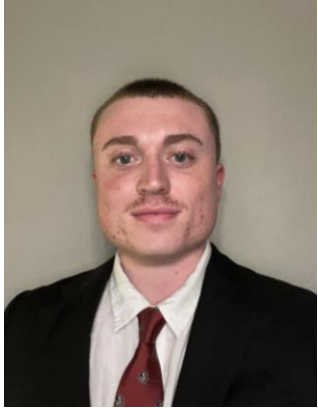


A 3D rendering of a human arm, showing the hand, forearm, and upper arm. The arm is colored in a gradient from blue to white. A red, glowing, cylindrical indenter is positioned against the forearm, with a white beam of light shining through it. The text "Human Bone Density Indenter" is overlaid on the arm in a white, bold, sans-serif font with a black outline.

Human Bone Density Indenter

Team Introductions



Grant Giorgi
*Orthopedic
Bioengineer*



Erin Petkus
*Biomaterials and
Biopolymers
Engineer*



Timothy Surface
*Manufacturing
Engineer*



Abrea Green
*Clinical
Engineer*



Tessany Schou
*Materials
Engineer*



Nicholas Vastano
*Bioinstrumentation
Engineer*

Sponsor and Advisor



Project Sponsor

Tom Vanasse

Director of Engineering, Exactech



Academic Advisor

Stephen Arce, Ph.D.

Professor, FAMU-FSU Engineering

Tessany Schou

Objective

The objective of this project is to create a functional prototype and complete feasibility testing of a device that assists the surgeon's selection in type of implant used during Total Shoulder Arthroplasty.

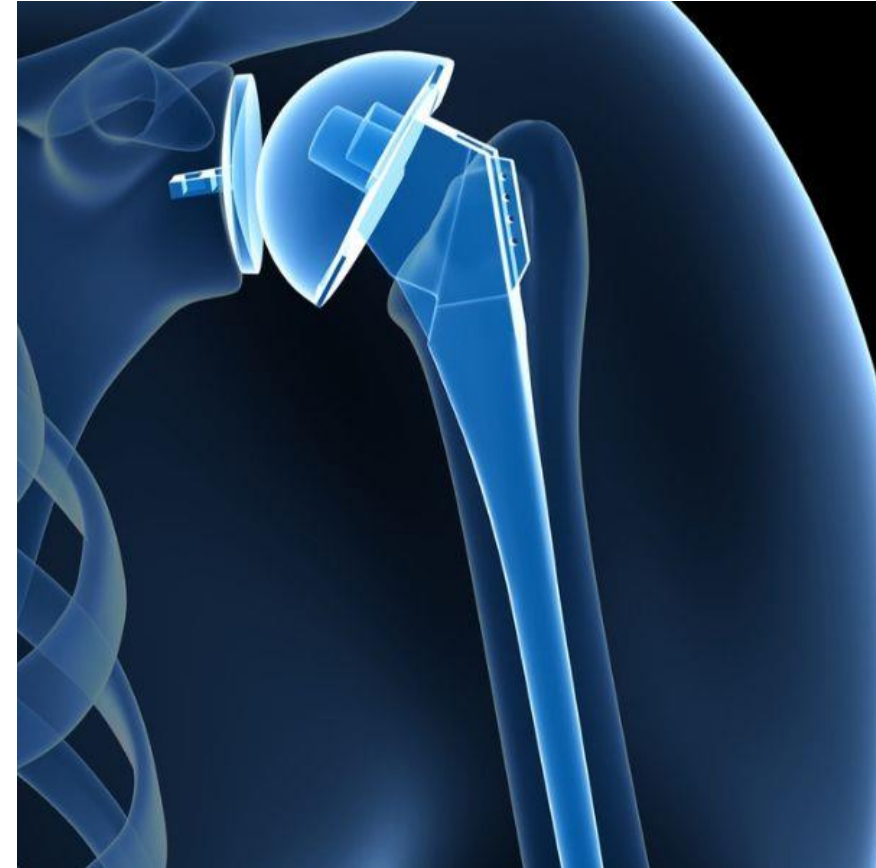
Tessany Schou



Total Shoulder Arthroplasty

Purpose

Eliminate source of pain and dysfunction by replacing shoulder joint with artificial components



