Adaptive Spoon for Tremors

by ihkaqwerty

Background

Participants who have severe elbow and hand tremors require physical assistance from staff/caregivers to feed them thus reducing their level of independence. Feeding oneself is usually the only self-help skill that people with severe disabilities can do for themselves. Food does not stay in the bowl of a standard spoon because of the severe tremors. Adaptive spoons that are sold through therapy catalogs (weighted and swivel spoons) do not compensate for severe elbow and hand tremors. The current adaptive spoons currently on the market (including the Liftware spoon) are made for people who have hand tremors only. This is a past project (2018) that requires a new start and/or redesign.

Market Research

There are many spoons in the market work to limit the effects of tremors during the eating process. However, there is no spoon that is able to completely stop the effects of tremors, with many only being able to stop 70% of the tremors (Kim and Yoon, 2019). There exists two main strategies when it comes to spoon designs with varying levels of electronics involved in the spoons. The first strategy involves the spoon shaking to counteract for the shaking of its user. The other strategy is to limit the shaking a user experience. The former strategy can combat stronger tremors, but it is also typically more costly and is more prone to breakage. The latter tends to yield simpler designs but cannot handle tremors of much strength. One of the biggest brands for adaptive eating utensils is Liftware. They provide many devices which aid in the eating experience for those with hand tremors. One of their biggest products is their Liftware Steady spoon which shakes to combat the effects of hand tremors (figure 1). The product contains sensors that detect tremors and shakes to stabilize the head of the spoon (Liftware Steady, n.d). It is very effective and combating the effects of tremors, but it is very expensive.Liftware products can cost up to $200 for a spoon, and any additional attachments add additional fees. The main electronic body of the product is also prone to breakage. The body cannot be submerged in water and stops working when exposed to too much moisture. Customers are often not compensating for the main body breaking, nor can they buy just the body. Thus, the price builds quickly, leaving many customers to stop using the product.

Another issue that many have found with the product is the shape of the handle. The electronic body is stubby and does not cater to the grip of many customers with tremors. Many find that they have a difficult time holding the spoon due to the bulk of the handle. The second design is that of the swivel spoon (Figure 2). This spoon used the same techniques as the Liftware spoon by shaking the handle of the spoon to keep the spoon head stable. The handle of the spoon turns and twists with the tremors while allowing the spoon head to stay as stationary as possible. This spoon is not as effective as the Liftware soon in terms of combating tremors, but it is much more affordable for the average consumer at around $14 (“Plastic Handle Swivel Utensils On Sale: Easy Grip Utensils”, n.d.).Customers have complained about the look of the spoon. To some people, it makes them feel less independent because it doesn’t resemble the typical spoon. The spoon also doesn’t work with flatter bowls and requires a ledge to push food against. The handle was also too thick for some customers, but it is easier to hold than the Liftware spoon.

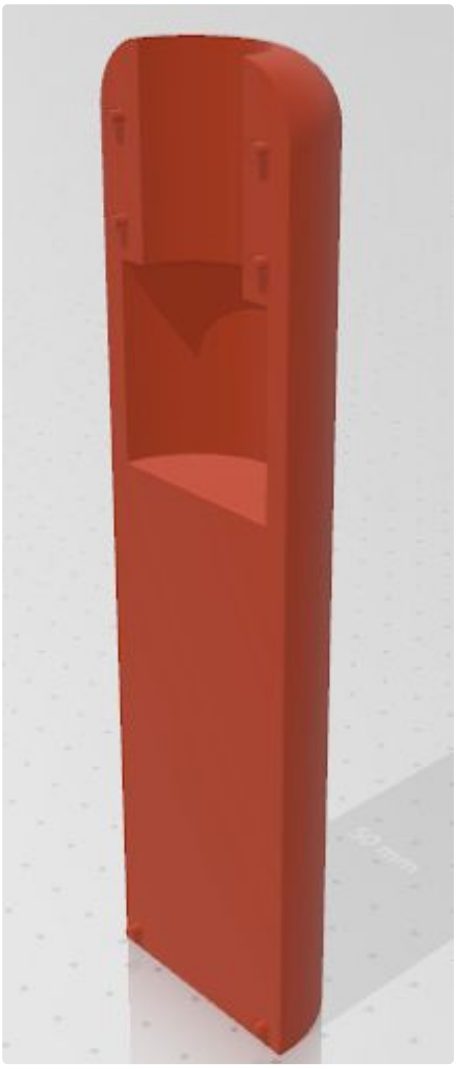
The last design is that of the weighted spoon (Figure 3). The spoon’s weight limits the amount of trembling users experience when eating. This is the simplest design and resembles a regular spoon the most. However, this spoon is only very effect with lighter tremors. And still can cost quite a bit of money. The utensil set in figure 3 costs almost $40.

