

**Motivation, Goal, Impact**

**Motivation:**

Rhonda's juvenile arthritis limits her range of motion.



**Goal:**

Develop a portable, handheld device that enables Rhonda to brush and pull her hair back.

**Impact:**

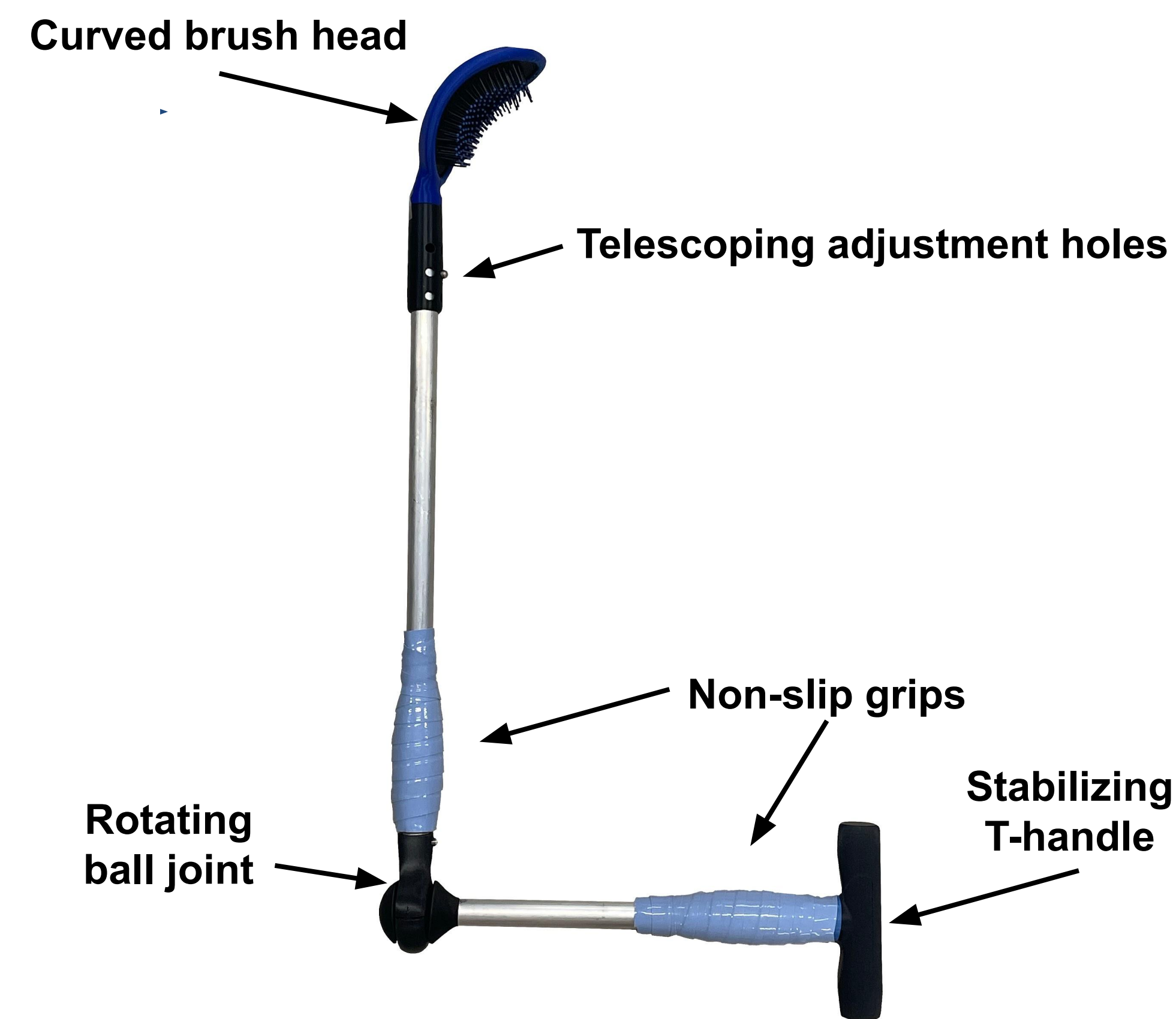
Increase independence in personal hair care, enhancing daily autonomy, and overall quality of life.

