

## Products in Practice

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### Aiming High

by Renee DiIulio

**Believing that recovery is a better approach than adaptation, Bill Thornton, MPT, sets ambitious goals for his patients who suffer from traumatic brain injuries.**



Bill Thornton, MPT, and Monique Perry, work with a client with severe trunk and lower-extremity extension synergy. Working with the client in the Gait Harness System allows Thornton to safely implement neuromuscular electro-stimulation to the muscle of his left leg that dorsiflexes his foot through a trigger switch. The dorsiflexion of the foot causes a brief flexion synergy that allows Thornton and the client to advance his left leg.

A 50-year-old female in a car wreck, a 24-year-old male who has fallen two stories, a 7-year-old boy hit by a car while riding his bicycle, a 54-year-old male who has been assaulted: ask the average person what these patients have in common, and aside from mentioning the obvious need for medical care, he will likely draw a blank. A health care provider, however, might guess correctly that all have suffered a traumatic brain injury, or TBI.

Yet even though these patients share a common diagnosis, the manifestations, treatments, and outcomes for each individual can vary as much as they do. "People would like to have it cut and dry, but it's not that easy," says Bill Thornton, MPT, a PT who provides services to three Michigan facilities: Irvine Head Injury Inc, in Southfield; Rehabilitation Medical Specialists, also of Southfield; and the Center for SCI Recovery, a part of the Rehabilitation Institute of Michigan (RIM), with facilities in Detroit and Grand Rapids. More than half of the 50 to 60 patients he sees each week suffer from TBI.

TBI can impact patients in a variety of ways that include function, thinking, sensation, language, and emotions. The severity of the symptoms is directly related to the severity of the injury.

Traditionally, treatment has focused on adaptation, or learning to live with the resulting impairments, but current thought is now looking at the opportunity for recovery. "People are starting to realize there is more potential for recovery of the brain," Thornton says, referring to neuroplasticity, a term that describes the brain's ability to reorganize by forming new neural connections.

Exercises and rehabilitation products can help to retrain the brain and the body to perform difficult or routine tasks. This, however, takes time, and the trends toward shorter stays and decreased reimbursement work against the patient. Thornton hopes that eventually the health care system will realize that greater savings can be realized from longer recovery-focused care following the initial injury rather than repeat care targeting adaptations and accidents later in life.

#### PROFILE:

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"You can get coverage for breaking a hip again, but you can't get an additional month of therapy to progress from a walker to a cane to independent ambulation," Thornton says. He suggests that therapists fight for their patients.

"If the patient were your family member, would you want to try to teach them to walk with a walker or to walk like they did before the accident?" Thornton asks. He believes that therapists should not shy away from setting high goals. "The goals might not be unrealistic. They might just be really hard to achieve," Thornton says.

## EXCEEDING EXPECTATIONS

Thornton knows many patients who have exceeded the expectations of their physicians. He offers as an example a 50-year-old female severely injured in a car accident when another automobile ran a red light. "She was lucky she lived," Thornton says. Her physicians did not expect her to, but she did. They did not expect her to awake from the coma into which she settled for approximately 2 months, but she did. They did not expect her to speak again, walk again, or demonstrate much functional ability, but there too, she did.

Thornton began to see her as a patient at an adult foster care facility where she had 24-hour-per-day, one-on-one supervision. "Over a period of 3 months, she started to make good recovery in her ability to walk," Thornton says. After surgery to deal with complications resulting from hydrocephalus, her steps toward recovery came faster. "Within 2 months, her transfers and speech improved. She learned to say my name. She would come to get me. She started to string sentences together," Thornton says.

A specialized speech therapy program helped with her language abilities while Thornton maintained rehabilitation at a certain intensity. "She would go crazy with irritation if I tried to use standard equipment, but if I took her outside into a distractible environment, I could work with her for an hour," Thornton says.