Users with weak grips may also struggle with holding and using the spoon. Due to the nature of weighted spoons, users are required to be able to withstand the heavier weight to effectively use it. Customers have also complained about the length of the spoon being too long. The design is simple, but it is helpful to those with weak or slight tremors.

Step 1: Approach

Pictured above is the deliverable device. The spoon attachment fits into the handle, and the cylinders rotate freely allowing the bowl of the spoon to be stabilized.

Here is a link for requirements document:
https://drive.google.com/file/d/1HCKJuLBWiEnY4bwZ6SnCG7FFssvP_Moa/view?usp=sharing



Step 2: Materials

- CAD software

- 3D Printer

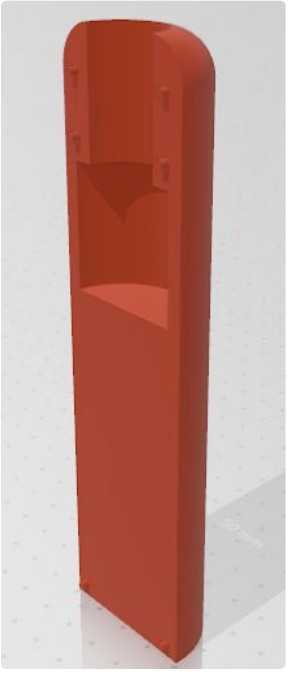
- 3D Printing Filament

Step 3: Build Handle

1) Create the desired shape for the handle of the spoon, and revolve it to make a full cylinder-like shape.

2) Extrude cut two circles of different sizes into the cylinder as shown above. This will provide the place for the spoon attachment to fit into.

3) Cut the handle in half along the long side, to end up as shown, and make another file with the same thing.



4) To one of the files, add pegs to the flat side of the hands, and to the other file, add holes for the pegs to fit in. This will allow the handle to fit together while holding the spoon in place.

5) Those two files together make the handle.

Step 4: Making the Spoon Attachment

1) Open a new CAD project.

2) We will begin with the long, curved stem of the spoon. Pick a plane, and draw a spline resembling the stem shown above. Dimension as desired.

3) Pick the perpendicular plane and draw a small circle. Then use the "Sweep" feature to extend the circle along the spline, making the stem.

4) Select one end of the stem, and sketch a larger circle and extrude. Then repeat by drawing another circle and extruding. This creates the two cylinders at the top. These cylinders must fit into the handle we made before, so dimension them accordingly.

5) Now select the other plane, to add the bowl of the spoon. First, sketch a semicircle/semi-ellipse. Then revolve 180 degrees to make the bowl shape. On top of said bowl, draw a smaller semicircle and revolve cut to hollow out a section of the bowl, creating the area for food.

6) Dimension as desired, and adjust the location of planes if necessary to create stronger joints.

Step 5: 3D Print

Print out the three parts: Spoon, and two halves of handle.

Step 6: How to Use

Step 7: Safety, Maintenance, and Extensions

Saftey

Make sure to use food grade filament, and possibly coat with food grade and dishwasher safe resin to make the device dishwasher safe. Normal filament and plastics may release harmful fumes or melt in dishwasher.

Maintenance

If coated properly, make sure to clean just as often as any other utensil. There are only three components, so if one breaks, simply reprint it.

Extensions

If the stem is too long and unwieldy, maybe look into shortening it. However, a shorter stem will make the spoon less stable, so maybe find a way to add weight to the bottom with bearings, sand, etc?