

Wearable robot can help patients walk again

October 2 2012, by Jay Price

A team of physical therapists strapped the robot onto him, one hit a button and with a faint electronic whir, David Ayscue was suddenly 6 feet tall again.

Then Ayscue took a step, and a different future came just a little bit closer for him and millions of others who can't walk on their own.

"I guess this is how a baby feels taking its first steps," he said. "I can't describe it. It's just overwhelming."

Ayscue, 56, was learning how to use a new [robotic exoskeleton](#) called an Ekso. The state Department of Transportation maintenance worker suffered a spinal cord injury on the job while cutting up a dead tree two and a half years ago.

The device that he was wearing is an outgrowth of Pentagon-sponsored research into [robotic devices](#) to help soldiers carry heavy loads. The civilian model was developed to help people who use wheelchairs to stand and walk again.

WakeMed's [rehabilitation hospital](#) is the first in the Carolinas and one of just 16 in the country to get the device since it went on the market in February, said Eythor Bender, CEO of Ekso [Bionics](#), based near San Francisco.

For now, the Ekso is an aid for physical therapy clinics with the help of therapists trained in its use, but the company is working on a sleeker,

cheaper model for home use, which it hopes to begin selling in two years.

WakeMed began using the device this week. Initially the hospital is using it on patients with [spinal cord injuries](#) who can't walk on their own, but it plans to eventually use it on other kinds of cases, such as [stroke patients](#).

Elsewhere, the device is already used for patients with other health problems, including multiple sclerosis, amyotrophic lateral sclerosis (Lou Gehrig's Disease) and traumatic brain injuries.

For patients who spend significant amounts of time in wheelchairs, being able to spend at least a little time in the device regularly is likely to offer improvements in a host of functions, such as circulation, respiration and digestion, said Cathy Smith, director of outpatient rehabilitation at WakeMed.

It may help those with partial spinal cord injuries regain some function more easily.

Harder to quantify are intangible benefits, such as what it means for someone who has been in a wheelchair for decades to simply to be able to stand, walk around and look people in the eye again.

The Ekso looks like a kind of mechanized, computerized combination of a backpack and leg braces. Patients wear it with straps below the knees, on the thighs, around the stomach and over the shoulders. Plates under each foot are attached to motors and lift up. More than two dozen sensors feed information into the Ekso's computer, which uses it to decide how and when to step.

Patients must have at least some upper body strength to use Ekso

because they must use a walker or crutches when wearing the device to ensure their balance. For the current model, they also must be lighter than 220 pounds and between 5 feet 2 inches and 6 feet 2 inches in height.

The device has three modes. In the most advanced, fully automatic mode, the device takes a step when the patient shifts his weight to the side and leans forward.

They have to work up to that, though. In the most basic mode, therapists talk the patient through the proper motions, and one of them uses a hand-held remote control to trigger each step. In an intermediate mode, the patient triggers each step via a button on one crutch.

Ayscue was still in the first mode Thursday, and all the patients using it will be for a while as they and the WakeMed therapists learn how to use it.

Eventually he will transition to trigger his own steps with buttons on one crutch.

The batteries last about three hours, but can be quickly swapped out for fresh ones.

The Ekso is designed to carry its entire weight, about 45 pounds, but the patient's weight goes through the patient's own legs, something the company believes will help fight the loss of bone density, a common problem for those who spend significant time in wheelchairs.

About 350 patients nationwide have used the device so far, said Bender, the company CEO. So far, there have been no falls. But using it in a controlled environment with trained experts just inches away is much different from using it at home.

A home model will be more elaborate in its function, but lighter, slimmer, and have a look that's more low-key, he said.

"We have to design a system that's comfortable enough and appealing enough that's it's something you would be proud to wear," he said.

"There could be more than one model, and eventually it could become like when we choose our pants in the morning, the jeans of the future."

That first "personal unit" also will need to have fall-prevention features. Also, cost and who pays are key issues. The current model costs \$140,000, with a \$10,000 annual service contract, Bender said.

The company is trying to reduce the cost and working with several rehab hospitals on research into the health benefits of getting people back on their feet and walking each day. If the various health benefits can be quantified, he said, the device could become a reasonable thing for insurance companies to cover.

The long-term potential that the Ekso suggests is limited by little more than the speed of improvements and imagination, Bender said.

"Maybe devices could help arthritis sufferers with their mobility, or help people like you and me do something outrageous like climb Mount Kilimanjaro," he said.

The potential market is huge, with nearly 70 million people worldwide who need wheelchairs, many in a position to benefit from assisted walking.

The company has a couple of competitors, Bender said, but it expects more. "It's just too obvious," he said. "Just look at all the unbelievable developments we have seen for amputees.

"Now it's time for people with neurological problems - their time is now and this is just the beginning."

As Ayscue was being strapped into the Ekso he quipped that he felt like astronaut John Glenn. And WakeMed's CEO, Bill Atkinson, who had joined a small crowd of other hospital employees marveled at what he was seeing.

"A lifetime of changes in health care and rarely does it walk right in front of you," Atkinson said. "For these patients, this is like the first steps on the moon."

After a few dozen steps, the motors overheated and Ayscue had to pause and sit until they cooled.

Company technicians said the problem was that Ayscue still has limited muscle function and his own muscles were fighting the machine, which has been programmed to take relatively slow, short steps until he's adept enough to go faster.

New software is on the way that will allow them to dial down the assist from the robot so it can more easily accommodate patients with at least limited function. For now, he needs to dial down himself. If he can.

"The motion just feels so natural, I guess in my mind I think I can walk just like I used to," he said. "That's the deal with the machine. I need to get used to it so that we can work together."

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