

Improving Food Transportation for Parkinson's Patients Using Gyroscopic Technology

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Background

- Parkinsonian tremor, characterized by **involuntary oscillatory movement**, is present in approximately **70% of Parkinson's disease patients**
- Patients who have the tremor want to continue to do daily tasks without hinderance from the tremor
- Parkinson's disease patients want to **carry food from the kitchen to the table** to feel like an active member of the family and continue to their daily tasks
- Patients tend to spill or drop the plates and bowls due to the tremor accompanying their disease
- Early stage Parkinson's tremor is mostly in the hand and forearm

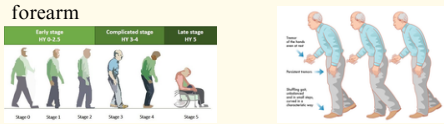


Figure 1 & 2: Depiction of Parkinson's Disease stages + tremor

Design Problem & Motivation

Our client, a friend of a Parkinsons patient needs a device for food transportation for Parkinson's patients. **Our goal is to design a device that allows Parkinson's disease patients to transport food and tableware from the kitchen to the table without spilling due to their tremors while maintaining their autonomy and dignity.**

Final Design Solution

Our final design solution incorporates the use of **gyroscopic technology** with the rings and bowl in order to prevent spillage, uses a specifically designed **handle for comfort**, and a **tray for stabilization**. Food is placed in the bowl and the tray helps in transportation from kitchen to table.

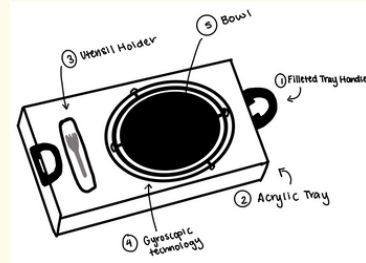


Figure 3: Drawing of Prototype with labels

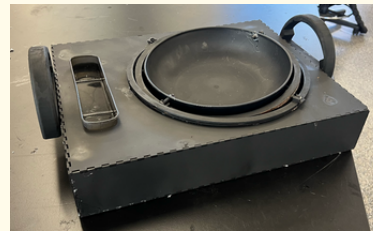


Figure 4: Final prototype

1 Filleted Tray Handles

- holds up tray and helps with transportation from place to place
- filleted sides of the handle help with comfort and stabilization

2 Acrylic Tray

- the acrylic tray makes the entire device easily washable and lightweight
- the tray provides stabilization for the food inside the dishware

3 Utensil Holder

- incorporating a utensil holder allows for multiple things to be transported at once within the tray adding to ease of use
- allows for the tray to be used as a placemat, if wanted

4 Gyroscopic Rings

- when the bowl is rotating on its axis, it tends to remain parallel to itself and to oppose any attempt to change its orientation due to the gyroscopic rings aiding movement in the x and y direction

5 Dish

- the bowl is a detachable part which helps the patient participate at the dinner table with regular dishware rather than the whole tray



Figure 5: Prototype in use with rice

Design Criteria & Testing

Design Criteria	Test Description	Target	Result
Spill-proof	Determine if food can be carried at various frequencies of tremor using a Muscle Stimulator (3.5 to 7.5 Hz) and 8 trials (with 0.5 Hz increments)	Over the 3.5 to 7.5 Hz increments there is little to no spillage, the spillage will be weighted and compared to overall mass	TBD - The muscle stimulator can only be used by the professor and has not yet been tested with him.
Aesthetics	User defined scale in a survey (Likert Scale) with 30+ responses	An average of a 3 or greater (considered successful)	PASS - The average after the user tried the device was a 4.64/5.00
Capacity	9 trials of 100g weight increments placed in the bowl and moved around with to see if bowl can hold.	Above 500g since that is the average weight of a meal in a dish the size of our dish	PASS - The dish was able to carry 800g of rice before any spillage.
Durability Test	Number of drops the device can sustain, 6 trials, 1 to 6 ft (1 ft increments) using the The ASTM D5276 drop test	The device is able to sustain all falls from different heights for all trials	PASS - After 6 trials of 1 feet increments the device sustained all 5 drops from each height
Washability	Determine the ease of cleaning the device through cycles of cleaning the device with soap and water	Average cleaning time < 5 minutes + no wear or loss of function	PASS - the entire device went through 30 cycles of cleaning and had minimal wear and tear after all cycles
Ease of use	User defined scale in a survey (Likert Scale) with 30+ responses	An average of a 3 or greater (considered successful)	PASS - The average after the user tried the device was a 4.4/5.0

Conclusions & Future Work

The gyroscopic tray, overall, has proven to be successful so far since the tray passed most the tests. We are assuming it will pass the spill-proof test due to general spill-proof tests that were completed without the stimulator. It has shown to be useful device for Parkinson's patients in moving food from kitchen to the table without spillage.

Future Work:

- Complete muscle stimulator testing to prove success in spill proof-ness
- Replicate gyroscopic technology for cups and other dishware
- Alter design to fit any bowl, rather than a specifically designed bowl
- Test prototypes with real Parkinson's patients
- Do more trials for tests to solidify findings

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