



Magical ring removal methods

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Client Information

Dr. Christopher Green

- Pediatric pulmonologist at UW hospital
- Received his medical degree from University of Rochester School of Medicine and Dentistry
- Has been in practice for more than 20 years.



Figure 1. Dr. Christopher Green



Background for Ring Removal Necessity

- ER visits due to swollen fingers lead to surgeons needing to remove the rings.
- Causes of swelling: infection, injury, pregnancy, edema. The most common cases in the ER are edemas.
- Tungsten carbide and titanium rings have a hardness scale rating of 8.5-9 compared to gold and silver with hardness scale rating of only 2.5-3.

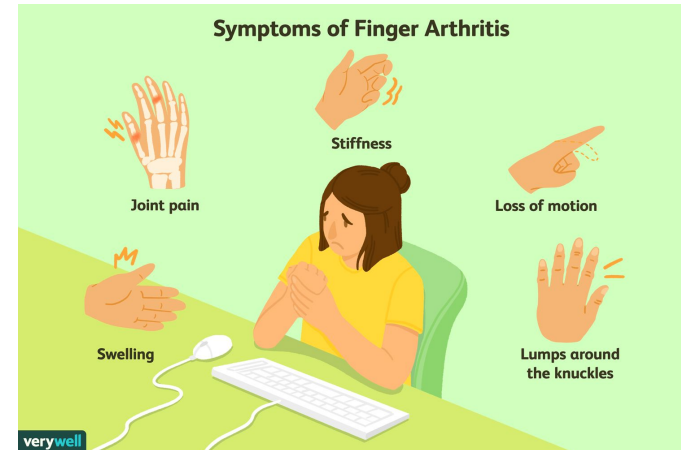


Figure 2. Arthritis as a possible cause of finger swelling

Current Existing Devices

- Gold/Silver ring cutter with a blade (manual/ battery powered)
- Titanium/Tungsten Carbide ring cracker (manual)



Figure 3&4. Ring cutter and ring cracker device



Problem Statement

- Current methods for ring removal can be dangerous to both patients and physicians
 - flying metal pieces, danger of cutting fingers
- Find safer methods of ring removal process that are both effective and safe to patients and physicians

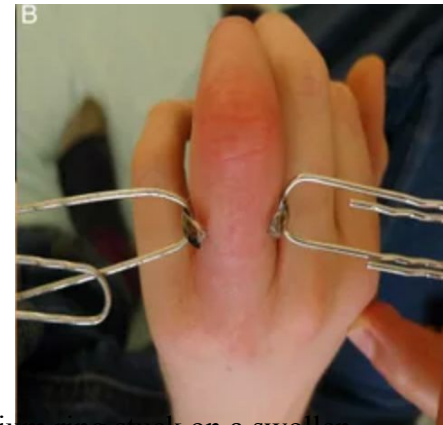


Figure 5&6. A titanium ring stuck on a swollen finger



Product Design Specifications

- The device should not allow shards to be thrown above 2 inches.
- Ring removal should be done between 1-2 minutes.
- Must be able to break Tungsten Carbide (1100 MPa fracture point) and Titanium metal (600 MPa fracture point) rings.
- Small surgical device, about 7 inches in length.
- Minimize patient discomfort with minimal damage to the skin (20 MPa Tensile strength).

How string wrapping works to remove a ring



Design 1. Automated String Wrapper

Advantages:

- The ring stays intact
- Automated wrapping eliminates manual wrapping
- Works for all ring materials

Disadvantages:

- Ineffective after certain level of swelling and injury on the finger
- Manufacturing the automation