**Requirements**

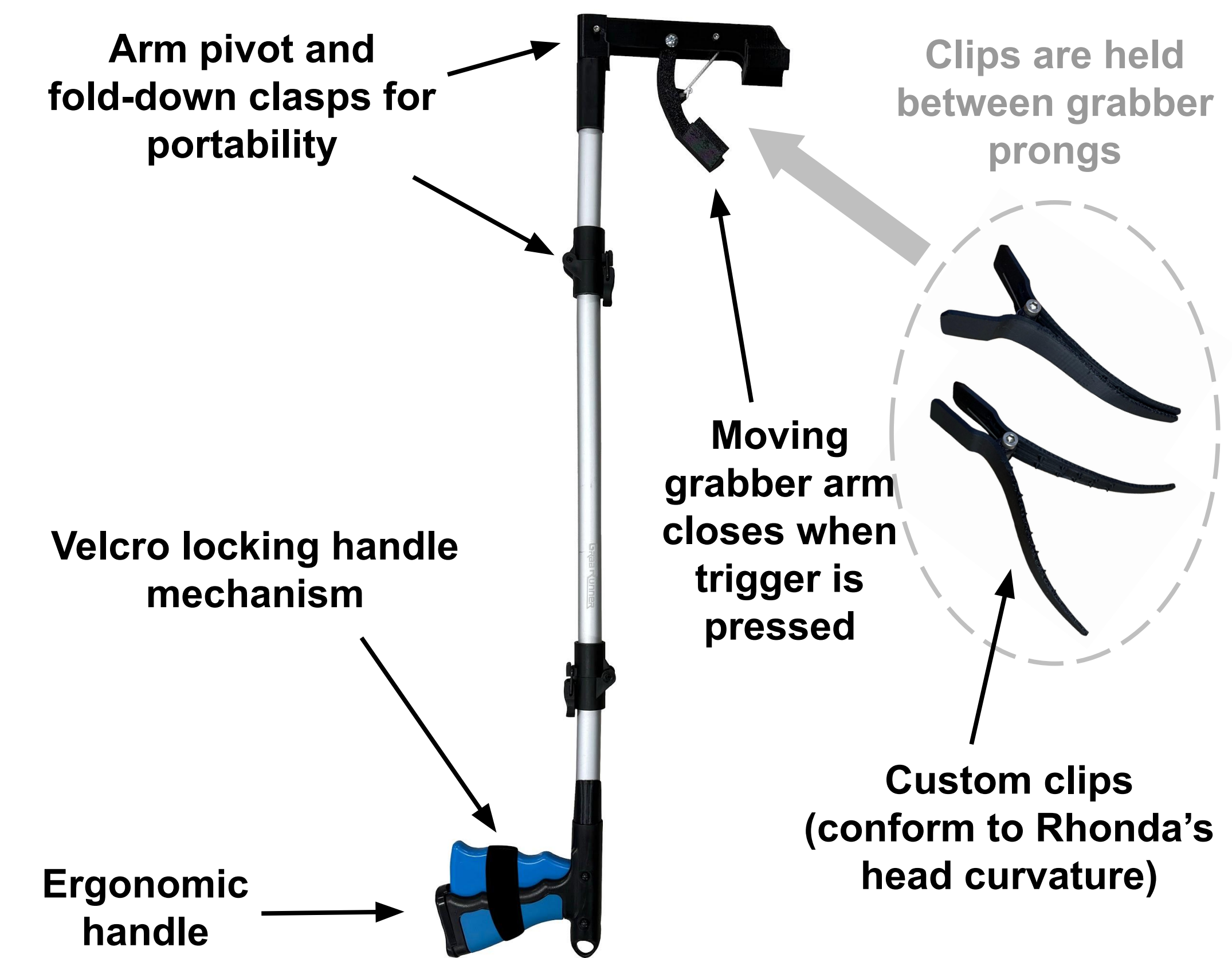
1. Requires limited dexterity and range of motion to operate
2. Brushes Rhonda's hair
3. Secures Rhonda's hair
4. Waterproof materials
5. Lightweight and portable ( $\leq 5$  lbs)
6. Aesthetically appealing
7. Compatible with existing case
8. Develop a user manual

**Final Design**

Brush



Grabber & Clip



**Design Calculations & Decisions**

**Key Results:**

Metric/Parameters	Magnitude	Everyday comparison
Brush Force	11.38 N	Pressing a light door
Moment at vertical grip	1.67 Nm	Turning a doorknob
Moment at horizontal grip	0.53 Nm	Turning a faucet handle
Brush head torque	0.34 Nm	Holding/tilting a smartphone
Trigger grip strength/force	9.1 N	Light squeeze (spray bottle)
Cordage tension	15.8 N	Pulling a drawer cord
Clip spring	0.15 Nm	Pressing a clothespin



**Decisions:**

Each component of the devices makes the brushing and clipping easy for our client.

- The vertical grip improves control
- The horizontal grip reduces moment and balances the brush device
- The handle length balances reach and torque demand
- The selected clip spring ensures a secure hold on the client's hair
- The use of a trigger-based grabber minimizes required hand input force

**Prototype & Test Results**

Brush

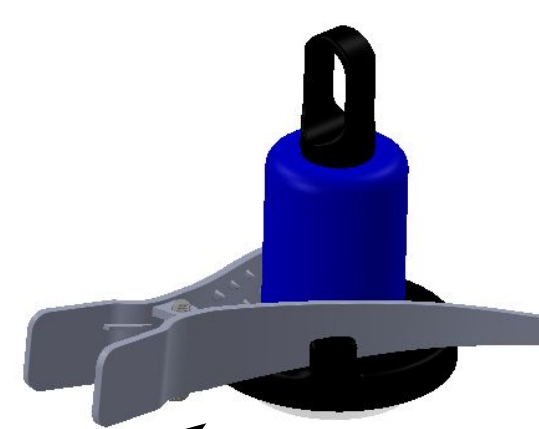


Grabber & Clip



**Steps of use:**

- 1) Attach clip to jig
- 2) Align grabber to back of clip
- 3) Press trigger to fully open clip
- 4) Lift clip to the user's hair
- 5) Release trigger to insert clip into hair
- 6) Repeat on the opposite side for the second clip.



**Future Improvements:**

- Make push buttons easier to operate
- Offer variable length
- Fabricate with more durable materials

**Future Improvements:**

- Make clip removal with grabber easier
- Provide a way to gauge proximity to inserting the hair clip
- Improve assembly process & durability

