The Universal Cuff: Designed to Help with Fine Motor Skills

Final Accessibility Poster Presentation

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Accessibility Problem

- Fine motor skills: ability to perform tasks that require manual dexterity
- Weak manual dexterity inhibits basic movement: writing, typing, and holding small objects (National Health Service, 2020)
- Research study: students with fine motor skill difficulties frequently experience issues with hand related tasks in education (Tal-Saban & Weintraub, 2019)
- Without modification to this current state, individuals with these limitations will be negatively affected both academically and personally. (Westendorp et al, 2011)
- At UVA, general accessibility resources are available, yet physical assistive devices for these conditions aren't provided (Kressin, 2023).

Design Constraints

- Comfortability, wearability, flexibility
- Low injury/risk factor
- Cost efficient & easy to produce

Success Criteria

- Easy to use – minimal learning curve required
- Able to complete aforementioned tasks with greater ease
- Provide greater support to wrist/hand

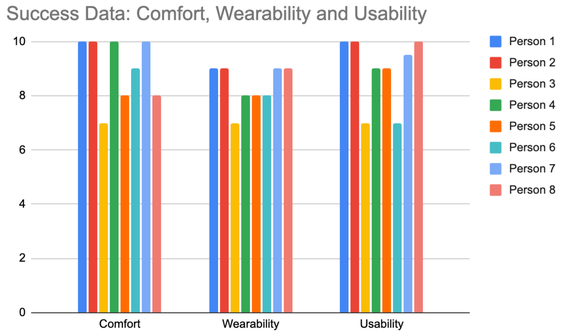
Initial CAD Design for the stabilizing joint/skeleton

Approach to Address the Design Challenge

1. Researched the problem/existing solutions
2. Brainstormed to design an improved solution with specific success criteria
3. Developed a trash prototype
4. 3-d printed an initial design for the stabilizing joint
5. Created a sleeve for the first print
6. Modified design based on comfortability and ease-of-assembly
   i. Decreased rod size and length - less bulky
5. Modified sleeve to fit second design
6. Added Velcro for easy adjustment and wearability
7. Tested comfort, wearability, and usability

Technical Description of Final Design

- Stabilizing cuff made from Velcro, nylon cloth, and PLA that supports the user's hand, wrist, and forearm using a stabilizing joint and a hinge.
  - Three adjustable Velcro loops will be used to secure the cuff.
    - One located at the wrists and elbow (2): to fasten the cuff on the arm
    - Palm: to secure the object being held
  - A cloth sleeve is implemented for comfort
- The stabilizing cuff will hold the hand up and prevent the hand from drooping to support a flat surface and thus easier usage of object securing loop
- To use: cuff rests on top of arm and is secured along the forearm; loop on hand is used to hold object(s)



Performance Data			
	Comfort	Wearability	Usability
Person 1	10	9	10
Person 2	10	9	10
Person 3	7	7	7
Person 4	10	8	9
Person 5	8	8	9
Person 6	9	8	7
Person 7	10	9	9.5
Person 8	8	9	10
Average	9	8.38	8.94

Explanation of Performance Data

Performance data focused on three categories: comfort, wearability, and usability.

- *Comfort*: Users scored the cuff on perceived comfort, with 10 as the most comfortable rating
- *Wearability*: Users determined if the cuff was easy to wear (10) or difficult (1)
- *Usability*: Users tried to write their name with the cuff and rated the task as easy (10) or hard (1)

Improvements and Changes

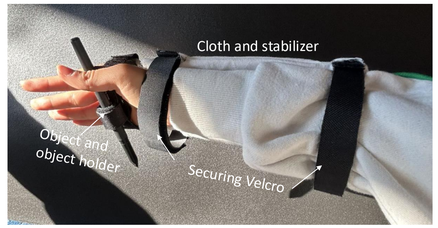
Due to issues with ordering materials, certain parts of the design had to be changed. To improve the design, these changes would be reverted to the ideal, first design idea. These include:

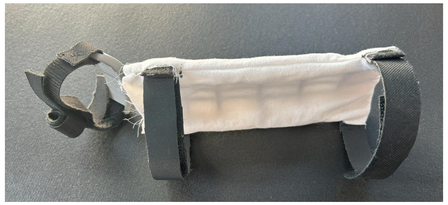
- *Velcro*: Using double sided Velcro instead of sticky back Velcro
- *Fabric*: Using a softer, more stretchy fabric for comfort

Other improvements that could be made unrelated to material issues include:

- *Weight*: Make the design lighter and less bulky to increase comfort
- *Modifiability*: Make the design easier for the user to modify to fit different arm sizes

Final Design





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