Thornton pads and prepares the client's knees for pre-gait training in a tall kneeling position in the Gait Harness System.

He suggests that therapists try different things until they find the method or techniques that will work. Those developed for other conditions, such as stroke or neuromuscular development, might apply to the TBI patient. "I've seen patients with stroke, spinal injury, and brain injury share physical injuries that look the same. So why do I think a technique developed for the stroke patient would work only for the stroke patient?" Thornton asks.

## RIGHT TOOLS AT THE RIGHT TIME

The same theory applies to equipment. Thornton employs a number of tools in working with TBI patients, including the Gait Harness System by Second Step Inc, Eugene, Ore; electrical stimulation products from Bioness Inc, Valencia, Calif; the Reo Ambulator from Motorika USA Inc, Mount Laurel, NJ; the Lokomat from Hocoma, Rockland, Mass; the LiteGait by Mobility Research, Tempe, Ariz; the MOTomed Movement Therapy System of RECK-Technik GmbH & Co, headquartered in Betzenweiler, Germany; GameCycles, such as those by Three Rivers Holdings LLC, Mesa, Ariz, or ExerGame Fitness, Stone Park, Ill; the Core Trainer Exerciser from Panasonic Corp, Secaucus, NJ; and SaebFlex of Saeb Inc, Charlotte, NC.

The products range in price, therapy, features, and benefits. "Some of these systems cost as much as \$50,000 to \$100,000, and if you don't have that capital, you try to mimic it the best you can," Thornton says. Others cost much less, \$1,000 to \$2,000. But, whatever the cost, they can be well worth it.

For instance, Thornton notes that his use of the Gait Harness System has enabled him to work with patients alone rather than with the assistance of two or three people. "If the patient is wearing a brace or orthotic, I might need help getting them up, but once in, I can walk with them alone. If they get tired, they can just lean back and take a standing rest break and then go again," Thornton says.

Another unique feature of the system is the harness support. Thornton equates most body-weight support systems to those used in rock climbing. "If a patient can't maintain their weight with these traditional

systems, the harness basically becomes crotch straps and hurts. If overweight, the traditional transfer belt can cause skin tears," Thornton says.

The Gait Harness System puts pressure on the patient's thighs instead, making it much more tolerable. It also is adjustable for height and width, fitting patients from 5 feet tall and weighing 100 pounds to those more than 7 feet tall and weighing 300 pounds. "The tallest guy I had was a football player, six feet three inches tall and 300 pounds," Thornton says.

Thornton has had patients crawl and walk on their knees in it. "This may not be what the makers intended, but we are only limited by our imagination in rehabilitation," Thornton says. Quick-release straps enable the therapist to free the patient immediately. Lockable brakes add safety and therapy options. "I might put a person in it backward so they can't activate the brake or I might bring them outside, not necessarily a grassy field but a parking lot, which can still provide an enriched environment," Thornton says.

Because patients feel comfortable with the system, they are better able to focus on walking rather than not falling. Patients can safely use the product at home. Its ability to go overground is particularly useful. "Research shows that body-weight support systems really work, but as soon as you turn the treadmill off, patients lose the sensation in their feet. To translate the movement into overground ambulation, you want to immediately reinforce the treadmill work with overground training," Thornton says.

The Gait Harness System has provided good success in this area.

Another system that provides overground movement is the LiteGait. The system is portable and strong, but heavy. "If I'm going to push somebody, I'll need a second person," Thornton says.

Robotic weight-support treadmill systems can help with walking movement, and Thornton suggests that any of the high-end products will do, though each offer different features. The Reo Ambulator is a robotic gait-training device that uses software and sensors to track function and monitor and adjust power and speed to match the patient's physical requirements. Patients contribute to the movement while robotics assist with achieving the necessary force for normal gait patterns.

