A New Assistive Glove Can Help People Regain Hand Function After a Stroke

About 800,000 Americans have a stroke each year, according to the Centers for Disease Control and Prevention. A stroke occurs when a blood vessel in the brain becomes blocked or bursts, causing brain damage. Sometimes, stroke can lead to long-lasting difficulties with moving one hand or arm due to both muscle weakness and spasms. Therapies are available to help people regain hand mobility after a stroke, but these therapies may not work for people with severely limited hand movement. Research shows that, even with therapy, some people can stall in their recovery (plateau) around three months after experiencing a stroke. A recent NIDILRR-funded study tested a new portable assistive glove to see if it could help people move beyond that plateau and regain hand strength and mobility after a stroke.

Researchers from the Rehabilitation Research and Training Center on Enhancing the Functional and Employment Outcomes of Individuals Who Experience a Stroke tested a new therapy device called the X-Glove. The X-Glove is a modified sports glove with cables running through the back of the glove along the fingers. The cables apply an external source to aid or resist finger movements through a battery-powered system. The glove can be set to one of two modes: passive stretching mode and active training mode. In the passive stretching mode, the glove bends and straightens the user’s finger joints in a repeating cycle. This passive movement provides finger stretching that helps loosen the muscles and reduce spasms. In the active training mode, the glove provides individualized constant tension that maintains the finger joints toward a straight position. The user then bends his or her finger against the tension to build finger strength.
The researchers tested the glove with 13 stroke survivors who were receiving rehabilitation services in a day program, including physical, speech, and occupational therapy. The participants were at least 40 years old and had a stroke in the past 2-6 months. Most had severe limitations in their hand function. The participants completed an additional 15 occupational therapy sessions, 3 per week for 5 weeks, using the X-Glove. At the beginning of each session, the participants completed 30 minutes of passive finger stretching with the glove set in the passive stretching mode to help loosen the muscles and reduce spasms. Then they practiced using their hand to complete meaningful tasks for 60 minutes with the glove set in the active training mode to help build strength and skills, while the glove provided resistance. For example, participants practiced grasping, holding, and lifting small objects in their affected hand while pushing against the tension applied by the glove. To find out if the task practice with the X-Glove improved hand function, the researchers first measured participants’ hand mobility and strength three times, once per week over 3 weeks, before the participants started working with the glove. The researchers then took measurements after the participants' ninth occupational therapy session with the glove, at the end of the fifteenth session, and again one month after the sessions ended.

Although the participants showed little or no improvement in hand strength or function over the course of 3 weeks before working with the glove, they did improve significantly with the help of the X-Glove. For example, the researchers found that participants’ grip was strengthened by about 35% and maintained the strength one month after the treatment ended. The participants also did better on functional tests, such as moving blocks or pouring water from glass to glass. According to the authors, participants showed improvement within the first half of the treatment, and continued to
improve throughout the treatment sessions. They suggested that participants could have improved more with more time using the X-Glove.

According to the authors, these findings indicated that with devices like the X-glove, improvements in hand function are possible even for people with severe hand impairment after a stroke. Incorporating both passive stretching of and active practice with the hand during occupational therapy using a device like the X-Glove may help push past the therapy plateau if implemented soon after a stroke. For future research, the authors recommended randomized controlled trials to test the X-Glove with stroke patients in inpatient and outpatient rehabilitation settings, as well as studies with longer treatment and follow-up periods.

To Learn More
The prototype X-Glove and other hand rehabilitation technology are under development at the Rehabilitation Institute of Chicago’s Hand Rehabilitation Laboratory: http://smpp.northwestern.edu/research/hand/research.html

To see the X-Glove and other hand rehabilitation technology in action, check out this Prezi from the Hand Rehabilitation Laboratory https://prezi.com/8jmdkzb3gm2h/new-developments-in-the-hand-rehabilitation-lab-at-ric/

Flint Rehabilitation developed the Music Glove, another hand rehabilitation device that was tested under a NIDILRR grant and shown to improve hand function post-stroke: https://www.flintrehab.com/musicglove/

The American Stroke Association and the National Stroke Association both offer resources for stroke recovery:

http://www.strokeassociation.org/STROKEORG/LifeAfterStroke/RegainingIndependence/PhysicalChallenges/Post-Stroke-Rehabilitation_UCM_310447_Article.jsp#.V5IeuvmANBc

http://www.stroke.org/we-can-help/survivors/stroke-recovery
To Learn More About This Study

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