Tessany Schou

Types of Implants

Stemmed Implant

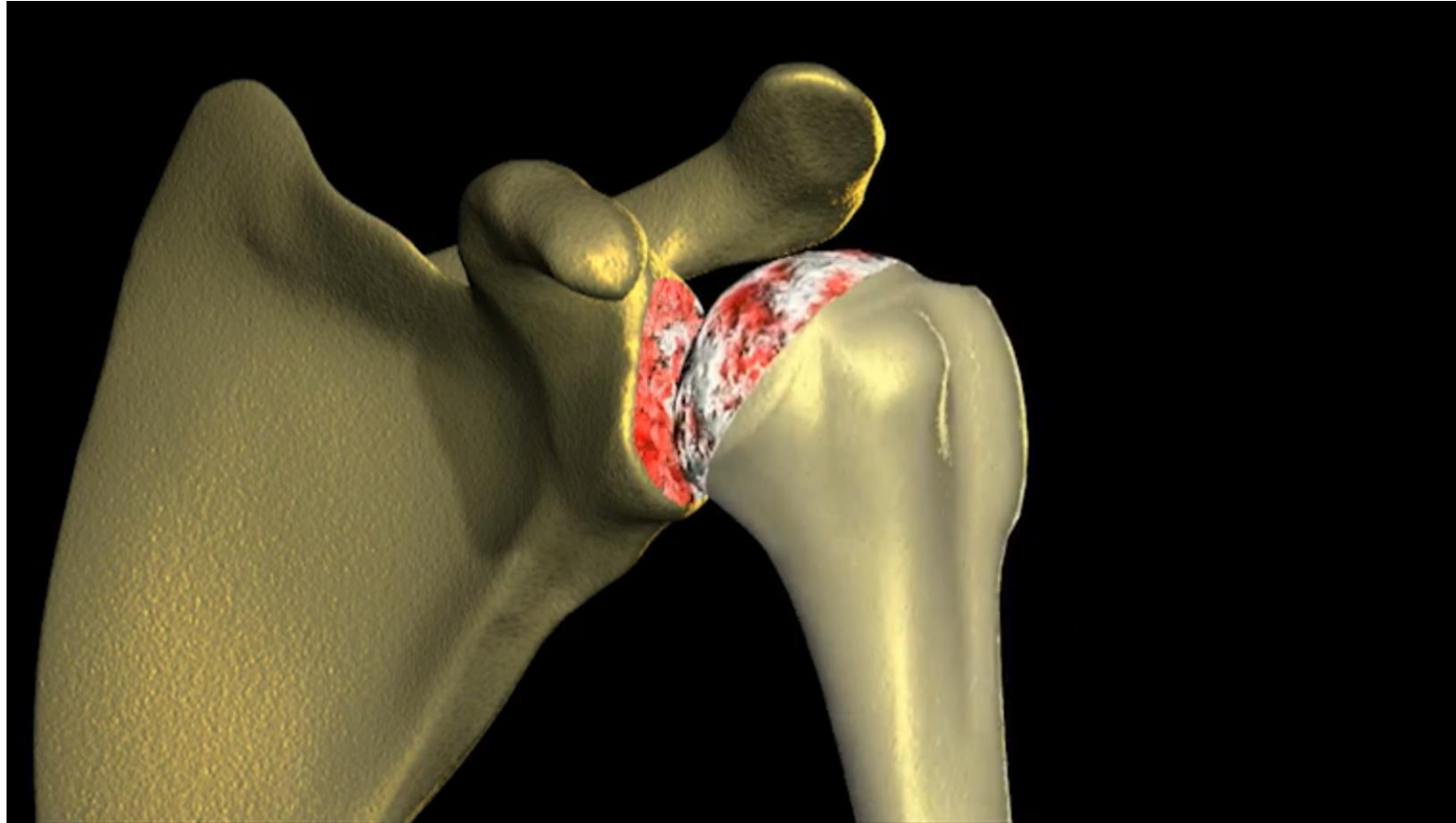


Stemless Implant



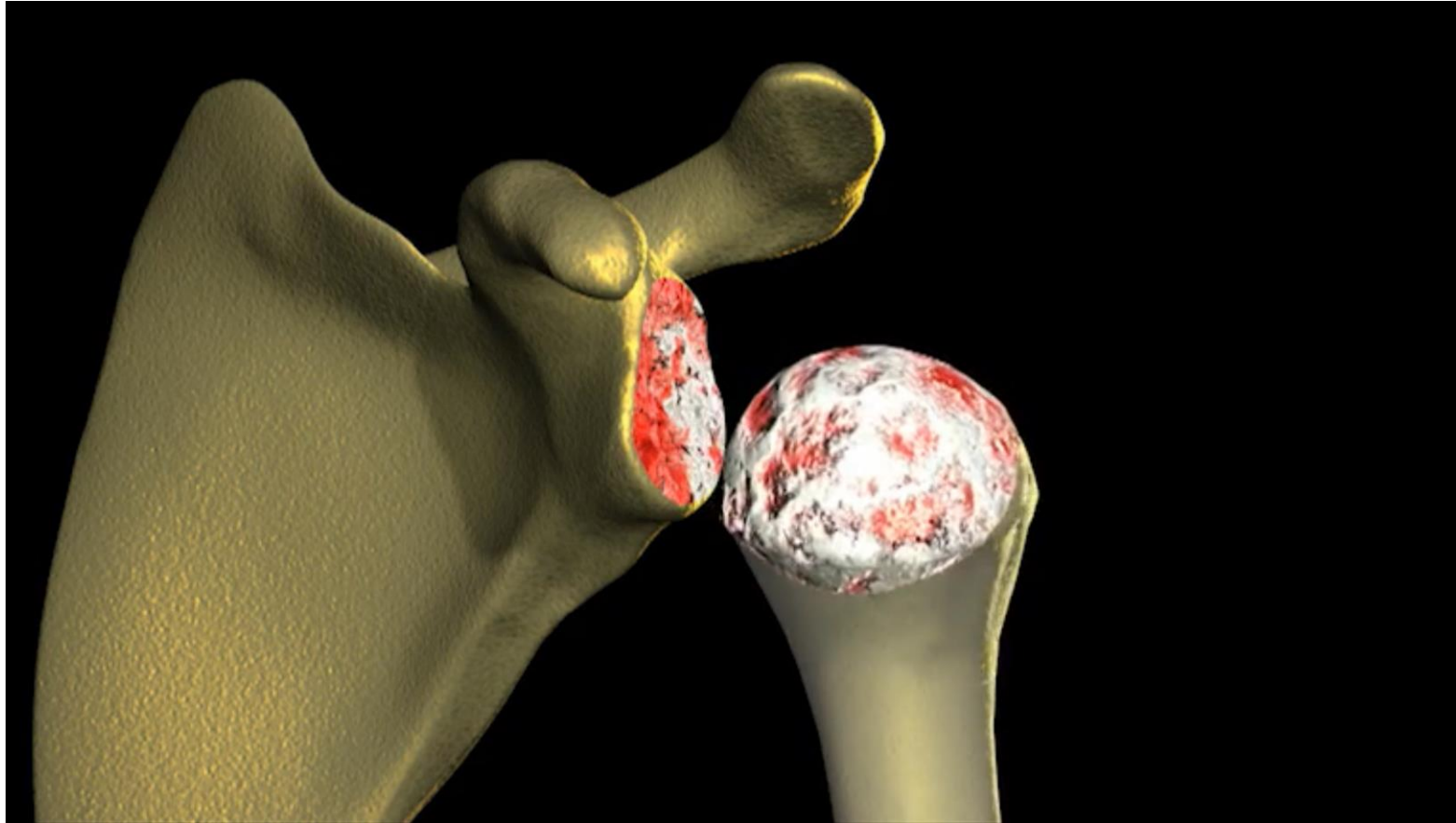
Tessany Schou

The “Thumb Test”