The Lokomat system also uses robotics and body-weight support to guide the patient's legs on a treadmill. Force transducers that measure interaction at the joints, visualized performance feedback, adjustable gait patterns, and guidance force help the therapist tailor the therapy to the patient. The result is typically less strain on the therapist, longer and more intensive training sessions, and faster progress for the patient.

One of the centers Thornton services just received a robotic motor performance and human body weight support system from Robomedica Inc, Irvine, Calif, purchased by donors. "This treadmill is nice because it goes forward and backward, and the ramps go up and down," Thornton says.

Sometimes, however, it isn't all about walking—sometimes, it's just about movement. MOTOMed devices, for instance, help with both passive and active movement, loosening up muscles and joints that could suffer from lack of movement. The device can help to increase flexibility, reduce spasticity, and rediscover residual muscle strength.

"It can also register the amount of force from the left to the right, so it's good to show progression," Thornton says. Although the device can help to improve walking ability, models are designed for patients with limited mobility, from those in wheelchairs to those who are bedridden.



Bill Thornton, MPT, works with a patient who has extreme lower-extremity ataxia. Working with the patient in the Gait Harness System in a kneeling position allows him to safely and efficiently concentrate on her pelvic position and how the proper pelvic tilt can influence her gait pattern.

## FACTS ABOUT TRAUMATIC BRAIN INJURY

According to the Centers for Disease Control and Prevention, approximately 1.4 million Americans suffer a traumatic brain injury (TBI) annually. Of those, 50,000 die, 235,000 are hospitalized, and 1.1 million are treated and released from the emergency department.<sup>1</sup>

TBIs are caused by physical trauma to the head—a blow, jolt, fall, or piercing—that can range from mild to severe. The leading causes of TBI include falls (responsible for 28% of TBIs), motor vehicle accidents (20%), struck by/against (19%), and assaults (11%).<sup>1</sup>

Symptoms can include light-headedness, dizziness, headaches, mental confusion, memory problems, attention deficits, frustration, mood swings, emotional problems, loss of sexual inhibition, changes in sleep patterns, decreased coordination or limited function of arms or legs, abnormal speech or language, and personality and behavioral changes.

Currently, the organization estimates that at least 5.3 million Americans have a long-term or lifelong need for help to perform activities of daily living as a result of a TBI.<sup>1</sup> This represents approximately 2% of the population.<sup>1</sup> In 2000, the direct medical costs and indirect costs, such as lost productivity, associated with TBI totaled an estimated \$60 billion in the United States.<sup>1</sup>

"The severity of the symptoms is directly correlated to the severity of the injury," says Bill Thornton, MPT, a therapist who works at Irvine Head Injury Inc, Southfield, Mich; Rehabilitation Medical Specialists, Southfield, Mich; and the Center for SCI Recovery, a part of the Rehabilitation Institute of Michigan (RIM) in Detroit and Grand Rapids.

TBI patients can have apparent problems or seem normal at first glance. "Some people use the term 'walking wounded,'" Thornton says. Patients can be normal but the next day come up and ask the same questions as if the original conversation never occurred. Yet even though they may have forgotten their brain injury, they cannot move on. "Functionally, they can walk around, but they can't live independently," Thornton says.

—Renee DiIulio

Electrical stimulation, such as that provided by hand and foot units from Bioness, also can help with movement. The stimulation can help to start a movement or complete it. "If I stimulate a patient's limb, even if they can't understand what I am saying, they might be able to understand what I want and reproduce the movement," Thornton says.

Sometimes, a patient knows exactly what the therapist wants but doesn't deliver, whether due to inability, pain, or boredom. Innovative tools can help to overcome these challenges by engaging the patient cognitively. With GameCycles (of which there are several out there, Thornton notes), patients play racing games on arm bikes in which they must control their vehicle while simultaneously exercising their upper body. "Young guys and girls particularly are more likely to sit there and play the game for 30 to 40 minutes as opposed to riding a bike in the corner at the right intensity for that same period of time," Thornton says.

