

## Client Background

Integra LifeSciences produces MicroMatrix®, a skin regeneration product that requires porcine bladder tissue cells. Employees must remove unnecessary smooth muscle fibers from the raw organ using a rectangular prism acrylic piece. This repetitive process has led to hand/wrist discomfort and injuries.



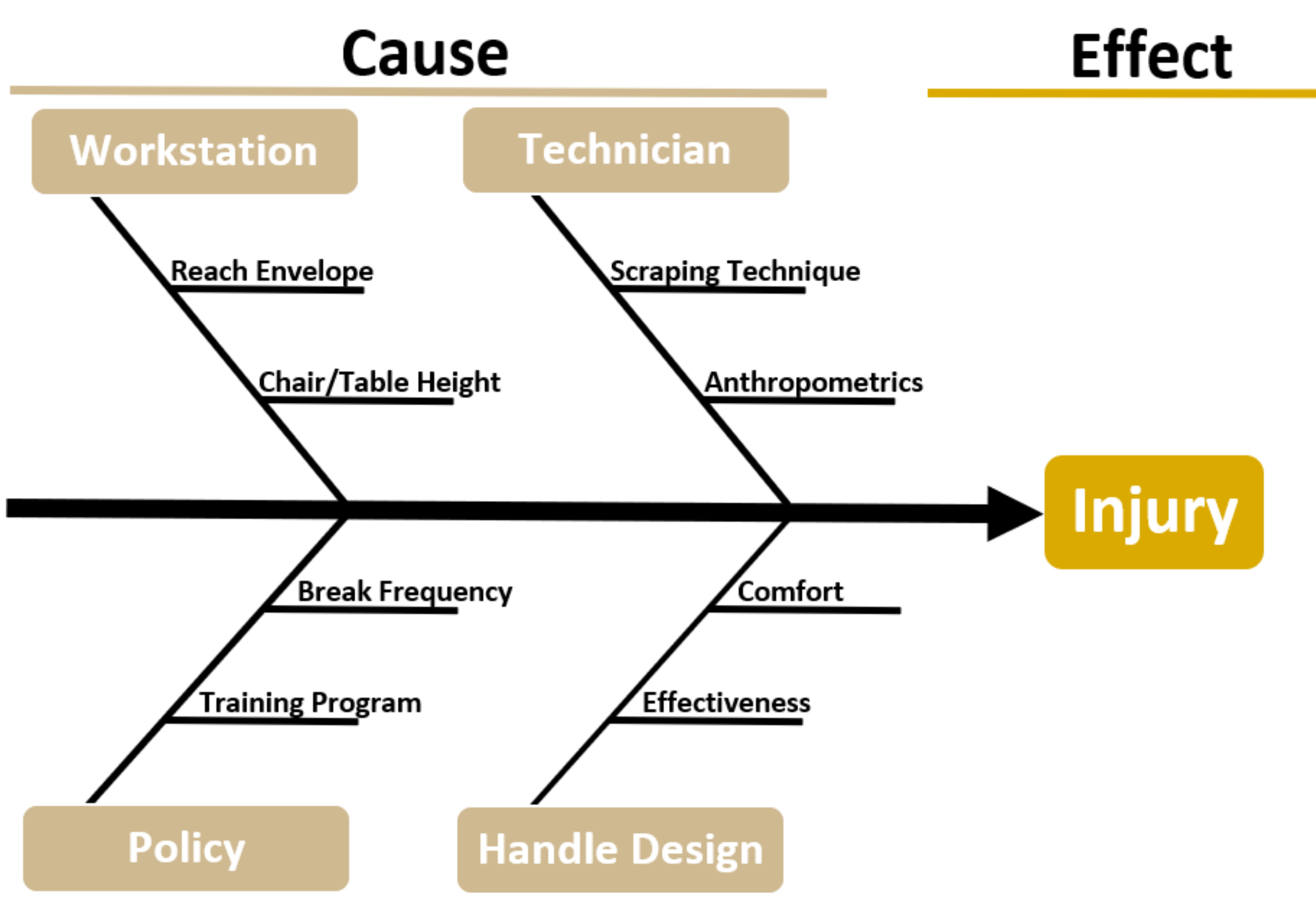
Scan to see scraping video



## Problem Statement

Develop an ergonomic approach incorporating both physical modifications and procedural protocols to the porcine organ scraping process to mitigate upper extremity injury occurrences in workers while preserving practicality.

