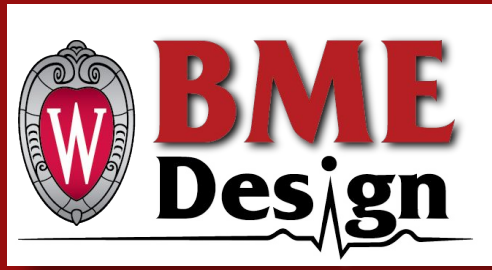
Arterial Line Simulator



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Advisor: Dr. Melissa Skala

Client: Mr. Mitchel Reuter

Overview of Presentation

1. Problem Statement
2. Background Information
3. Product Design Specifications
4. Design Ideas
5. Design Matrix
6. Future Work
7. References & Acknowledgements

Problem Statement

- Want to simulate arterial line waveforms without use of manikins
- Current practice is to move the syringe plunger by hand
- Use in teaching labs

Background

- Arterial line monitoring is an invasive method of monitoring both heart rate and blood pressure through arterial waveforms
- Helpful for real time feedback about a patient's cardiovascular system
- Not many accessible designs for practicing placing and reading the waveforms from this device
- We must create a device that can accurately and consistently produce an range of arterial waveforms

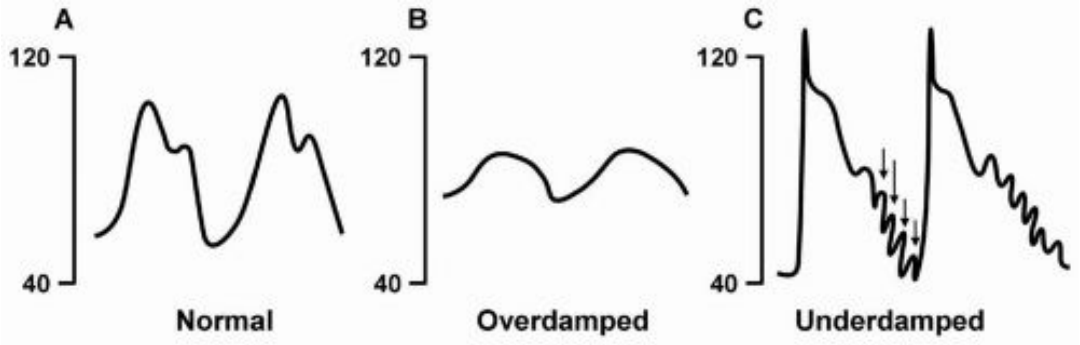


Figure 1: Examples of the various arterial waveforms [1]

Product Design Specifications

Our device must be:

- Be about the size of a vhs tape
- Have variable speeds 30-200 rpm
- Be able to replicate the various arterial waveforms
- Can be reusable and easily attached to a 10ml syringe

Figure 2: Current manikin model capable of our goals [2]

