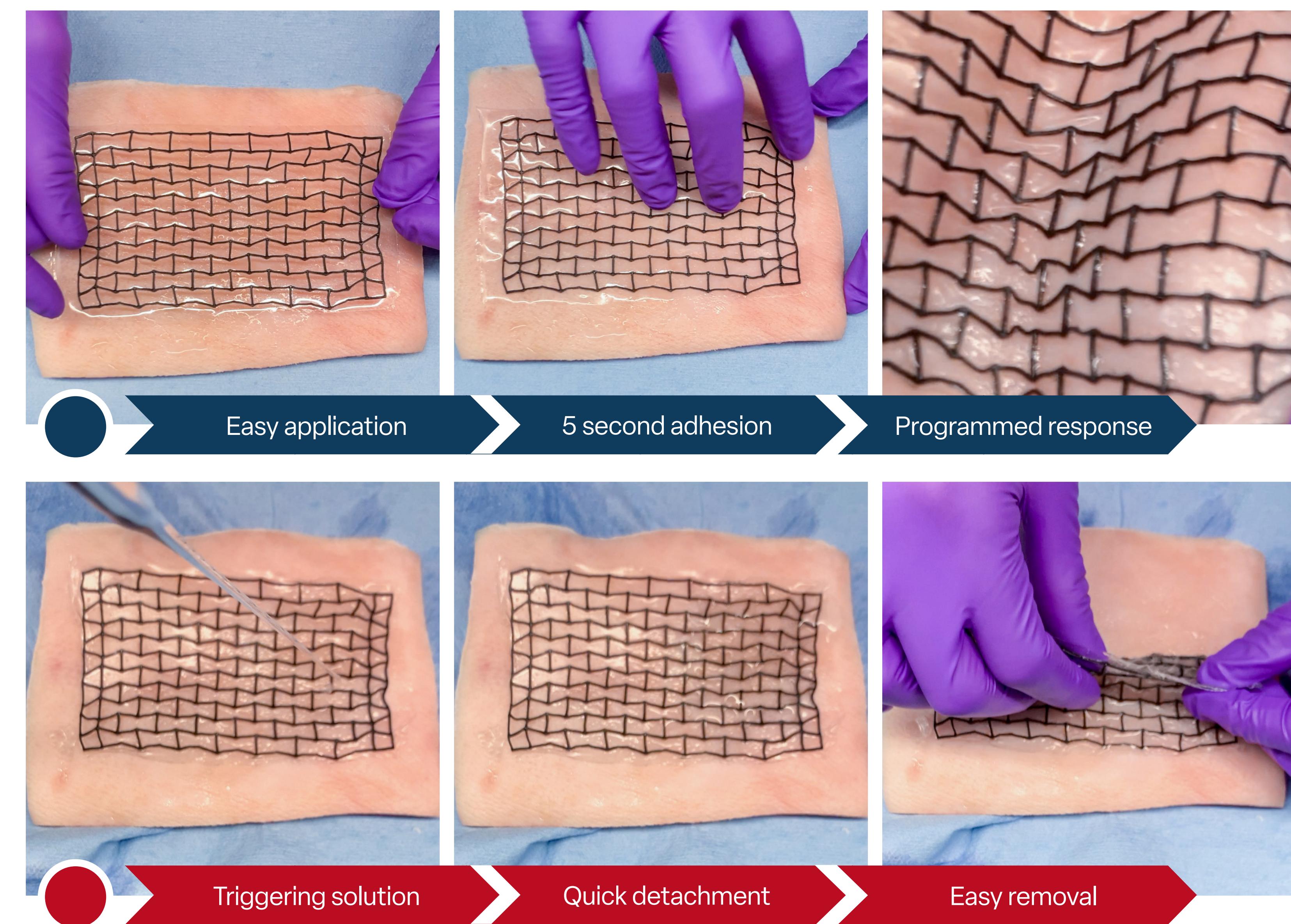
Test athletic performance with athletes at Stanford University.<sup>8</sup>

Integrate mechanical actuators and electronic sensing for bionics & haptics.

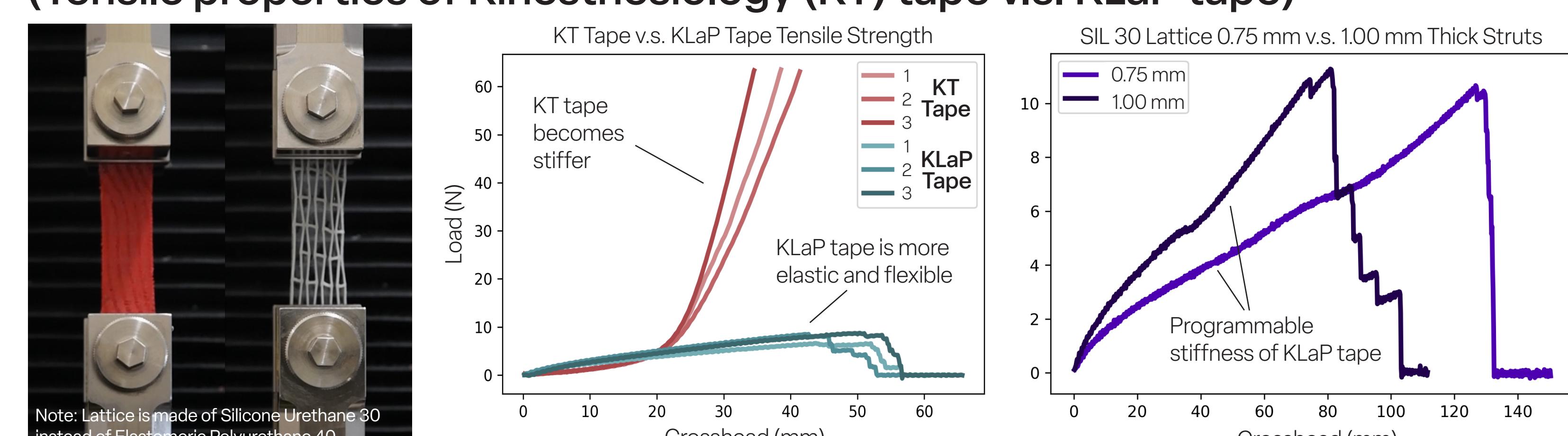
## References.

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- Photos from Stanford Athletics.

## Results. (Ex vivo porcine skin adhesion test)



### (Tensile properties of Kinesthesia (KT) tape v.s. KLaP tape)



## Conclusions.

**KLaP Tape is a promising platform** to help millions of patients with patellofemoral pain.

- Implemented design process for further development.
- Achieved tough adhesion, quick application, and easy on-demand removal.

A lot to learn and still develop from characterization and clinical testing.

## Acknowledgements.

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