## System Model



A fishbone diagram model was developed to identify relevant subsystems to individually address for an overall effective solution for upper extremity injuries.

## Methodology

### Scraper Handle Design

A comparative analysis approach was used to develop three distinct prototypes, each with unique trade offs in strengths and weaknesses.

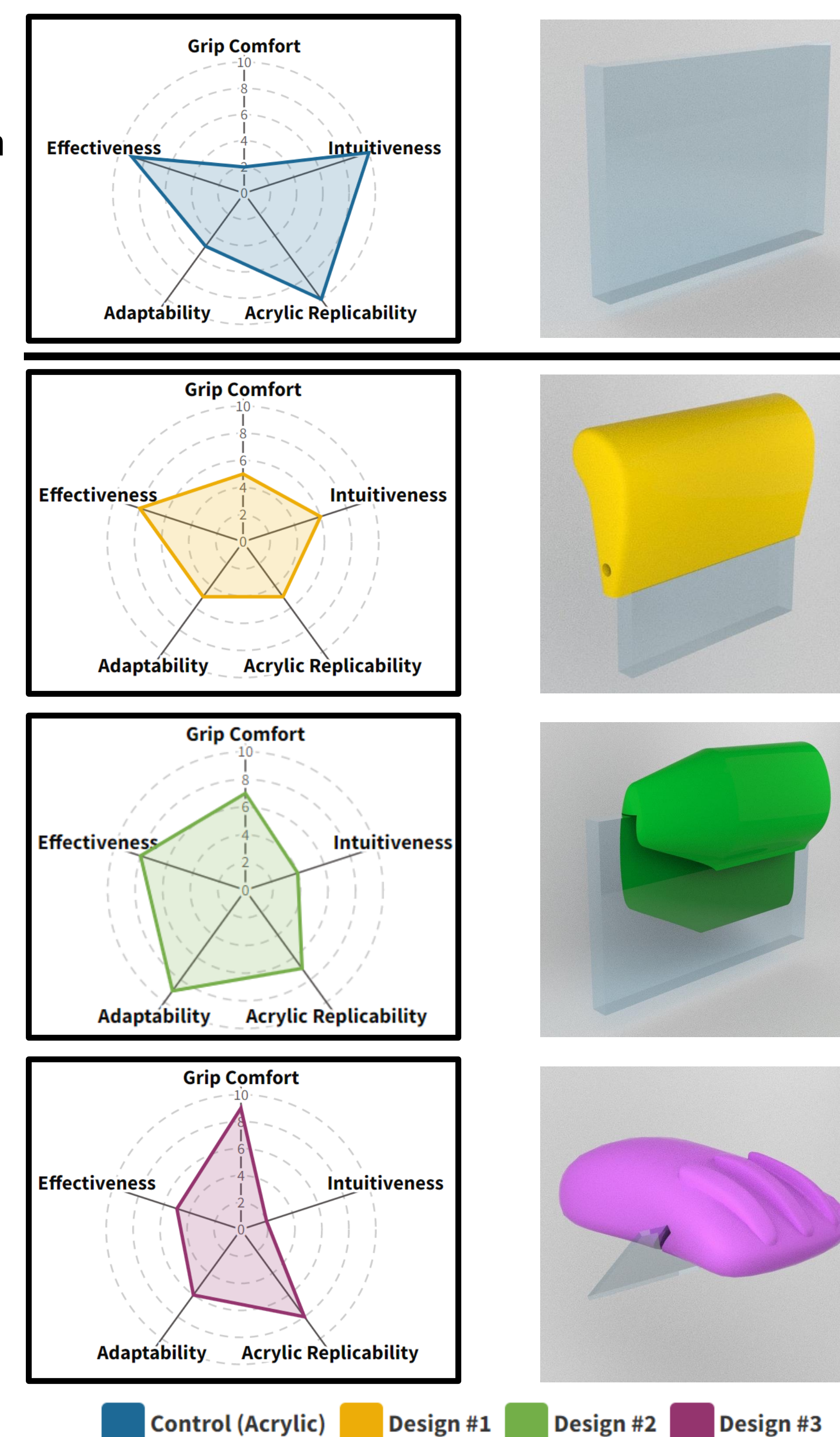
The following quantitative analysis was performed to evaluate the designs:

- Step 1: Employees evaluate the control and prototypes using the *System Usability Scale (SUS)* survey.