Mateo Silver

Design Idea 1: The Cam

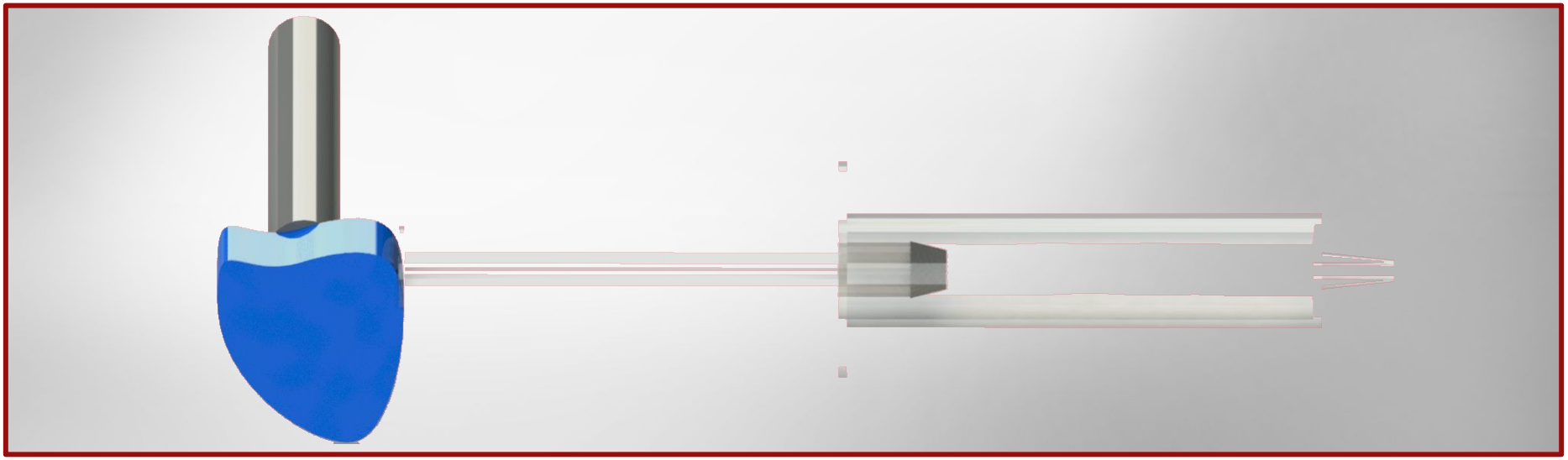


Figure 3: The Cam design

Mateo Silver

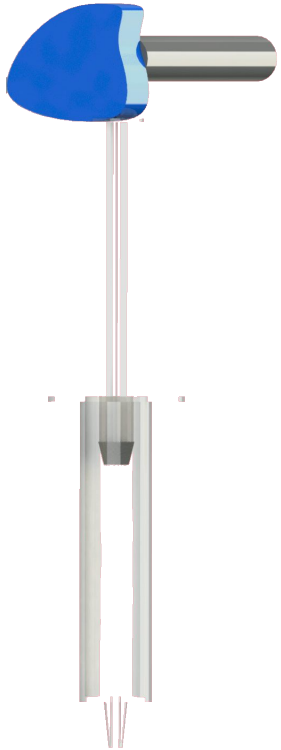
Design Idea 1: The Cam

Advantages:

- Simple mechanism – fewer points of failure
- Range of use – swapping cams
- Cost – only one motor and one moving part

Disadvantages:

