Robotic rehab -- how a determined 7-year-old has become stronger than ever

Written by

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Anna Good waited patiently for her mom, Susie Good, to fasten her feet in the Velcro straps on the pedals of her light pink tricycle.

Once Anna's feet were in place and she was turned around, she pedaled between two pickup trucks in the driveway and down to the sidewalk in front of the red brick house she and her parents moved into just months ago.

Anna wore pink and blue Crocs and a pink bow in her blonde hair. She smiled as she rode. It was the same smile she used when she talked about turning 7 in May and all of her birthday presents.

"Lots of toys," she said, describing one as a "big-girl bike." The new pink bicycle is her favorite color, but since it has only two wheels, her dad, Kelly Good, will add training wheels to keep her stable.

Anna, who has cerebral palsy, really wanted the bike, so her parents told her they would make it work, even if it's a challenge.

For now, she enjoys riding her tricycle. With each push, the West Lafayette girl gets stronger. And riding her big-girl bike may not be too far off, thanks in part to a relatively new pediatric therapy that utilizes robots.

Anna was one of the first patients to use the Robotic Rehabilitation Center at Riley Hospital for Children in Indianapolis. The center, which opened in September, is believed to be the only one in the country that has three different robots for pediatric use.

Anna has used two of the robots. Their constant, controlled repetition helps train her brain to do everyday motions and has improved her movements and endurance.

"Robotic rehabilitation is still in the early stages," said Ryan Cardinal, Anna's physical therapist at the center. Specific
long-term benefits and how long Anna will have to continue robotic rehab are unknown, but improvements in the short term provide hope for future advances.

A collaboration among Riley, Indiana University Health Rehabilitation Services and the IU Department of Physical Therapy the center focuses on both clinical and research aspects for pediatric robotic rehab.

With multiple robots and the ability to treat and study the results in one place, Cardinal said, the center is pioneering how best to use robots in pediatric treatments of cerebral palsy and other movement disorders.

Using an upper extremity robot called the MIT-Manus, Anna improved grip, strength and muscle tone in her left hand, which she seldom used before. And thanks to a lower extremity robot, called the Hocoma Lokomat, she’s walking better, too.

"Before, she would walk through Target in her walker and by the time we got to the checkout line, she was sweating and panting," Susie Good said. "Now she goes to the line and runs out to the car and is fine."

In eight-week sessions, meeting twice a week, robotic rehab is a push forward for children with cerebral palsy and other movement disorders.

"It’s not a way to replace traditional therapy, but to augment it," Cardinal said.

The improvements can be capitalized on during other continuous therapy sessions. So Anna keeps up her weekly physical therapy visits. The benefit of the robot is that it helps Anna repeat movements -- over and over and over again.

If a therapist was helping her move, the movements might vary as the therapist tires, Cardinal said. The robot, however, helps Anna do about 1,000 identical movements, without a stop.

"Each movement that they perform is exactly like the one before," Cardinal said.

And each repetition helps her brain reorganize and learn to walk or use her hand in a way she couldn't before.

When Anna was learning to crawl, her mom and dad would move her legs in a crawling pattern, over and over. At 16 months, Anna wasn't crawling.

Then one day, after hundreds of times moving her over and over, she was
crawling by age 2. It was an "army crawl," with her tummy scooting along the floor, but it was as if she had always been crawling, Susie Good said.

As a baby, all of Anna's limbs were affected, but treatments since have helped her improve to what Cardinal describes as hemiplegic cerebral palsy, meaning one side is affected more than the other. For Anna, her left side is weaker.

To walk, Anna uses a walker. In reality, it's more like she runs around, dragging her feet and legs along with her. She did this so much, she wore holes in her tennis shoes, Susie Good said.

So, to encourage Anna to use her legs more, her parents got her a pair of quad canes, each of which has four feet for stability.

"They have my name on them," Anna said, looking at the outlined block letters on the side of each cane. With words of support from her mom, Anna took a few tentative steps.

Although she's had the canes since last summer, she mostly uses them in the house. Susie Good encouraged her daughter to use the canes, knowing it will help legs get stronger.

For four weeks in July and August, Anna and her mom spend weekdays at a summer camp designed for children with motor skill impairments. The camp is at the Conductive Learning Center in Grand Rapids, Mich., where for about 51/2 hours a day, Anna works on gaining independence of movement.

On the weekends, mom and daughter come home to be with Dad, who spends the week working as the owner of KJG Architecture Inc. in West Lafayette.

The center teaches through conductive education. Everything campers do is a function of doing something else. At lunch, they practice sitting with feet flat on the ground and feeding themselves as they interact with others. Weekly swimming lessons include practicing dressing and walking, all before getting in the pool.

"It's not practicing walking; it's getting to the pool," said Andrea Benyovszky, the center's program director. "Every moment is a learning opportunity."

While Anna and her fellow campers build friendships and motivate each other with songs and counting, the goal is the same as the goal at Riley: build Anna's strength.
At the robotic rehab center, Anna is strapped into what looks like a parachute harness and walks on a treadmill with the help of the Hocoma Lokomat robot.

The machine pairs her movements to a video game on a screen in front of her. With every step, she can watch her avatar move toward cows in the game.

Her mom cheers and urges her to turn and kick so the avatar will do the same. Anna focuses on the cows.

"They make sounds," she said quietly.

The Hocoma Lokomat robot, one of about 14 used for pediatric treatment in the U.S., moves her legs to help her walk. Cardinal can program the game to work on different skills.

"It's a video game that they play with their legs," he said.

When the center first opened, Anna didn't have anything to entertain her during the walking sessions that last up to 45 minutes. It was difficult for her to stay focused, Susie said. Now she can watch videos or play games. Anna said Disney's "Handy Manny," an educational cartoon character, is one of her favorites.

When the center first opened, Anna participated in sessions to help train physical therapists in using the robots. Since then she has completed one session to help with walking and one to help with her left hand.

To increase use of her left hand, she sat in front of a screen while a pediatric MIT-Manus robot -- one of three in the U.S. -- helped guide her arm as she moved a cursor on the screen.

The improvements are worth being on the waiting list to continue treatments with the Hocoma Lokomat. Even though she'll move from half-day kindergarten to full days in the first grade at Burnett Creek Elementary this fall, Susie Good said Anna will make the twice-a-week visits for robotic rehab work.

The hour drive from their house to Riley isn't so bad, Susie Good said, especially considering some days it can take nearly 30 minutes just to get across Lafayette through traffic.

When Anna was first diagnosed, after not hitting childhood development milestones at 6 and 9 months, Susie Good was in denial. The former nurse said she knew something was wrong with her daughter, born premature at 32 weeks, but she knew...
next to nothing about cerebral palsy. So she read what she could on the Internet. And as Anna has visited different doctors and gone to therapy sessions, Susie Good has met other parents along the way.

She said some connections are luck, yet the support and advice from other parents, especially at the Conductive Learning Center, has led Susie Good to some of her closest friends.

"We all have the same things going on," she said.

At home, Susie and Anna go on walks, bike and swim -- all to build Anna's core strength.

Summertime also means Anna can go on campouts with friends and play. She's quick to say she likes summer vacation better than going to school.

During the school year, Anna takes swimming lessons at Purdue University. For the summer, she and her mom go swimming at the pool in their subdivision almost every other day to keep up what she's learned.

Anna can touch in the shallow end. She's swimming and going underwater all on her own. And Susie Good has learned to not help Anna swim, or her daughter will protest and stay determined.

"She says, no, I'm fine."