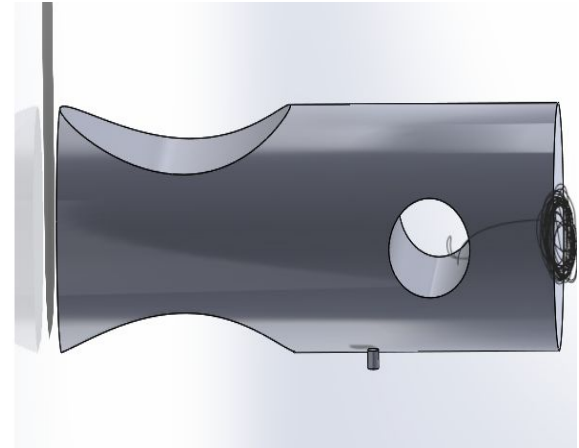


Figure 7. Automated string wrapping device solidwork design



Design 2. Automated Ring Cracker Protection

Advantages:

- Automated process with minimal manual intervention
- Applied to all type of materials of ring
- With full protection system

Disadvantages:

- “Scary” appearance might not be acceptable to all patients
- Manufacturing feasibility

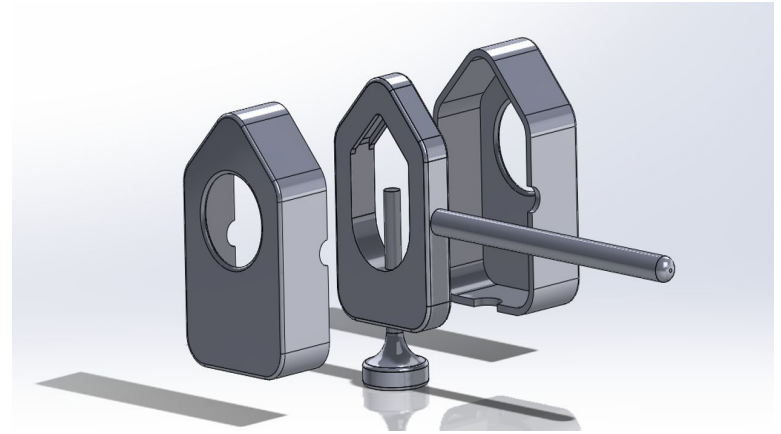


Figure 8. Automated ring cracker design



Design 3. Finger Shrinking Lubricant

Advantages:

- Easy to operate by the physicians
- Less painful for the patients
- No damage to the rings

Disadvantages:

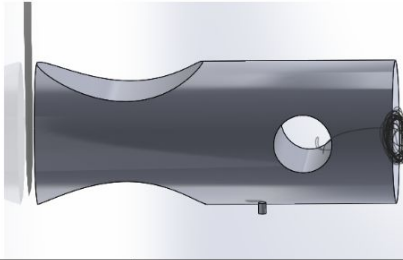
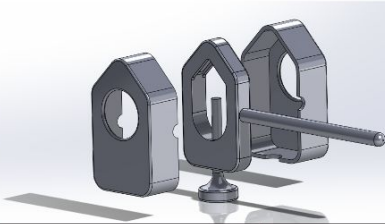

- Need thermal contraction to achieve which may lead to no blood flow in fingers
- May not be effective enough for very swollen fingers