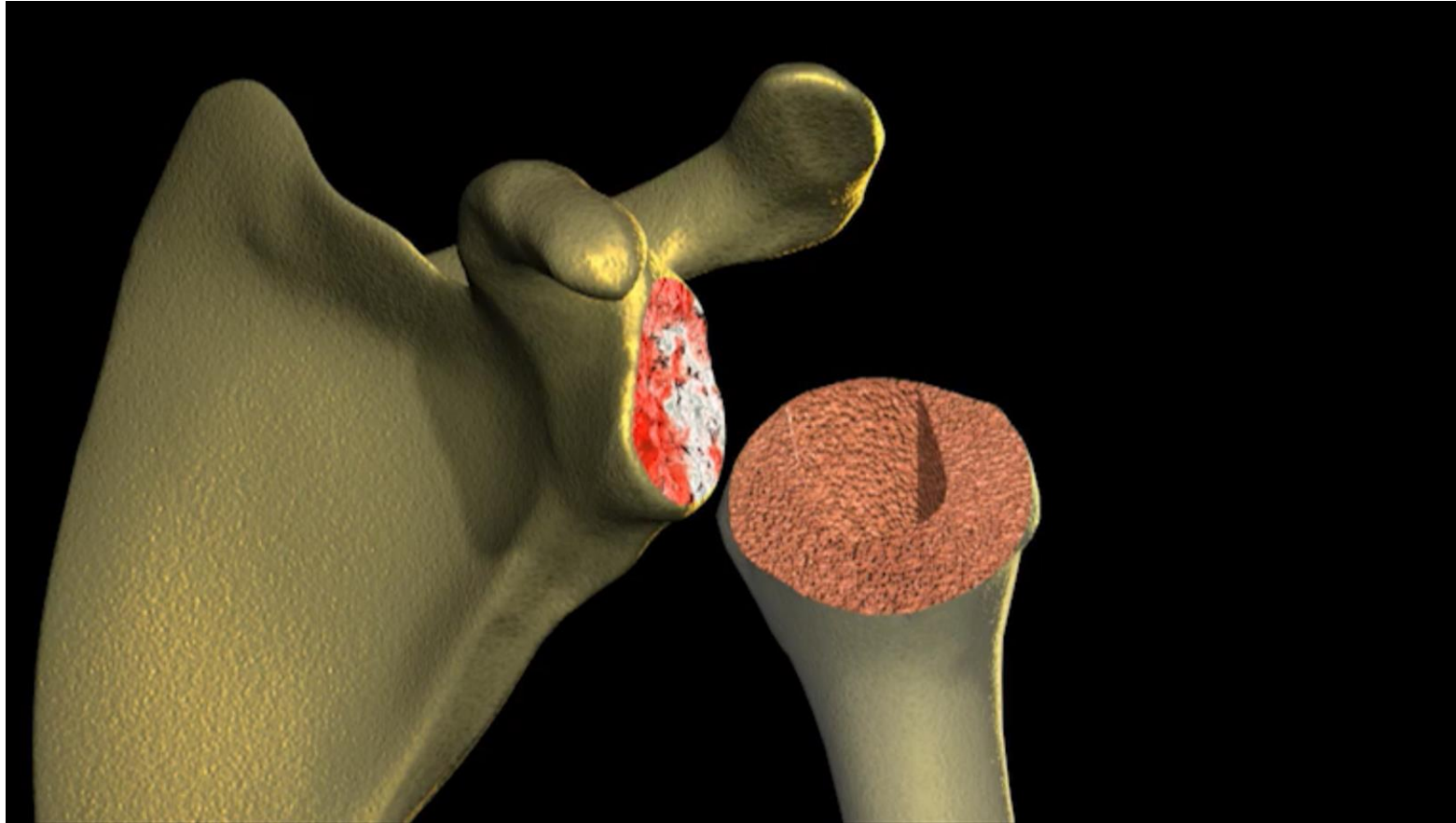
Tessany Schou

The “Thumb Test”



Tessany Schou

The “Thumb Test”



Tessany Schou

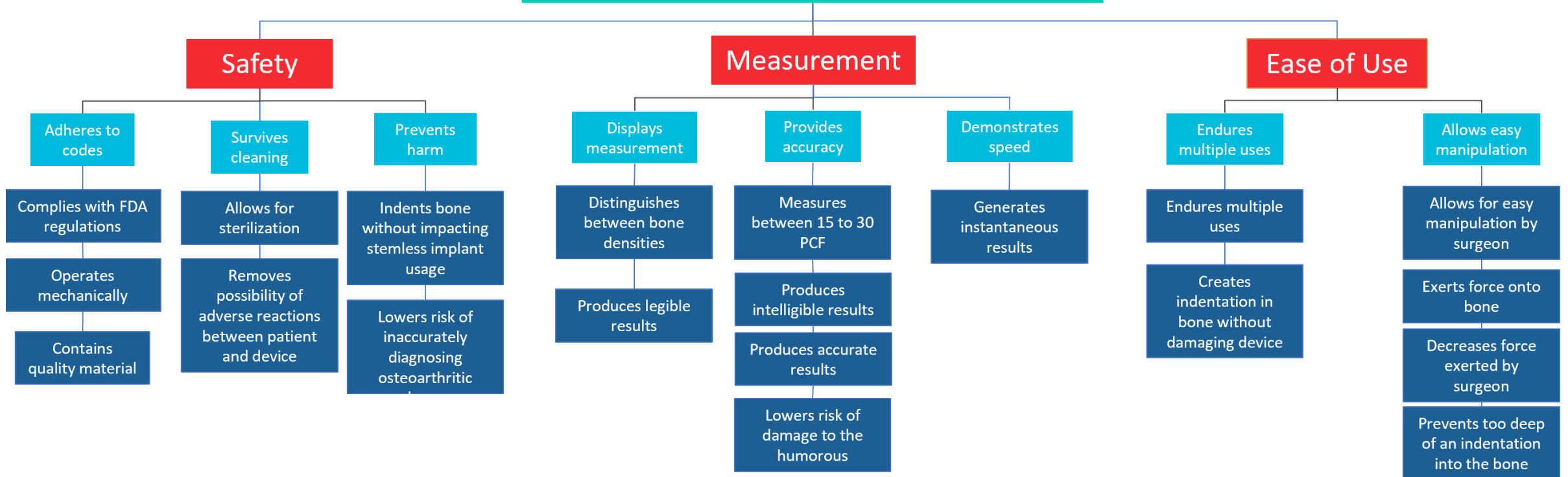
Levels of Bone Density/Quality



Tessany Schou

Functional Decomposition

Device for Use in Surgery that will Easily and Safely Provide Measurement



Tessany Schou

Targets

Compliant
with FDA
regulations

Reports results
with 95%
accuracy

Measures to
an accuracy of
.5 PCF

Width of
device is
smaller than
6 in.

Device
withstands
temperatures up
to 140 °C

Lifespan
greater than
50 uses

Creates
indentation less
than or equal to
2 cm

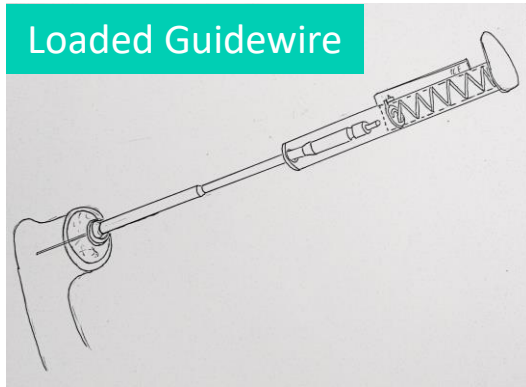
Weighs less
than or equal
to 5 lbs



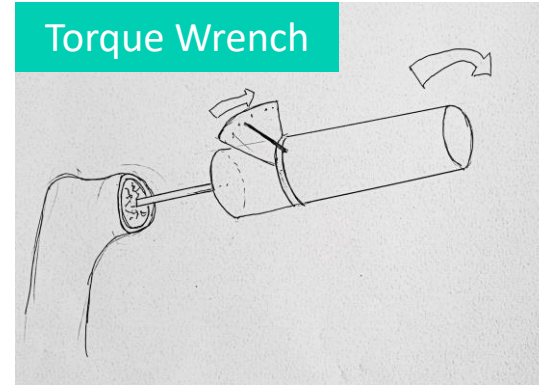
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Concepts

