Liftware: Self-stabilizing Eating Utensils for Individuals With Hand Tremor
Background

Tremor is the repetitive, involuntary shaking of a body part, characterized by small, oscillating (back-and-forth) movements.\(^1\) Everyone experiences slight trembling, which is noticeable when you hold your hands in front of you and try to keep them still.\(^2\) However, more severe tremors accompany a number of conditions, including neurological disorders such as essential tremor or Parkinson disease.\(^1\)

Essential tremor is the most common movement disorder and the tremor may affect the hands, arms, legs, trunk, head, or vocal cords.\(^3,4\) Shaking in essential tremor worsens both with movement and when holding a static posture, but may stop when the limbs are at rest.

In Parkinson disease, tremor often begins in one hand, and may spread over one side of the body to the arm, leg, and foot.\(^5\) Over time, the tremor may also affect the opposite side of the body, the chin, lips, and trunk.\(^1\)

People with tremor often have difficulty performing activities of daily living such as eating, writing, and grooming, which limits their independence. Because tremor limits tasks that require fine motor control, using eating utensils can be challenging and may discourage people from sharing meals with family and friends. Embarrassment about tremor can be as emotionally burdensome as the accompanying physical limitations, causing some individuals to avoid social situations and significantly reducing their quality of life.\(^6,7\)

The Technology

The Liftware spoon is a self-stabilizing utensil that compensates for hand tremor. This non-invasive, assistive device includes a stabilizing handle, rechargeable battery, and three attachments: a soup spoon, everyday spoon, and fork.\(^8\) A computer and two motors embedded in the handle act as a sensing mechanism (Active Cancellation of Tremor technology), which detects the direction of tremor and moves the utensil attachment in the opposite direction.\(^9\)

Summary

- Liftware is a self-stabilizing, computerized handle and selection of attachments, including a spoon. It compensates for hand tremor, enabling people with mild to moderate tremor due to conditions such as essential tremor, Parkinson disease, or other neurological disorders to eat more easily.

- The handle uses computer technology to sense the direction of tremor and move the utensil attachment in the opposite direction.

- One small pilot study, led by the developers of Liftware, found that the device reduced tremor amplitude by 71% to 76% during three tasks: holding, lifting, and transferring.
Weighing approximately 100 grams, and similar in size to an electric toothbrush, Liftware is intended for use in restaurants and at social occasions, as well as at home. The rechargeable battery can run continuously for 90 minutes, and automatically turns off when the spoon is placed face-down. The Liftware utensil heads detach from the stabilizing handle for cleaning.

Liftware eating utensils may help those with mild to moderate tremor, but are not intended for individuals with severe tremor.

Regulatory Status

Liftware was developed by Lift Labs (Mountainview, California), a subsidiary of Google. In Canada, Liftware is not considered to be a medical device as defined by the Food and Drugs Act and Medical Devices Regulations, and potential marketing of the device will be regulated under the Consumer Product Safety Act. Liftware is not currently available in Canada, but is sold online in the United States.

Patient Group

Parkinson disease affects approximately 100,000 Canadians. Most individuals with Parkinson (70% to 100%) will experience tremor.

While neurologists and researchers generally agree on the symptoms of essential tremor, there is no standard definition and diagnostic error is common. Many cases are not diagnosed, making it difficult to determine the number of people affected. Some population-based studies suggest a prevalence rate of 0.4% to 3.9%, but these figures are likely underestimates.

Both essential tremor and Parkinson disease are more prevalent in the elderly.

Current Practice

Currently available treatments for both essential tremor and Parkinson disease are used to control the symptoms, rather than cure the condition. Treatment of essential tremor depends upon which parts of the body are affected and the degree to which the condition disrupts activities of daily living. Patients with tremor are advised to make lifestyle changes, such as avoiding caffeine and participating in stress-relieving activities. Medications are prescribed if lifestyle changes fail to provide relief. Propranolol, a beta blocker, and primidone, an anticonvulsant, are two medications commonly used to alleviate symptoms of essential tremor.

The 2012 Canadian Guidelines on Parkinson’s Disease recommend that motor symptoms be treated with levodopa in combination with carbidopa or benserazide. As the disease progresses and symptoms worsen, increasing doses of the drugs are used.

Because only one study has evaluated the Liftware spoon, there is limited evidence of its effectiveness.

Two surgical procedures, thalamotomy and deep brain stimulation, may be used to reduce the severity of tremor in essential tremor and advanced Parkinson disease. More commonly used for individuals with essential tremor, thalamotomy involves inserting a liquid nitrogen probe into the brain to create lesions on a small area within the thalamus. In deep brain stimulation, an electrode is implanted in the brain to deliver electrical impulses to the surrounding tissue. The electrode is controlled by a pacemaker-like device, placed in the abdomen or upper chest.

