



Paint A Little Picture for Me

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Problem Statement

Due to their limited mobility, individuals with spinal cord injury have difficulty holding a paintbrush and painting using traditional methods. This project aims to engineer a mouth-based device that can be used by individuals with limited mobility in their arms and legs.

Requirements

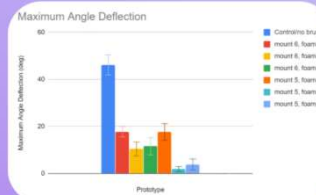
Level	Type	Requirements statement
1	User	The device is the user's preferred method of painting
2	Functional	The device shall be compatible with paint
3	Functional	The device shall function without the user needing to use their hands
4	Functional	The device shall be able to create art based on the users input
5	Functional	The device shall include a user manual
6	Functional	The device is stable and durable for the length of one paint session
7	Functional	The device shall fit comfortably for people with different face and body shapes
8	Functional	The device shall pivot at least 10 degrees from horizontal
9	User	The user shall be able to move the part of the body necessary to use the device
10	Physical	The device shall not contain sharps or other dangerous parts
1	Physical	The device shall be made of a nontoxic material

Build

1. The prototype was designed using Solidworks CAD software
2. The prototype was printed using a 3D printer
3. The velcro band was attached to the prototype by looping it through the end without the stub and attaching the hook to the end with the stub.
4. The insulating material was rolled into a cylinder and masking tape was placed around the foam to create the compression cylinder.
5. The compression cylinder was pushed into the hole in the prototype to allow the paintbrush to stay there and the paintbrush was inserted into the compression cylinder.

Design Study 1

This study measure the maximum deflection from the horizontal by placing the paintbrush with each mount and the control (paintbrush without a mount) into the user's mouth and having them deflect as much as possible



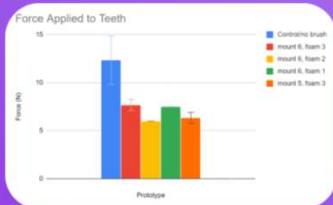
Design Study 2

This study measured the precision of the painting with each mount. The tester tried to trace a 3x4 rectangle with each device and the length of the areas that were not traced was measured.



Design Study 3

This study measured the force applied to the teeth with each device. This was measured by placing a weight on the edge of the paintbrush and measuring the amount of forced applied to the other end.



Mount 5, Foam 1

This design utilized the fifth mount and the first foam.



Fig 1. The 3D printed mount is pictured to the left, and the foam is to the right.

Mount 5, Foam 3

This design utilized the fifth mount and the third foam. The third foam was deemed to be the best after the design studies, but mount 6, which was slightly more sloped, was better than mount 5.

Mount 6, Foam 2

This design utilized the fifth mount and the second foam.



Fig 2. Mount 5, Foam 1.

Mount 6, Foam 3

This design utilized the sixth mount and the third foam. The third foam was deemed to be the best after the design studies and mount 6 was determined to be the best mount, so this was the final prototype.



Fig 3. Mount 5, Foam 3.

Conclusion

The control performed considerably worse than the devices in all the design studies, and mount 6 consistently outperformed mount 5. Since mount 6 and foam 3 performed the best both qualitatively and quantitatively, those were used in the final study.



Fig 4. Mount 6, Foam 2.

Future Directions

In the future, more foams and more mounts will be tested to further improve this device. In addition, an electronic component will be added to facilitate rotation of the paintbrush. Testing on clients was not possible at the time, but in the future, this device will be tested on clients at Seven Hills



Fig 5. Mount 6, Foam 3.