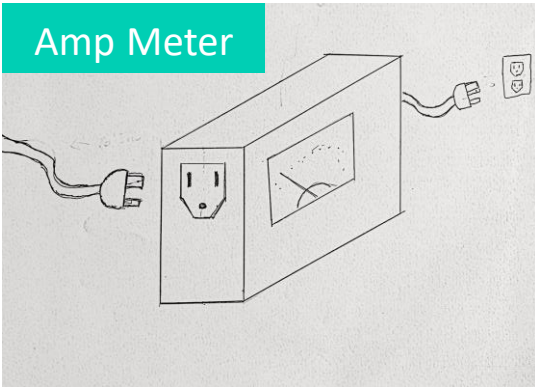
Loaded Guidewire



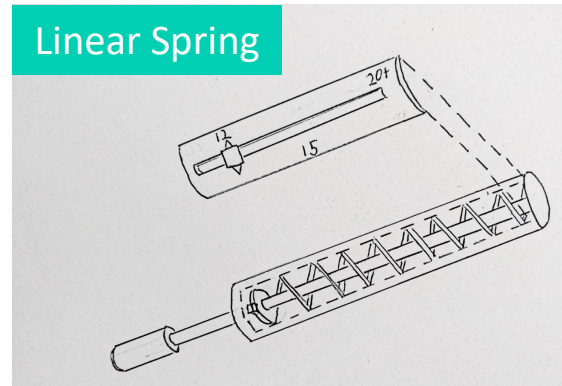
Torque Wrench



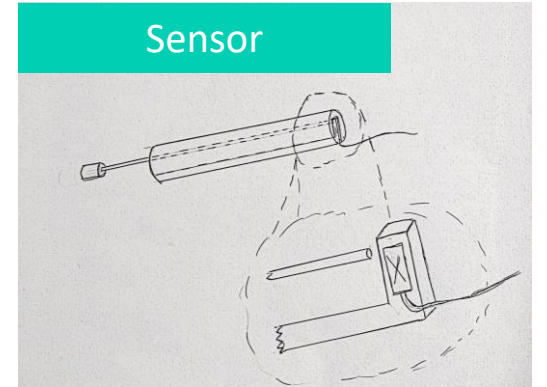
Amp Meter



Linear Spring

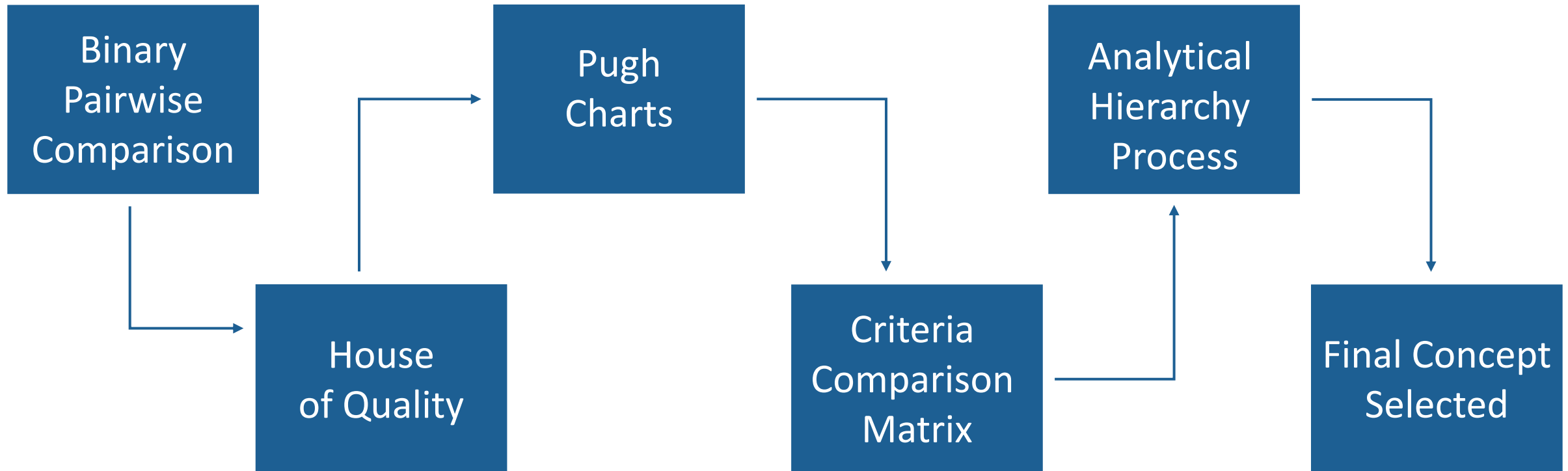


Sensor



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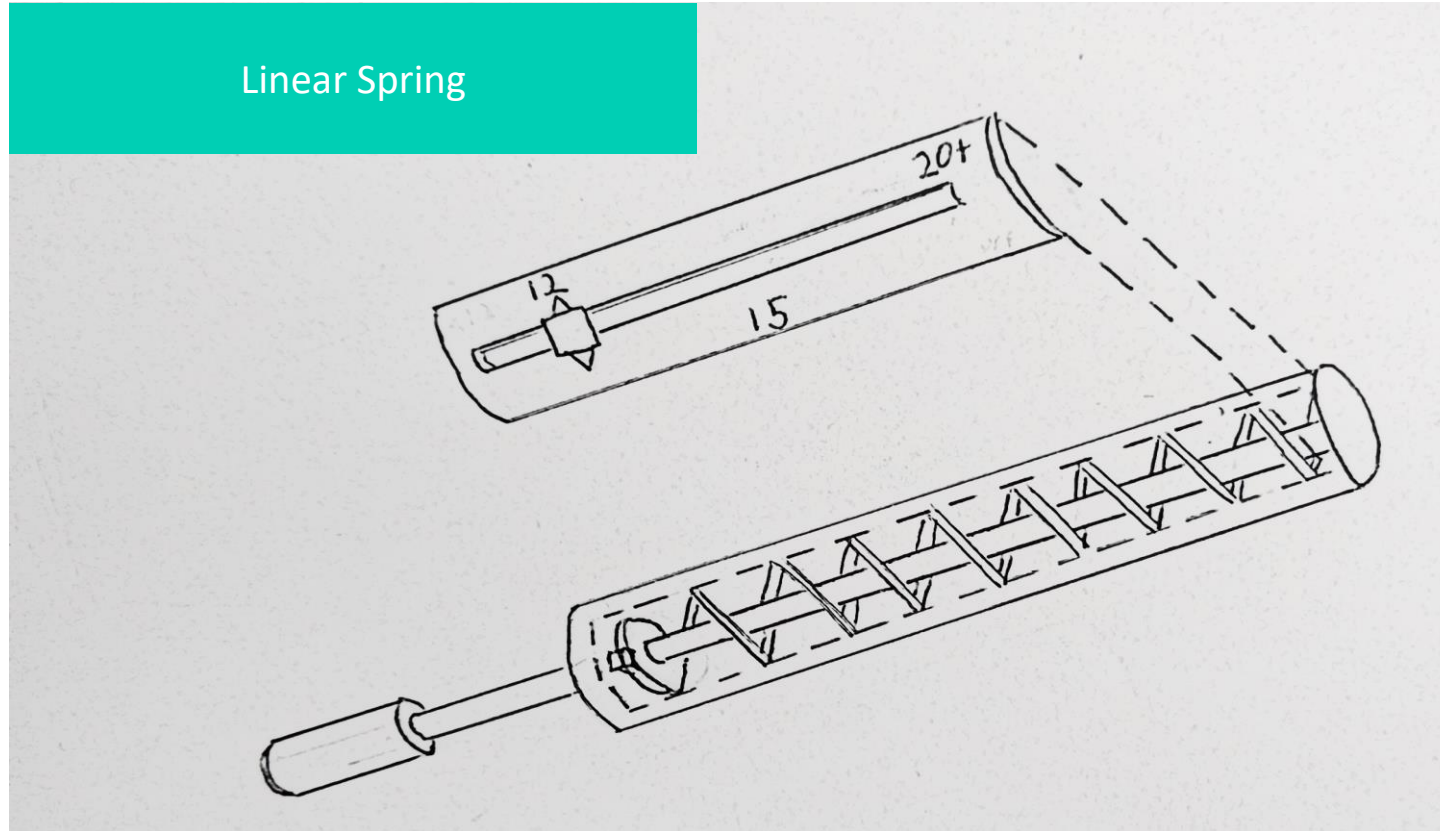
Concept Selection



