

## **Project Title: *Rehabilitation of Finger Extension in Chronic Hemiplegia***

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### Project Description

Studies of cortical reorganization following infarcts and preliminary results from studies using robots in therapeutic training suggest that devices which assist in the active production of repetitive movements may prove beneficial in restoring function. We have found that individuals with chronic hemiplegia subsequent to stroke have directionally dependent weakness, such that finger extension is impaired to a greater extent than finger flexion. Thus, we have developed two devices to assist finger extension when needed: a portable, self-driven cable orthosis (HandAid) and a pneumatically-driven orthosis (PneuHand).

### Progress to Date

A pilot study involving training with the hand orthoses was conducted at the Rehabilitation Institute of Chicago (Fischer et al., [in press]). While improvements observed after training were quite modest, the pilot study did provide very valuable feedback that we have used to redesign our devices and training protocols.



**Fig. 1: Revised prototype for the HandAid. Redesign makes home use more feasible.**

with finger individuation. Thus, we have modified the PneuHAND to permit independent assistance to the different digits. There are now 5 distinct air chambers in the glove (Fig. 2), with each controlled by a separate electropneumatic valve. Concurrently, we have reduced the number of cables tethering the individual to the control computer by replacing the electrogoniometers measuring joint angle with ben sensors that communicate wirelessly with the computer.

Finally, we noted that stroke survivors had difficulty using our virtual reality head-mounted display (HMD) due to the limited field of view; efforts to raise the arm produced upward rotation of the head which made viewing of the hand difficult. We have incorporated a new HMD with a much wider field-of-view into our protocol.



**Fig. 2: Revised prototype of glove for PneuHand. Each digit has a separate air chamber for assistance.**

Fischer HC, Stubblefield K, Kline TL, Luo X, Kenyon RV, Kamper DG. Virtual reality and mechatronics for hand rehabilitation following stroke: a pilot study. *Topics in Stroke Rehabilitation* [in revision].