	Strongly disagree	1	2	3	4	5	Strongly agree
1. I think that I would like to use this system frequently							
2. I found the system unnecessarily complex							
3. I thought the system was easy to use							
4. I think that I would need the support of a technical person to be able to use this system							

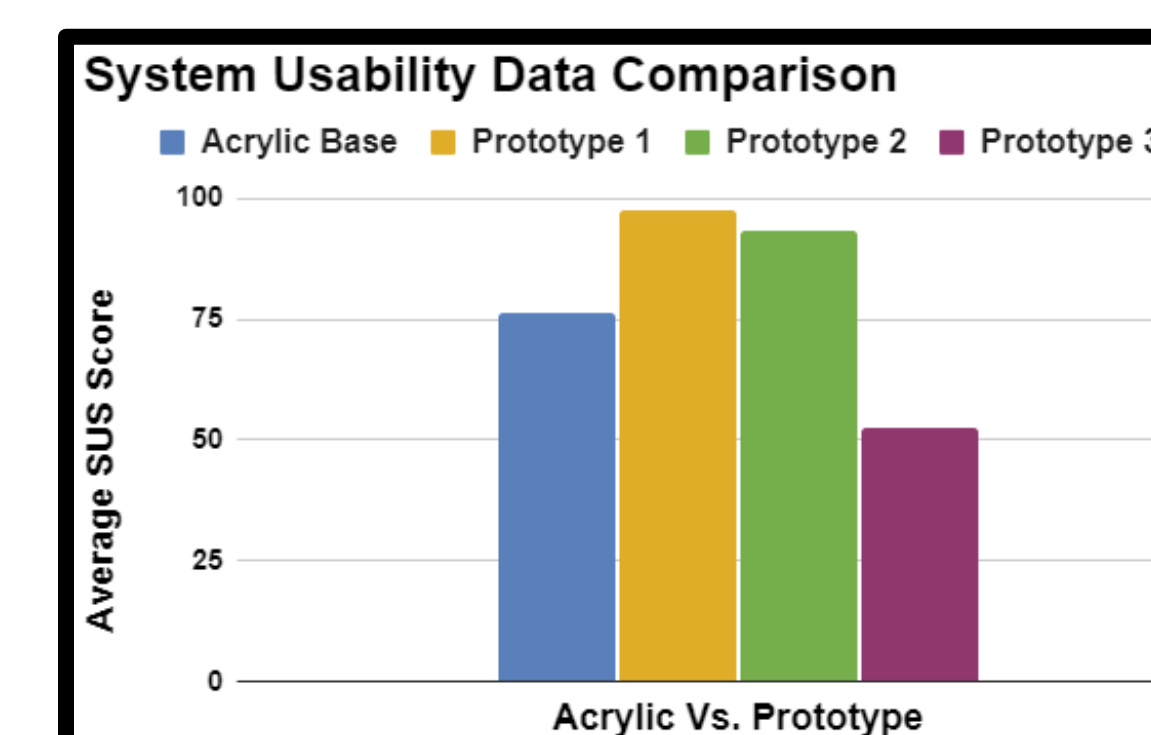
- Step 2: Perform one-way ANOVA for analysis of variance
- Step 3: Perform t-testing for analysis of statistical significance against the control

The experimental data from the prototypes are to be compared against the control to determine if the proposed solutions were considered effective.



## Results

SUS Score Averages				
	Control	Design #1	Design #2	Design #3
SUS Score	76.5	97.5	93.25	52.5



SUS Score	Grade	Adjective Rating
> 80.3	A	Excellent
68 – 80.3	B	Good
68	C	Okay
51 – 68	D	Poor
< 51	F	Awful