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Concept Selection

Linear Spring



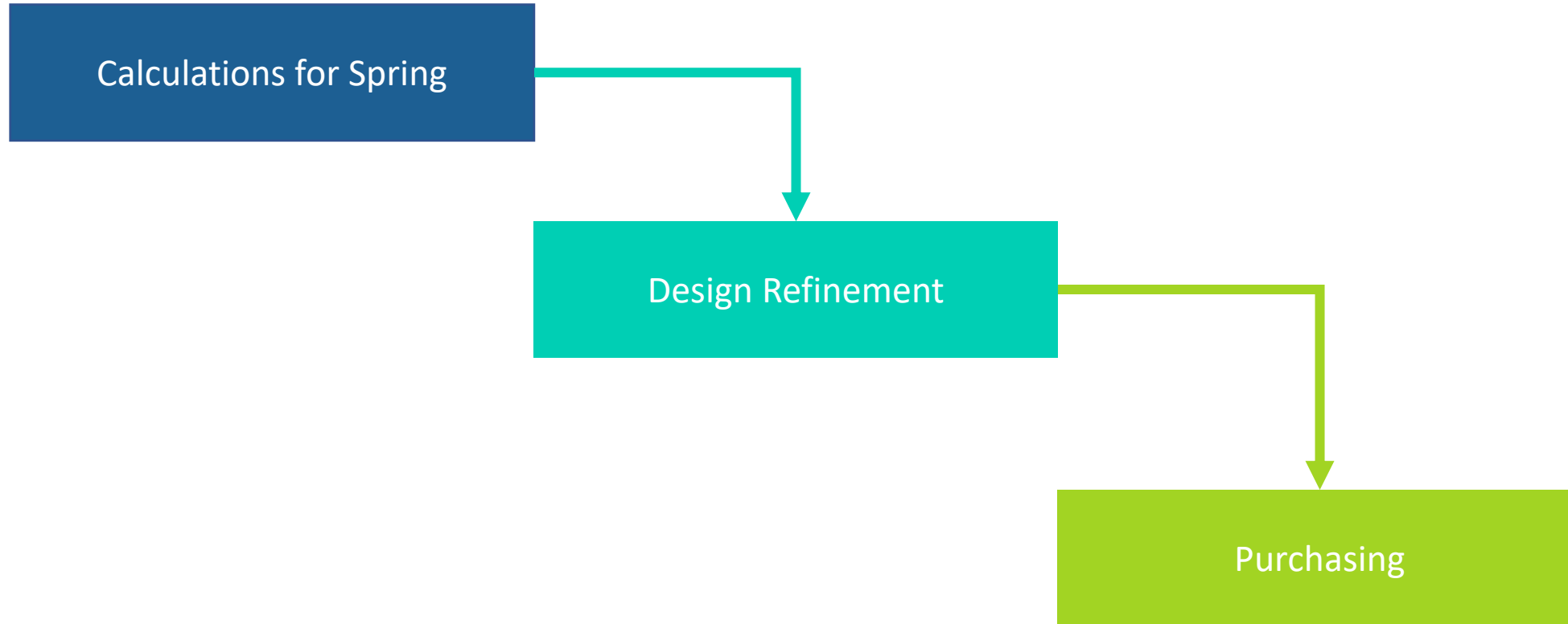
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Rework and 3D Model



