

## Senior Capstone Design

Project: **Arthroscopic Bone Shaver**

Primary Author: **Maclean Landis**

Team: **The 1500 Dollar Shave Club**

Date: **10/22/2020**

### Design Validation Plan & Results (DVP&R)

Requirement	Test	Test Subject	Target Date	Result	Recommendation
Motor and servo are able to be activated by pulling the trigger	Ensure all electronics work properly when a toggle switch is pressed	Prototype #1	11/7/20		
Prototype #1 battery life will last for two hours	Ensure that the device can be powered at maximum shaving speed for two hours	Fully Functional Prototype #1	11/13/20		
Frequency Output	Ensure that the device has a variable speed output between 900 and 6000 RPM	Fully Functional Prototype #1	11/7/20		
New battery must conform to comfortable handle size	Ensure that the battery can be stored securely in handle and that new handle is comfortable.	Fully Functional Prototype #1	11/13/20		
Maximum outer shaft diameter between 4 and 6.5mm	Ensure that inner mechanics can achieve orbital sanding motion via the narrow shaft	Fully Functional Prototype #1	11/13/20		
Compatible with 100-400 grit shaver heads	Ensure that head design does not have interference with shafts on Solidworks, test with actual components	Fully Functional Prototype #1	11/21/20		
Final Prototype battery will last for two hours	Conduct mathematical analysis, Test fully working circuit to battery failure	Fully Functional Final Prototype	4/29/21		
Compatible with surgical suction pumps	Model suction pump in solidworks then test for interference in assembly	Fully Functional Final Prototype	4/29/21		
Tip can be easily swapped out and sterilized via autoclave	Check that design can be disassembled in 3 minutes; handle casing can be autoclaved	Fully Functional Final Prototype	4/29/21		
Bone must be shaved	Ensure that the motors are able to overcome friction force to be able to shave bone	Fully Functional Final Prototype	3/4/21		
Smooth shaving surface must be achieved	Qualitatively identify smoothness via feel after manual sanding of cartilage and bone vs. device	Fully Functional Final Prototype	3/4/21		
Device must be thermostable	Ensure that circuit does not overheat	Final Prototype	3/4/21		
Device must operate reliably under load	Shave cartilage and bone separately to ensure full shaving head articulation for > 1hr	Fully Functional Final Prototype	3/4/21		

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Multiple End Attachments	Making sure that the shaver can have different shaving heads on the output shaft.	Final Prototype	3/4/21		
Make device compatible with current Operation Room batteries	Power Device with Currently Used Batteries.	Fully Functional Final Prototype	3/4/21		
Make device able to switch from predetermined motor speeds.	Change speed of motor with buttons	Fully Functional Final Prototype	3/4/21		
Ensure that handle components are durable enough for back-to-back surgeries	Shave bone for > 1hr, disassemble and reassemble handle with new tip (simulate sterilization), and retest	Fully Functional Final Prototype	4/29/20		