- Cam shape – manufacture multiple types
- Durability – swapping cams



Frankie Szatkowski

Design Idea 2: The Piston

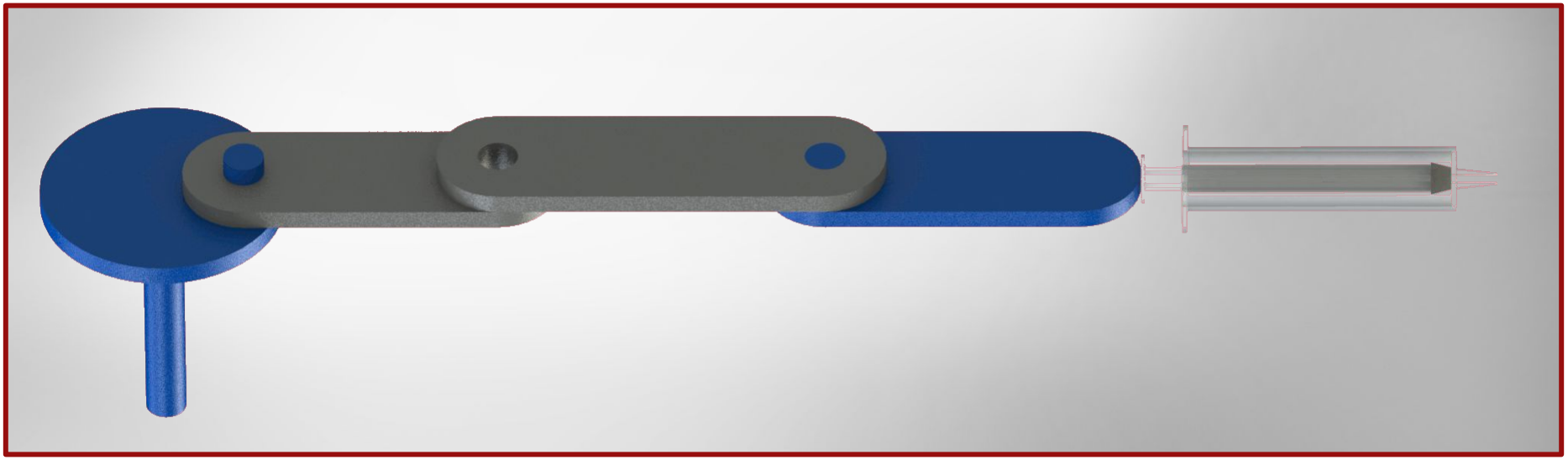


Figure 4: The Piston design

Design Idea 2: The Piston

Frankie Szatkowski

Advantages:

- Simplistic Design
- Consistent - Same motion time and time again

Disadvantages:

- Multiple parts -> more points of failure
- Difficult to produce multiple waveforms