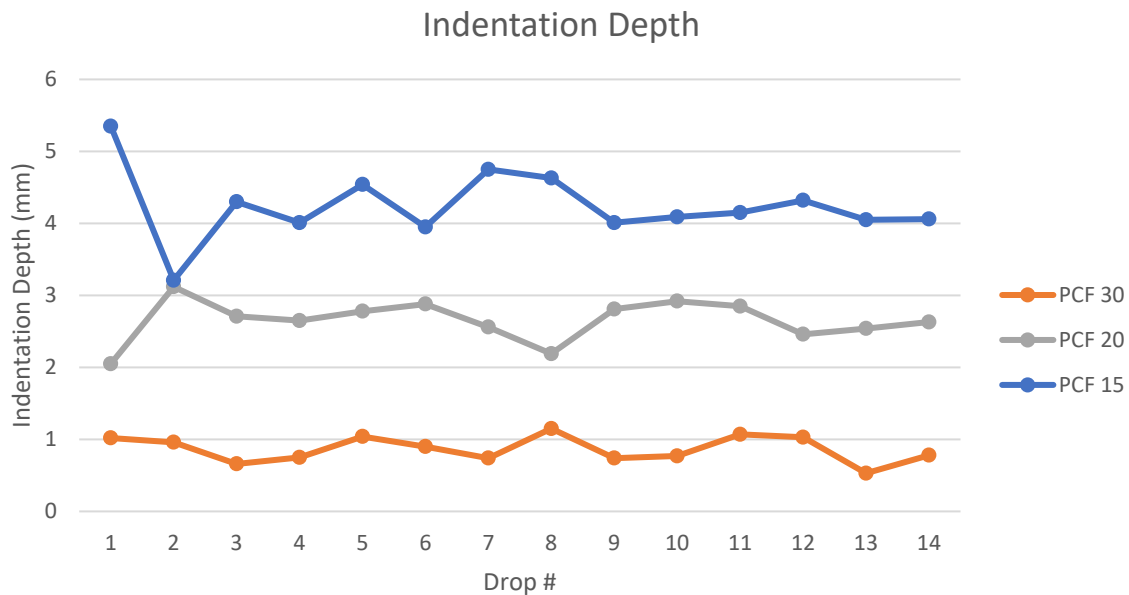
Timothy Surface

DR4



Timothy Surface

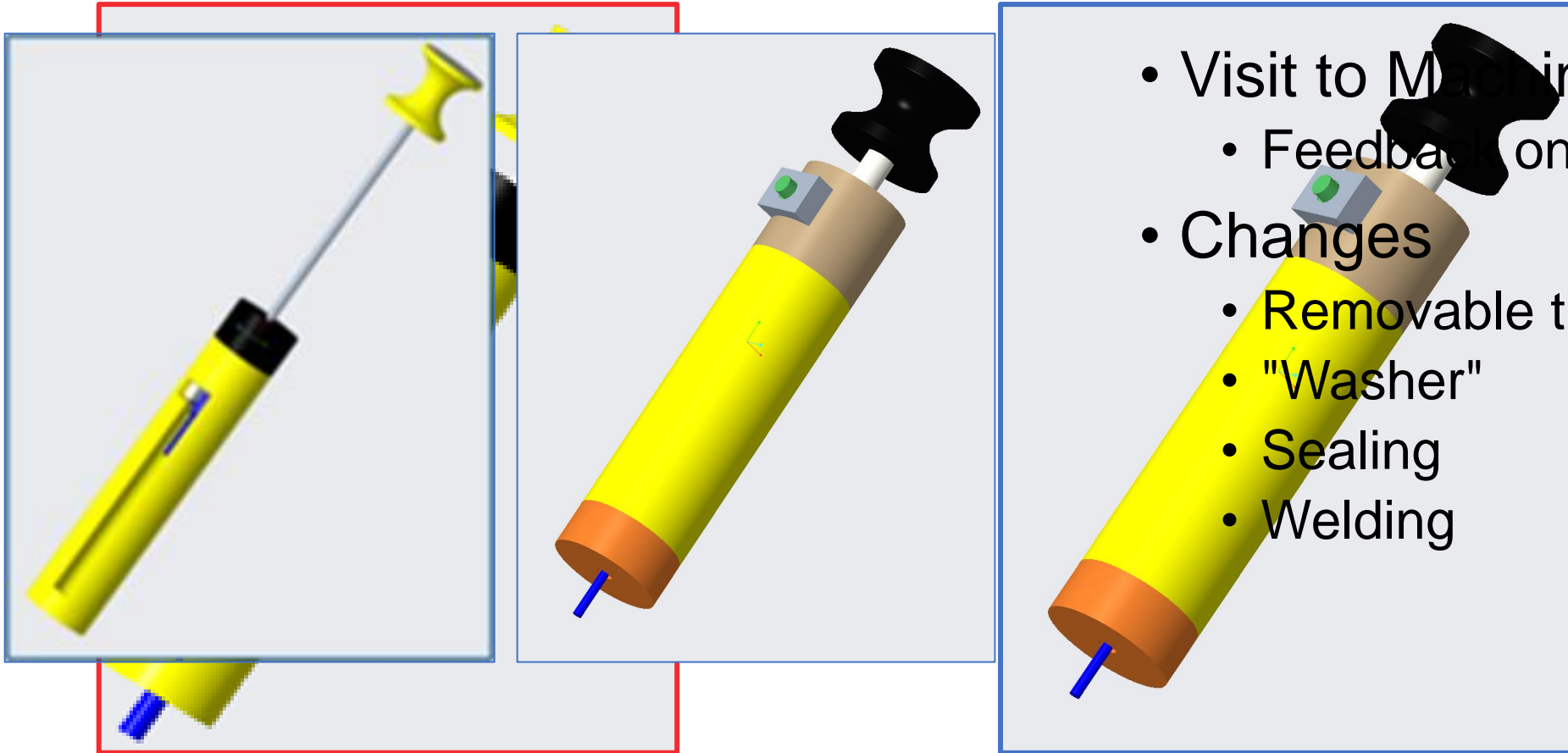
Saw Bone Quantification



- Research
 - Journal articles
- Compression testing
 - Maglab
- Drop testing
 - Methodology
 - Results

Timothy Surface

Design Refinement

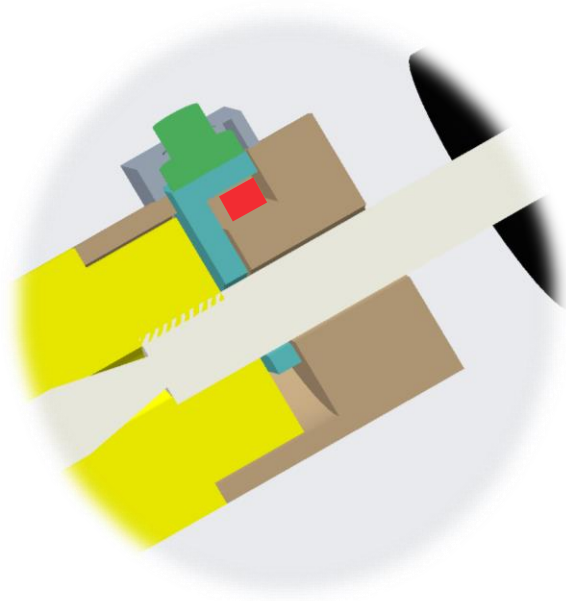


- Visit to Machine shop
 - Feedback on design
- Changes
 - Removable tip
 - "Washer"
 - Sealing
 - Welding