### ANOVA Test

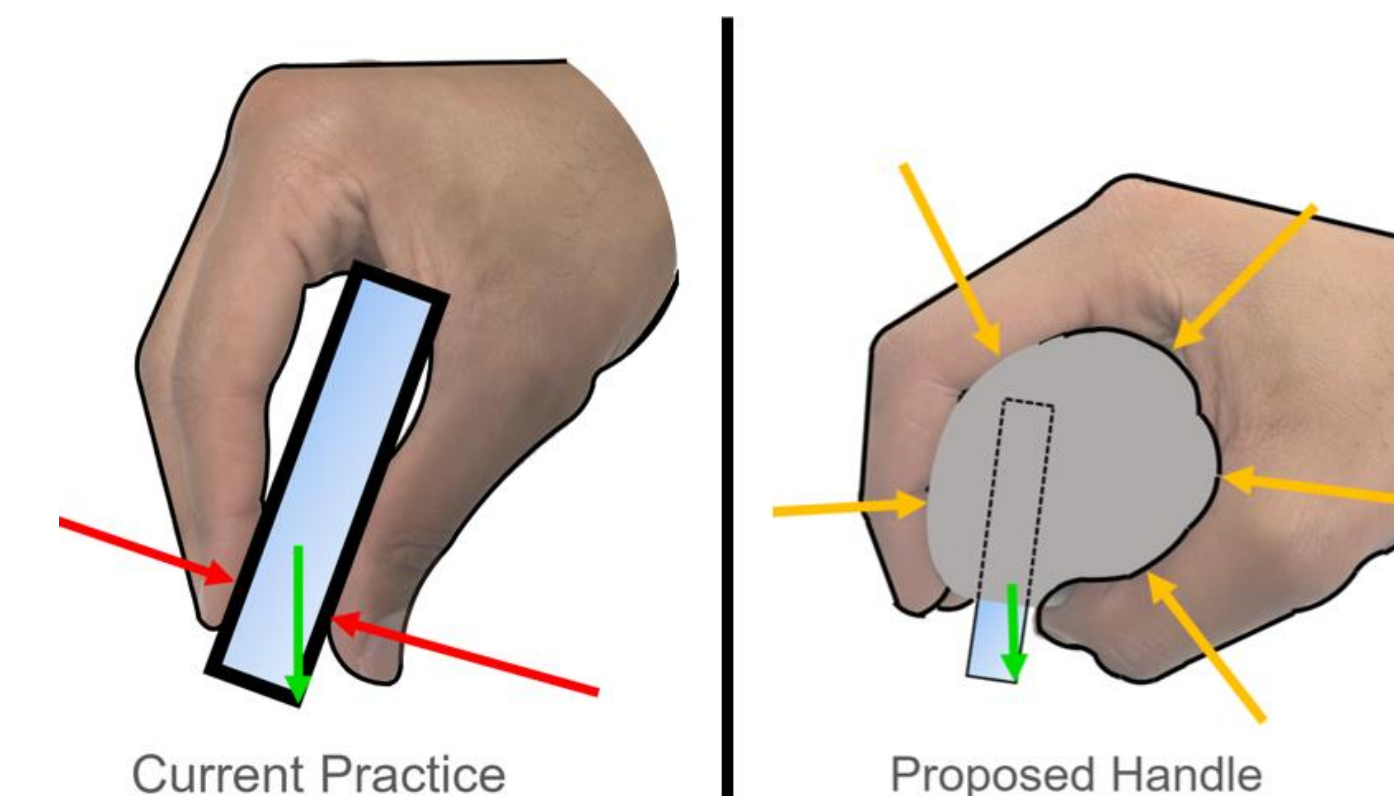
p-value	0.01245
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### T-Test