Similarly, the Core Trainer also provides a novel, enriched environment. Essentially designed as a mechanical bull, the product engages a patient's thighs, back, abdominals, and other core muscles. "It can loosen up the trunk and get the patient transferring and walking better," Thornton says.

Simple therapies, such as vibration, also can help to train muscles. Vertical vibration devices, on which the patient stands upright, help to reduce spasticity as well as tone and educate muscles. "It's incredibly intense so it has to be the right person, but you don't even have to say anything. You just have to know how to position the muscle," Thornton says.

The SaeboFlex also works with positioning. The device holds a patient's wrist and fingers in an extension mode to prepare for a grasping or pulling activity that the patient initiates with voluntary flexion. A spring system helps the patient to then reopen the hand and release the object.

Systems from DynaSplint Systems Inc, Severna Park, Md, also help with position and movement. By applying low-load, prolonged-duration stretch, the devices treat stiffness and limited range of motion and can help to permanently lengthen soft tissue. Adjustability increases comfort and compliance.

## RECOVERY VERSUS ADAPTATION

The right exercise for the right duration at the right time can promote neurotrophic growth factors. Products and treatment techniques should be implemented, however, not only with specific rehabilitation intent but also with a holistic focus. "A lot of times, people will say treatment needs to be a multidisciplinary approach, but I say interdisciplinary. You need to know the other specialist's goals and what is working in their therapy," Thornton says.

He explains that if he is working with a patient on gait but using verbal cues that are the opposite of what the speech pathologist is using to train the patient's memory, then he could be undoing that specialist's work.

Therapist and family goals must also match or there is little chance of reaching any of them. "The length of stay and amount of inpatient and outpatient therapy is decreasing, so you need to maximize family care and educate them in every aspect of the rehabilitation," Thornton says.

Length of recovery varies with the patient, but rarely does it occur within the 16 to 18 months that people in the past have assumed is the cutoff. Patients have made significant improvements with cognition, speech, and gait anywhere from 2 years to 5 years in intensive recovery. Some patients have shown spontaneous recovery years later. Thornton asks why, if children take 12 months to stand up and walk, TBI patients should be expected to do it in six. "It's not realistic or fair to the patient," Thornton says.

It is particularly unfair to assume the patient cannot recover, and Thornton is happy to see that the medical community is beginning to focus more on recovery rather than adaptation. He describes it as the difference between teaching a patient to use their right arm when the left has been disabled by a TBI and forcing them to use their left arm, thereby retraining the arm and the brain.

If a team decides a patient cannot walk without a walker, then the patient has no chance of walking without a walker. Yet if that patient wants to walk again, then why not try? "Some people say, 'Well, then you don't meet your goals,' but if the patient does end up with a walker, it's better than just aiming for the walker. You didn't even give the patient a chance to try," Thornton says. Thornton has one group of patients at a particular facility who were all told they would never walk again—only two use a wheelchair as their primary locomotion.

The big challenge is trying to achieve these goals in the short time frames allowed by reimbursement. A therapist who has only 2 weeks with a mobility-impaired patient will have to focus on getting the patient comfortable with a wheelchair rather than getting them up and walking. Yet the more ambitious goal can benefit the payor as much as the patient.

"Hospitalization for a pressure ulcer or urinary tract infection can run \$50,000 to \$80,000 and can happen every 3 years," Thornton says. The more ambulatory and independent patient is less likely to require this care. Thornton expects that as patients progress and make more improvement, length of stays and reimbursement will increase.

"The chance of recovery may be small, but if the patient going to achieve it, everyone has to work together and work hard. Recovery is possible," Thornton says.

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## REFERENCE

1. National Center for Injury Prevention and Control. What is traumatic brain injury? Centers for Disease Control and Prevention. [www.cdc.gov/ncipc/tbi/TBI.htm](http://www.cdc.gov/ncipc/tbi/TBI.htm). Accessed May 16, 2008.