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Research offers the promise of more independence, along with the wow factor

By Jeannie Kever Updated 10:51 am, Thursday, June 14, 2012

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Dr. Eugene Alford, right, who is a paraplegic, waits during testing of a robotic exoskeleton as University of Houston research team members Harsha Agashe, left, and Atilla Kilicarslan, center, confer in the UH ... more

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With a mechanical wheeze, Eugene Alford stepped into the future, a mix of science fiction and high-tech research that promises a freedom once unimaginable for the millions with spinal cord injuries or other disabilities.

"I'm not going to sneak up on anybody," joked Alford, a plastic and reconstructive surgeon who was paralyzed 4½ years ago by a falling tree.

But his halting and noisy steps, made with a robotic exoskeleton in a project led by a University of Houston engineering professor, illustrate new possibilities opening up for people with disabilities.

"We have no shortage of dreams," said **Jose Luis Contreras-Vidal**, the professor, who came to UH from the **University of Maryland** last winter. "Just a few years ago, the bottleneck was technology. That is no longer the case."

For now, the exoskeleton is guided mostly by a joystick. But Contreras-Vidal and a small crew of assistants are mapping brainwaves in preparation for using them to guide the device.

Last week, Alford moved the exoskeleton - known as "Rex," for robotic exoskeleton as well as for its manufacturer, New Zealand-based Rex Bionics - by blinking after the brainwaves produced by his eyes was isolated and programmed into a laptop computer.

That illustrates how the device can work for people who have no use of their hands, Contreras-Vidal said. But he said the main thing setting his work apart from other experimental approaches is that it relies on an external brain-machine interface, rather than on electrodes implanted in the user's brain.

The idea of using robots to restore mobility drew attention last month, when the journal Nature published a study that showed a paralyzed woman using a brain-computer interface to control a robotic arm to move a cup of coffee to her mouth. Implanted electrodes sent signals to a computer that translated them into operating orders for the robotic arm.

Intangible benefits

Contreras-Vidal envisions the user wearing a headset similar to Bluetooth wireless technology, an approach that he said will be less expensive and less invasive.

He predicts the interface will be ready to test later this summer. Clinical trials could begin at **Methodist Hospital** by early fall, said Dr. **Robert Grossman**, co-director of the **Methodist Neurological Institute**.

Grossman said the ability to power the exoskeleton with an external brain-machine interface would be a tremendous advance. But he said the trial, which could begin with 20 patients, will focus on the physical benefits of standing and walking.

"Being upright, bearing some degree of weight, is good for the patient's own skeleton," said Grossman, also chief of neurosurgery at Methodist. "It's good for the patient's cardiovascular system. It's a form of physical therapy."

He said the trial will consider the impact on controlling blood pressure, the ability to breathe deeply and prevent skin ulcers, among other things.

But there are also intangible benefits.

"Self-confidence," Grossman said. "Being the same height as people when you're talking with them."

Alford, who hopes to participate in the clinical trials, learned about the research from Grossman, who helped to recruit Contreras-Vidal.

Last week he was at Contreras-Vidal's **Laboratory for Non-Invasive Brain Machine Interface Systems** to try the exoskeleton, walking in a figure eight laid out in tape as undergraduates worked on their own projects nearby.

It's not like being able-bodied, Alford said. "It's very slow. It's not practical for everyday use."

But it has intrinsic balance and doesn't require crutches or canes to steady the user.

"I got in and just took off," he said. And that, he admitted, was pretty cool.

Closing on 'symphony'

Contreras-Vidal grew interested in the mysteries of the brain when his mother had an aneurysm and spent a year in a coma after he earned an engineering degree from the **Monterrey** (Mexico) **Institute of Technology**.

"It was frustrating," he said. "We didn't know anything."

He later earned a Ph.D. in cognitive and neural systems from **Boston University** and, after studying neuroimaging techniques in Paris, his ideas began to take

shape.

He describes the goal of a noninvasive brain- machine interface this way: The brain is a symphony, with various components - cognition, action, emotion - among the instruments. His research is based on filtering and amplifying the signal that powers leg movement.

"We're very close," he said.

The speed of future development depends on funding, he said. Most of the research has been funded by UH and Methodist, and he is waiting to hear about a grant request submitted to the **National Science Foundation**.

"There are steps to get to the dream," he said. "Some are pedestrian, and some are a challenge."

jeannie.kever@chron.com