	Design #1	Design #2	Design #3
t-value	0.0019	0.0504	N/A

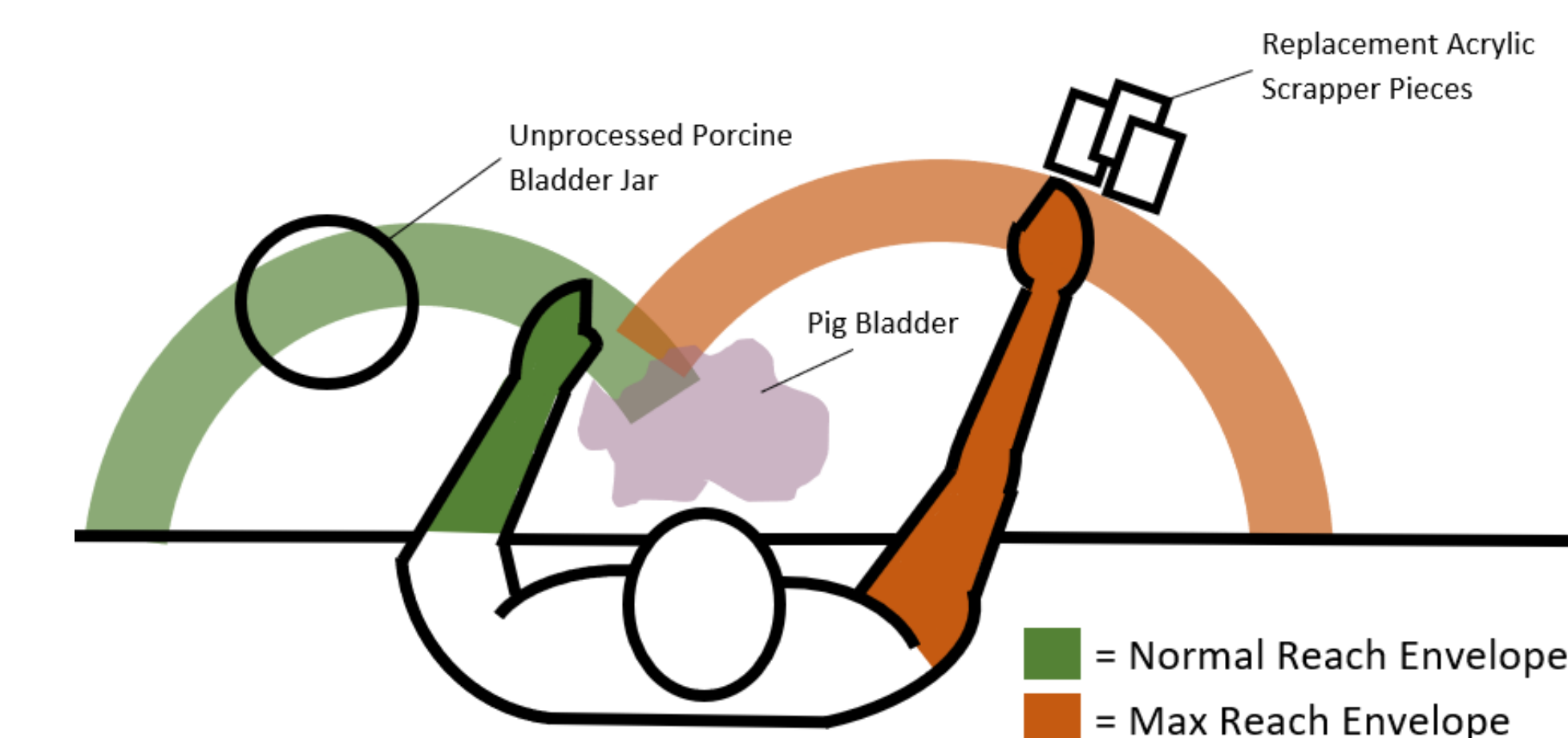
## Discussion

- SUS Score:** Designs #1 and #2 outperformed the control with ratings considered "Excellent".
- ANOVA:** Data obtained from testing holds quantitative validity due to p-value < 0.05
- T-Test:** Designs #1 and #2 show that they are statistically significant in outperforming the control group data as the t-value < 0.05



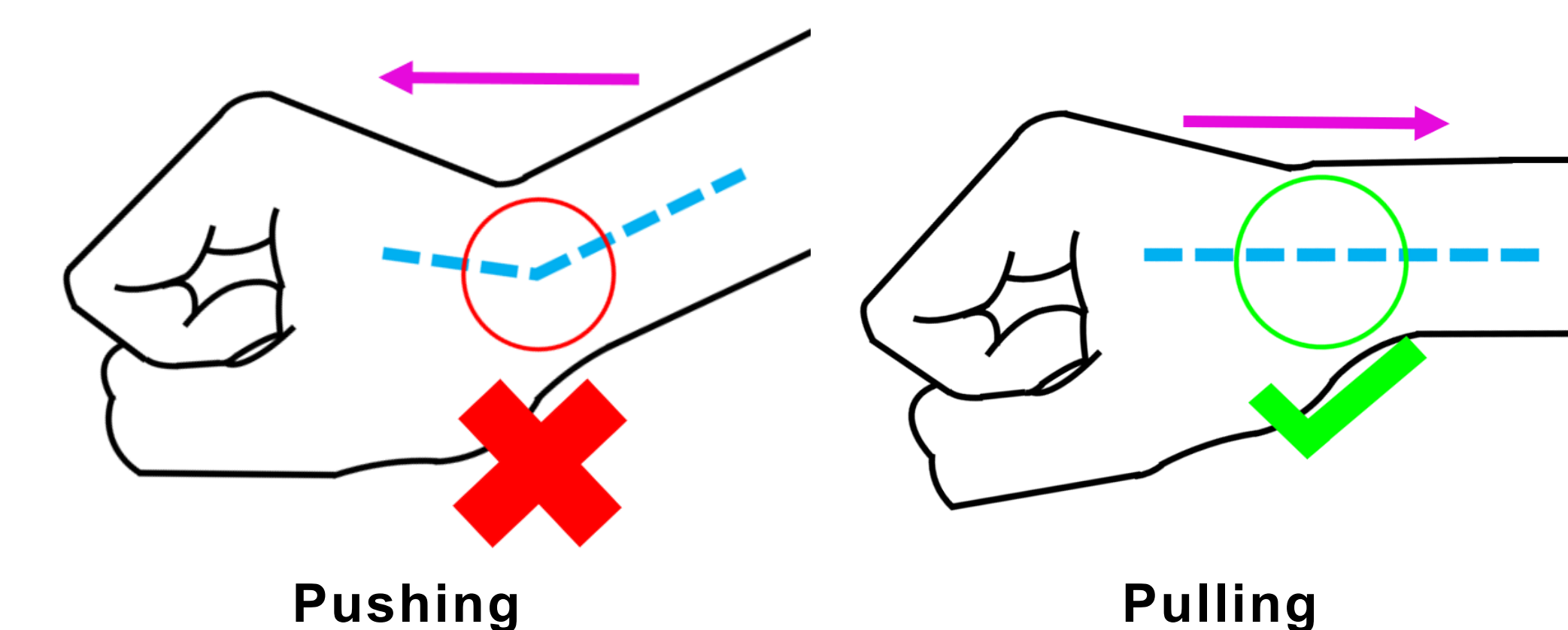
- Limitations:** Testing was only done during brief sessions. Long-term usability studies could provide additional relevant insight.

