

Knitted robotic textile promising for hand edema patients

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KnitDema consists of machine-knitted semi-glove and hardware to compress edematous hands sequentially. The device covers the index finger and uses embedded shape memory alloy (SMA) bands to mobilize edema fluid from the fingertip to the base. Credit: Hybrid Body Lab

Researchers at Cornell University have developed a knitted wearable

tool to treat hand edema—swelling caused by excess fluid accumulation, from injury or disease—that can be personalized and used in the comfort of one's own home.

Currently, the [best treatment](#) for hand edema is manual edema massage (MEM) by a trained therapist, but access to care and cost can make the procedure prohibitive.

Cindy (Hsin-Liu) Kao, assistant professor of human centered design and director of the Hybrid Body Lab, and her team worked with physicians and therapists to devise a knitted wearable technology called KnitDema that can gently massage the swollen area through sequential compression by small robotic actuators.

They chose to focus on hand [edema](#), particularly swelling of the fingers, "because it's a condition that affects a lot of people and can have significant impact to activities of daily living, since finger mobility is indispensable in our day-to-day lives," Kao said.

The lab first tested KnitDema on a simulated finger (a saturated sponge encapsulated in silicone), then tried it on patients at Cayuga Medical Center. Participants generally rated the device as comfortable to wear, quiet and offering more evenly dispersed compression around the swollen area as compared to MEM treatment.

Kao sees KnitDema, and potential other devices using this technology, as a personalized rehabilitation device, a term coined by the team as something that could be prescribed to an outpatient, as would a medication.

"Instead of having to schedule a hard-to-get visit with a therapist for MEM," she said, "we envision this as something that people could take home with them. They would go to their rehab doctor and their

occupational or physical [therapist](#) once, and at that session they would be able to configure the right amount of compression for daily use, then adjust as necessary."

"It also allows for use any time that is convenient for the patient—often when symptoms are worst for the individual," Stilling said. "In addition, each device is personalized for each person through the digital machine knitting, allowing for a customized fit, which is not readily available through standard treatment options on the market."

Researchers will present the study at the ACM CHI '23 Conference on Human Factors in Computing Systems, in Hamburg, Germany.

More information: Conference: chi2023.acm.org/

Provided by Cornell University

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