Figure 9. Lubricant example

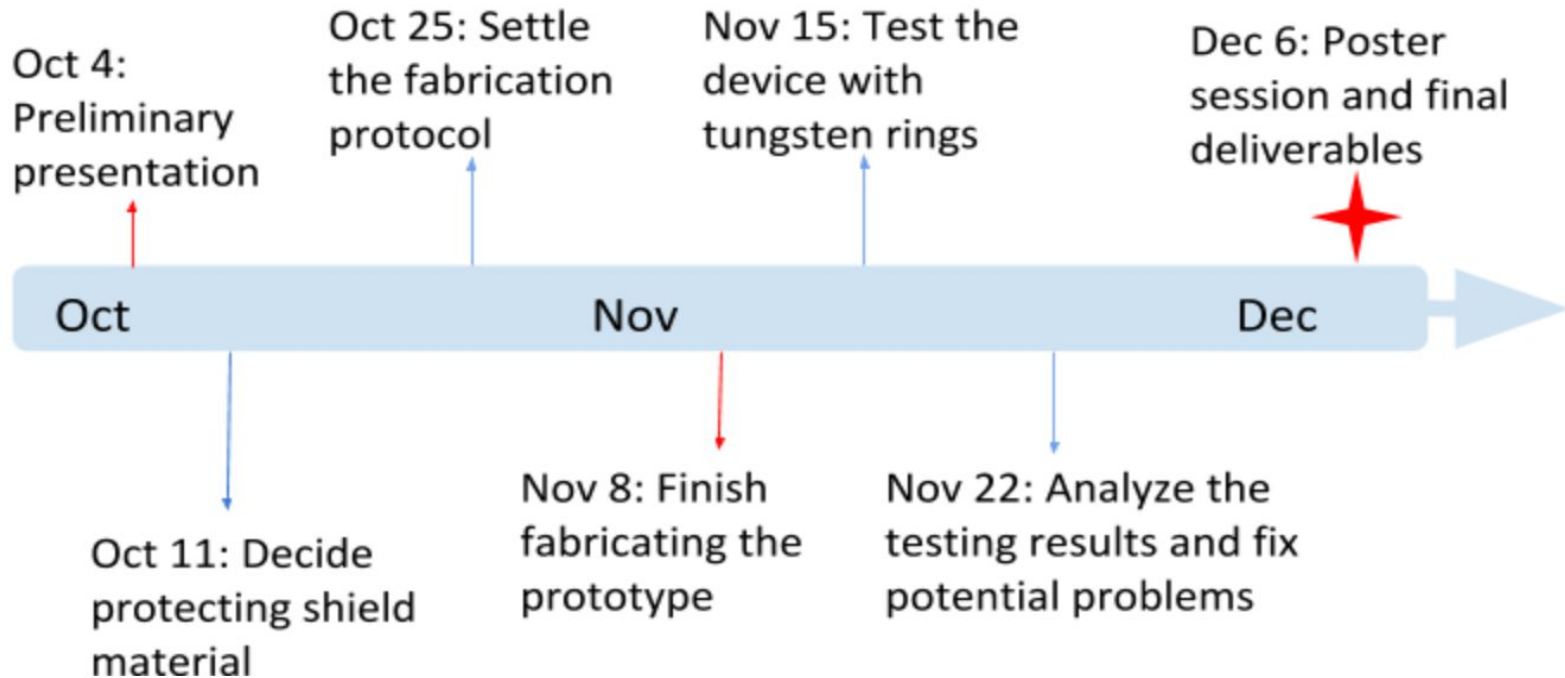


Design Matrix

	Automated string wrapping		Ring cracker protection		Finger Shrinking Lubricant	
						
Chemical Stability & Safety (25)	4/5	20	5/5	25	4/5	20
Patient Comfort (20)	3/5	12	3/5	12	5/5	20
Effectiveness (15)	3/5	9	5/5	15	2/5	6
Ease of Fabrication (15)	3/5	9	3/5	9	2/5	6
Patient Ease of Mind (10)	4/5	8	3/5	6	5/5	10
Ease of Operation (10)	5/5	10	4/5	8	5/5	10
Cost (5)	4/5	4	3/5	3	4/5	4
Total (100)	72		78		76	

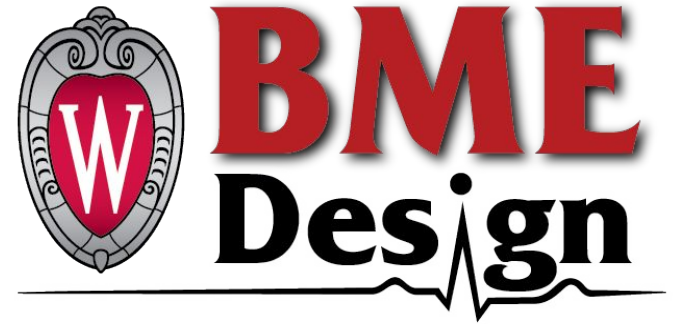


Future Work - Timeline



Acknowledgements

Thank you to our client Dr. Christopher G. Green and our advisor Dr. Tracy Jane Puccinelli for the guidance and help.



References

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- [2] <https://www.sciencedirect.com/science/article/pii/S2211419X12000389>
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