## Further Recommendations



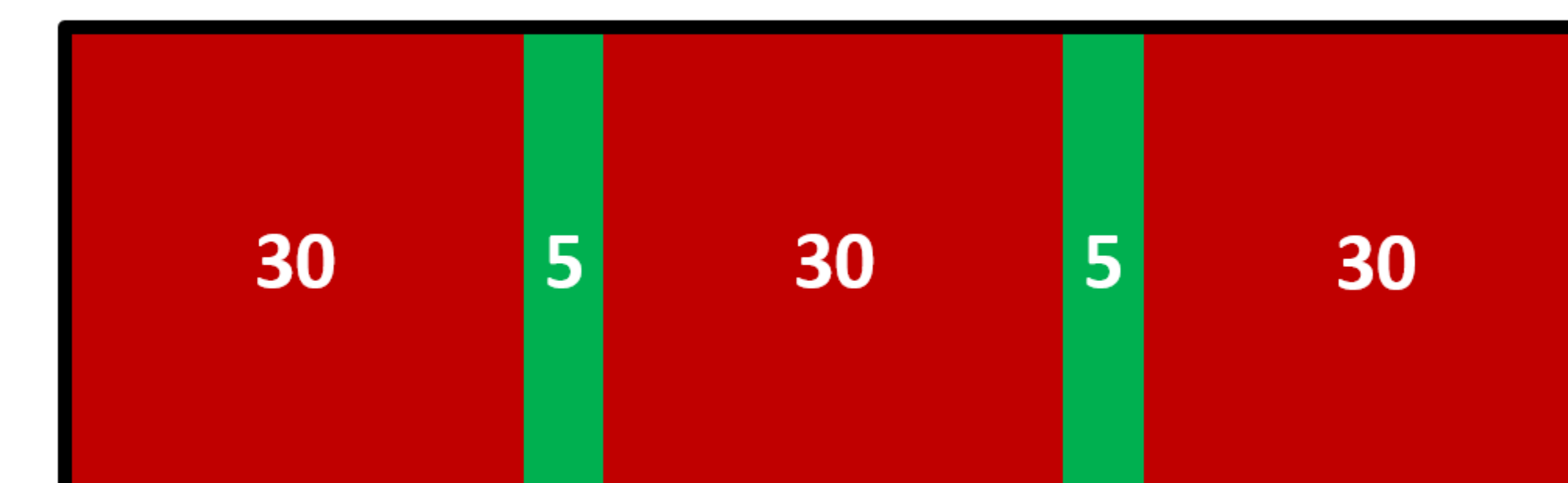
### Workstation

- Keep items within normal reach envelope
- Adjust chair height to ensure shoulders are relaxed and forearms remain parallel to the worktable



### Technician

- The pulling motion places less strain on hand/wrist than pushing
- Practice a natural grip, neutral wrist position, and avoid forearm pronation (inward palm rotation)



### Policy

- Implement and enforce frequent short breaks
- Suggestion: 30-minute work segments followed by 5-minute breaks to perform stretching exercises