Sophia Finn

Design Idea 3: The Bolt

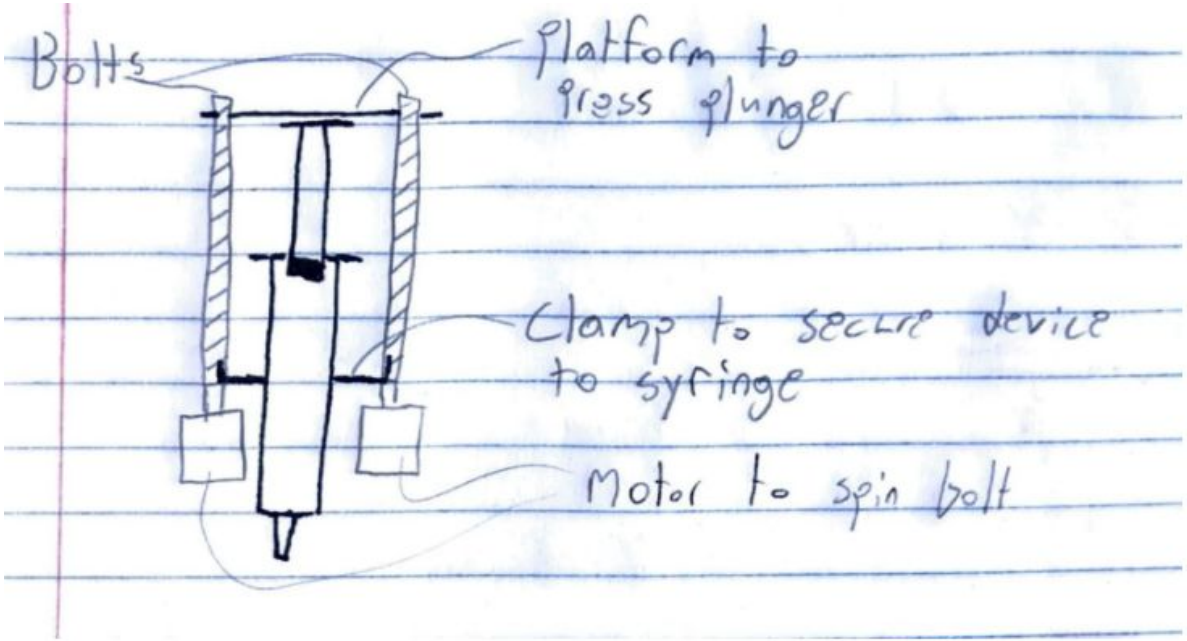


Figure 5: The Bolt design

Sophia Finn

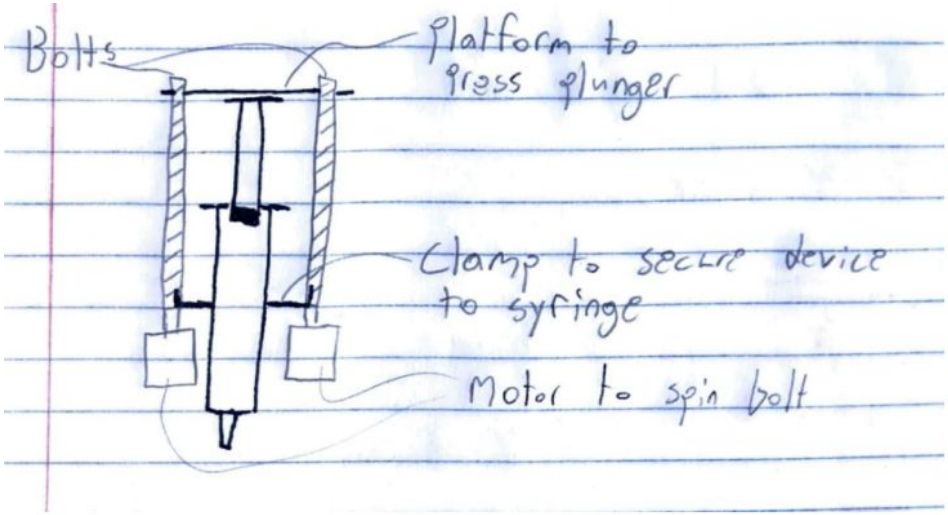
Design Idea 3: The Bolt

Advantages:

- Durability - stable clamp
- Range of Use - all waveforms

Disadvantages:

- Consistency - slow motion of bolt
- Cost - bolt, motors, clamp



Design Matrix

Criteria	Design 1: The Cam	Design 2: The Piston	Design 3: The Bolt
Consistency (25)	5/5 * 25 = 25	5/5 * 25 = 25	4/5 * 25 = 20
Range of Use (25)	4/5 * 25 = 20	2/5 * 25 = 10	3/5 * 25 = 15
Ease of Use (20)	5/5 * 20 = 20	5/5 * 20 = 20	4/5 * 20 = 16
Ease of Fabrication (10)	3/5 * 10 = 6	2/5 * 10 = 4	2/5 * 10 = 4
Safety (10)	5/5 * 10 = 10	5/5 * 10 = 10	4/5 * 10 = 8
Durability (5)	3/5 * 5 = 3	3/5 * 5 = 3	4/5 * 5 = 4
Cost (5)	5/5 * 5 = 5	4/5 * 5 = 4	4/5 * 5 = 4
Total = 100	**89 / 100**	**76 / 100**	**71 / 100**

Future Work

- Calculate cam shape
- Determine what motor will be used
    - Use motor speed to determine diameter of cam
- Fabrication options
- Automate waveform controls

Kasey Mohlke

Figure 6:
3D Printing
[3]

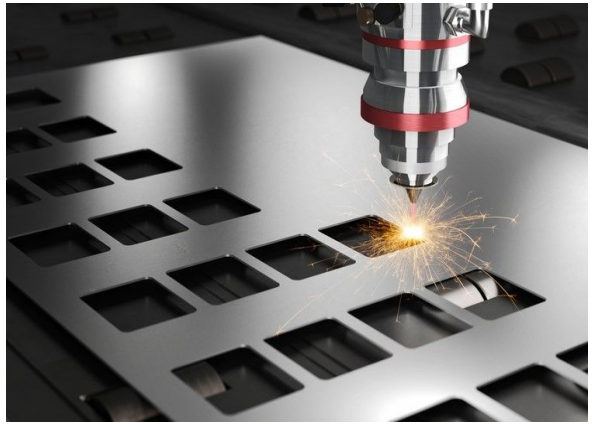


Figure 7:
Laser Cutting
[4]

Acknowledgements

Mr. Mitchel Reuter

Dr. Melissa Skala

BME Department

References

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