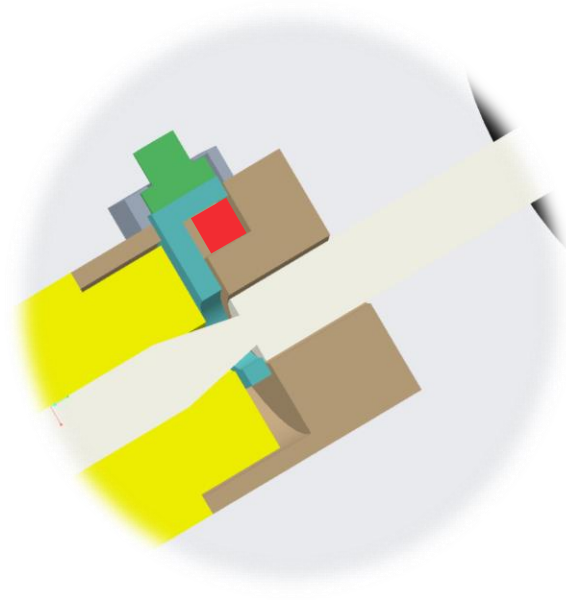
Timothy Surface

Current Method of Release

Free Position



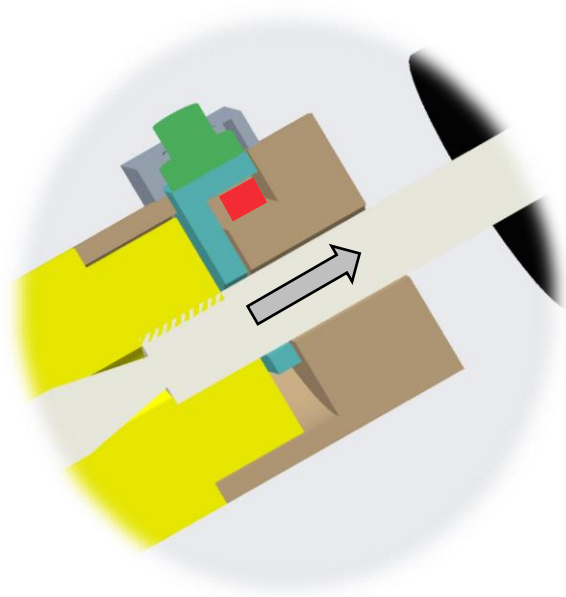
Locked Position



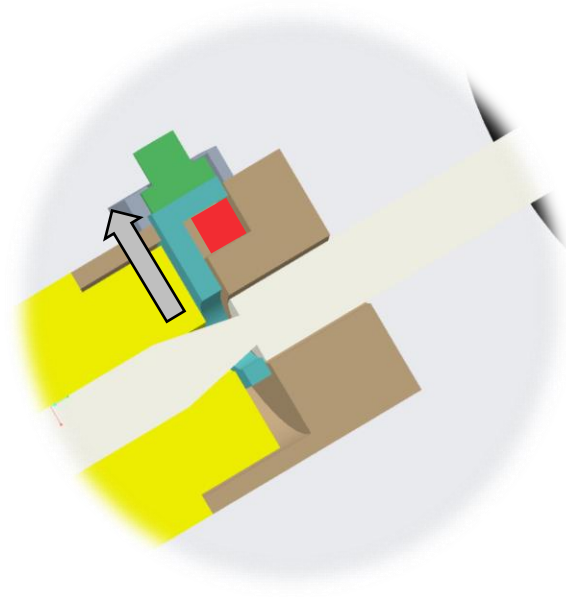
Timothy Surface

Current Method of Release

Free Position

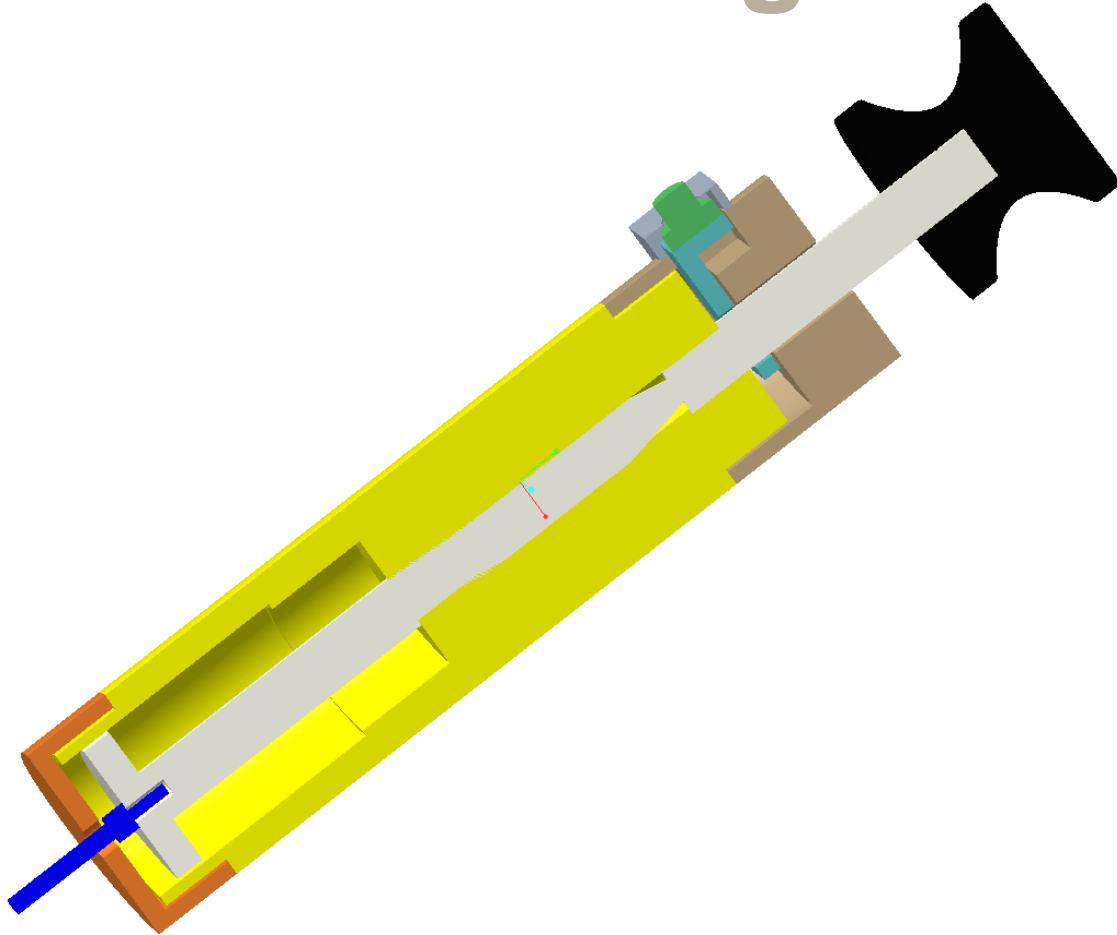


Locked Position



Timothy Surface

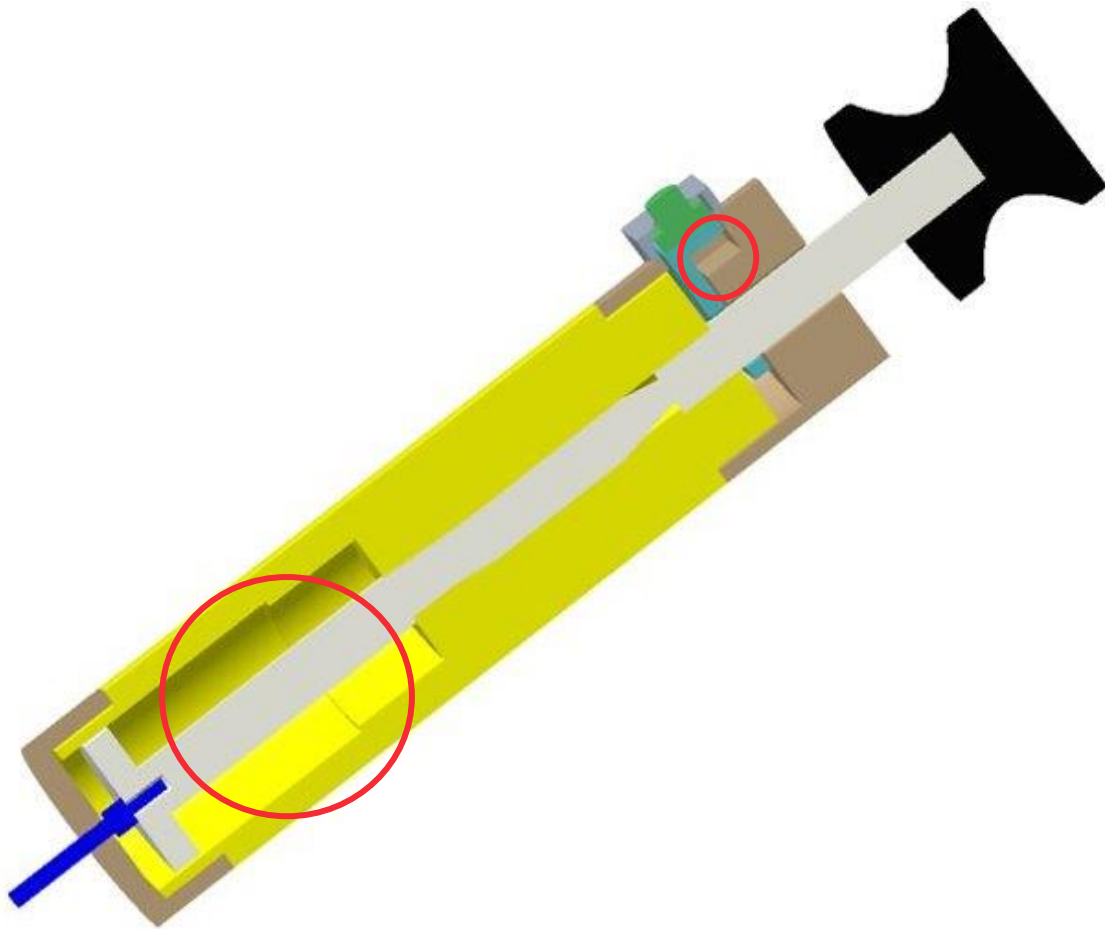
Internal Design



- Visit to Machine shop
 - Feedback on design
- Changes
 - Removable tip
 - "Washer"
 - Sealing
 - Welding