Methods — Literature Search

A peer-reviewed literature search was conducted using the following bibliographic databases: MEDLINE, PubMed, Embase, and the Cochrane Library. Grey literature was identified by searching relevant sections of the Grey Matters checklist (http://www.cadth.ca/resources/grey-matters). No methodological filters were applied. The search was limited to English-language documents published between January 1, 2010 and March 10, 2015. Regular alerts were established to update the search until May 2015.

The Evidence

Because only one study has evaluated the Liftware spoon, there is limited evidence of its effectiveness. Fifteen participants with essential tremor were enrolled in a single-arm pilot study; however, accelerometer data for four participants were excluded.
The conclusions were based on results from 11 participants (nine men and two women), with a mean age of 70 years. Although Liftware is marketed for individuals with Parkinson disease, essential tremor, and other tremor disorders, only patients with essential tremor were included in the study.

In this study, the participants used the device to perform three tasks: holding (holding the spoon between the table and the body), eating (lifting a spoonful of foam blocks to the mouth), and transferring items from one dish to another. The participants performed each task twice, with the device both on and off. Participants were randomly assigned to complete their first set of tasks with the device either on or off, with their second set of tasks using the other setting. Neither the subjects nor the neurologists knew whether the device was on or off during each round of testing. Because foam blocks were substituted for food in the study, it is not clear whether Liftware enables individuals to successfully eat lower-viscosity foods, such as soups or cereal with milk. The weight and dimensions of the foam blocks were not reported.

Researchers embedded accelerometers (devices that measure acceleration) in the spoon’s handle, to record tremor magnitude. The Fahn-Tolosa-Marin Tremor Rating Scale (with adapted items for feeding, pouring, and upper limb tremor) was used to measure the degree of tremor in the tip of the spoon during each task. Researchers did not specify how the tremor rating scale was adapted, and whether this modification provides valid ratings is not known.

To capture patient experience with the device, participants were asked to rate their level of improvement after each action using the seven-point Clinical Global Impression Scale (CGI-S). Results showed significant improvements in tremor rating scale scores across the three tasks with the technology turned on. Accelerometer data displayed average tremor reductions of 72%, 76%, and 71% in the holding, eating, and transferring tasks, respectively. Participants’ CGI-S scores also improved in the eating and transferring tasks, but indicated no change in the holding task.

Two participants with severe tremor were unable to complete the tasks with their deep brain stimulation therapy devices turned off, which suggests that Liftware may be helpful only in those with mild to moderate tremor.

Adverse Effects

No adverse effects were reported in the pilot study.

Administration and Cost

Liftware’s “starter kit” — which includes the stabilizing handle, charging cradle, soup spoon attachment, and storage pouch — retails at US$295, and can be purchased online in the United States. The fork and everyday spoon attachments are sold separately for US$19.95.
Concurrent Developments

The International Essential Tremor Foundation and other self-help guidelines suggest that weighted eating utensils may be helpful. However, weighted utensils may not be effective for, and may actually worsen tremor in, individuals with Parkinson disease. One study found that lightweight utensils, rather than heavy cutlery, enabled individuals with Parkinson disease to eat more easily.

Rate of Technology Diffusion

A recent review estimated that the incidence of Parkinson disease in Canada will increase considerably over the next 40 years (by about 50% from 2010 to 2050). Parkinson disease and essential tremor are both more prevalent in the elderly, and the numbers of those affected will likely rise with an aging population and increasing longevity. Demand for technologies that improve independence for those with tremor disorders could increase accordingly.

Patient response to the device will influence the diffusion of this technology. An online video series, produced by Lift Labs, features three individuals with varying degrees of tremor using the Liftware spoon. The ability of each user to lift, hold, and eat a spoonful of food appears to improve with Liftware; one woman is shown successfully eating soup. Another online video, Introducing Liftware, produced by the developer, has received 525,640 views on YouTube since its release in September 2013. A profile of the Liftware spoon by a technology review Web series received 48,379 views in six months, and a home video of an elderly man using the spoon to eat a bowl of nuts gained 33,895 views in one year. The Web series and home video gave positive reviews of Liftware. While these clips do not provide clinical evidence of the spoon’s effectiveness, viewership suggests that there is substantial public interest in these products. The International Essential Tremor Foundation has also promoted Liftware by circulating an advertisement for the technology to its members.

Implementation Issues

If Liftware becomes available in Canada, its eligibility for public reimbursement will need to be determined. As it is not considered to be a medical device, it may be considered instead as an assistive device or aid to daily living.
References