Timothy Surface

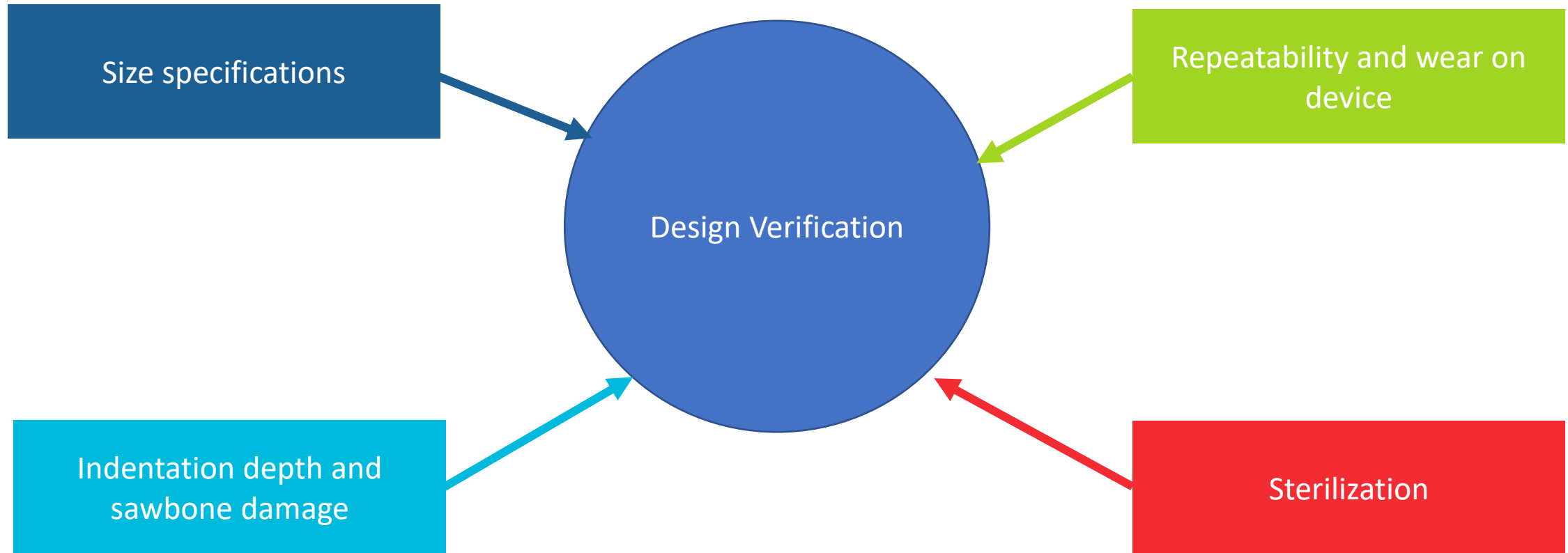
Components and Ordering



- Housing and Caps
- Rod
- Tip
- Button Components
- Spring

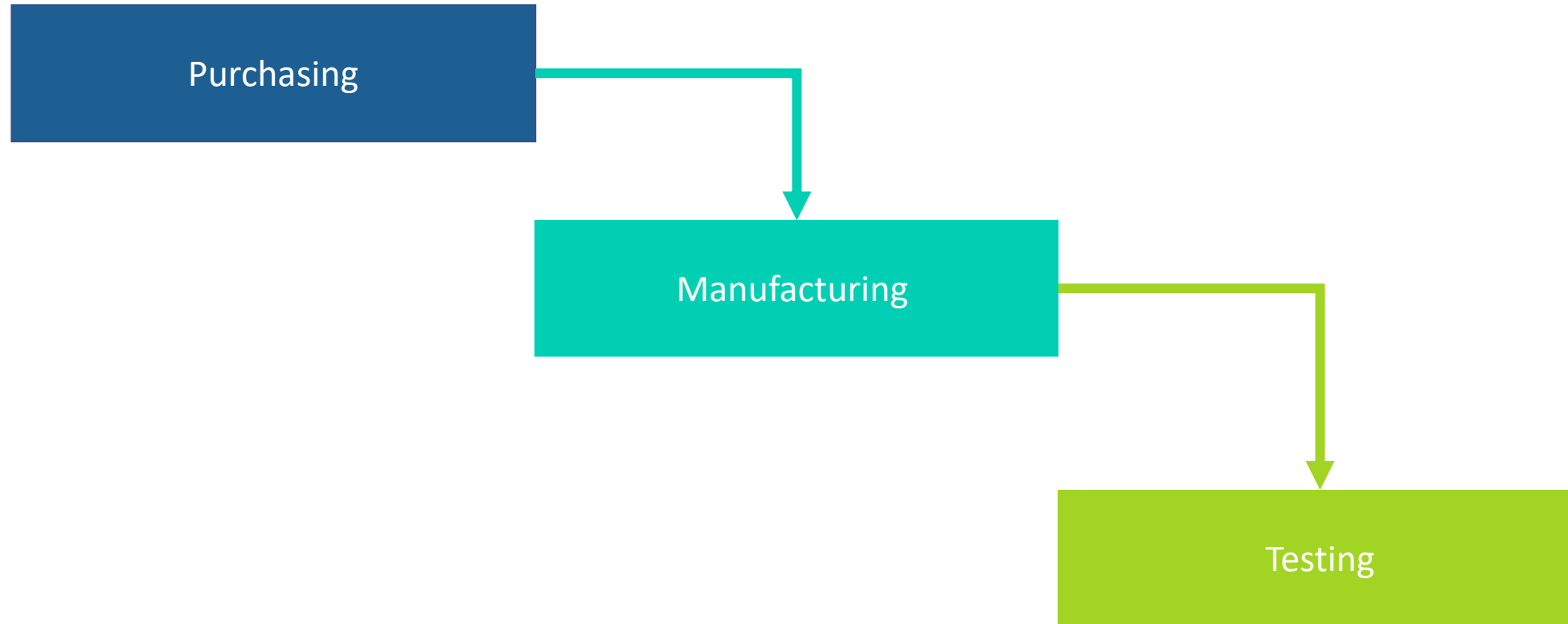
Timothy Surface

Testing



Timothy Surface

Looking Ahead



Timothy Surface

4 Most Important Points

1. Project is to develop a device to measure bone quality.
2. Second prototype is completed.
3. Currently ordering material.
4. Working with machine shop for design refinement and manufacture.

Timothy Surface



Reference

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<https://doi.org/10.1002/jor.24633>

Timothy Surface

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Timothy Surface