

An Uphill Climb

Molly V. Strzelecki

In January of this year, Sarah Doherty OTR, BS, Reg. BC, hiked to the summit of Mt. Kilimanjaro on one leg and crutches.

That in and of itself was an amazing feat for this pediatric occupational therapist educated at Boston University, who lost her right leg at age 13 when she was sideswiped by a drunk driver while she was riding her bike.

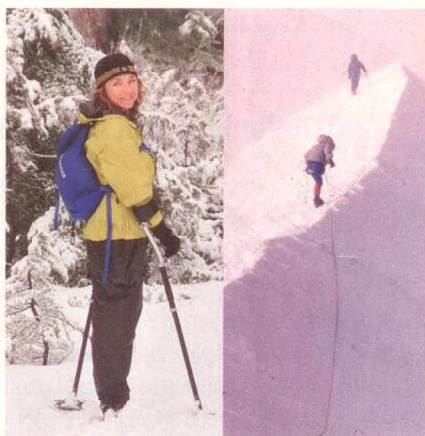
But what's more amazing is that the crutches were designed by Doherty, and she hopes to bring them to the mass market for others. Her crutch, called SideStix, is the first "sports" crutch design with a damper shock system and attachable "feet" for a variety of terrains. For example, the hiking "foot" attachment is similar to a golf shoe, with cleats on the bottom to grab the terrain. Her hike up to the summit of Kilimanjaro was a field test for the crutches, and one that went well. Mostly.

"As I progressed up the mountain the shock system helped reduce the compression against my joints, so I didn't have any joint pain," Doherty says. "And I didn't have blisters. I can take the feet on and off the crutch very quickly and they worked well, especially the hiking foot."

However, she says, while she and her fellow hikers, including her engineer and partner, Kerith, had brought along many extra replacement pieces in case something failed on the design, they hadn't anticipated that the design would break in half, just above the handles.

"That totally changed an eventful evening into an epic evening," Doherty says.

The tubing for the crutches, a high-grade 6061 aluminum used in high-end mountain bikes, wasn't strong enough, she explains. The walls of the tubing were thinned out to reduce weight and the annealing process was



Sarah Doherty standing in snow (L) and climbing on Denali (R).

probably flawed—not slowly cooled down—which caused the welded piece to be brittle and created too much force above the tube, resulting in the break.

"Believe it or not, Kerith was able to fix the break at the nearest base camp, although it was not easy," Doherty says. "Although the design mostly worked, at least now we know where there was a problem in the forearm section that needed to be worked on. That's what field testing is all about."

And while Kerith was fixing SideStix, Doherty and her guide, Sosta, stayed on the mountain.

"It took him over 2 1/2 hours to fix it using some very primitive tools," Doherty says, "and in the meantime, to stay warm, my guide and I decided to hop up the mountain. I used my guide's arm as a forearm crutch and used my other crutch to make my way up. The headway we made was giving me hope. I was also feeling amazed at my body's ability to go on in this fashion—10 to 15 hops then rest. I'm usually fairly optimistic about what my body can do, but hopping up a mountain at 17,000 feet above sea level was impressive to me as well. I don't know what it is in a human, because I know I'm not unique in this manner, but somehow you find a reserve deep inside and it seems to

re-create new boundaries of what you thought you were capable of doing. By the time Kerith and his guide reached us we had climbed over a mile, and 1,000 vertical feet, by hopping!"

Doherty felt for certain that her hopes for a summit bid were dashed when the crutch broke, but the return of the device reenergized her. "I felt so lucky that Kerith and Sosta had turned a seemingly impossible situation around. I was going to make it to the summit. I now knew this, and the gift of this knowledge gave me all the energy I needed to negotiate the next set of difficulties on this slope."

Post-hike and back at sea level, Doherty explains that her background as an occupational therapist certainly sparked her interest in designing adaptive equipment.

"It's a frame of reference in the way you look at things," she says. "I think I naturally break down activities to analyze them and figure out ways to make them better, and I think I figured out a way to apply that to crutches. My design work was all done after I became an occupational therapist. I'd already been exposed to a lot of adaptive equipment by the time I started designing, around age 24."

In designing crutches, Doherty remembers the common themes she learned in school. "It has to be relevant, it has to allow someone to participate more in their life, and it has to promote health," she explains. "If you have all of that, it's going to be used by the person that you're designing it for, and it's going to succeed in the market because you're providing a solution to a problem. The problem right now is that there is no technology out there for crutches. The unique aspect of SideStix is that it uses a damper system, and we will be testing the hydraulic damper. All the other type of "shock systems" on the market used a spring system or depended on the

material to absorb shock. We just borrowed from the mountain bike industry what was proven in that field of study. But the technology is out there to prevent joint problems and to get us where we want to go on a variety of terrains by adding a variety of feet to crutches.”

Although not everyone is willing to tackle the challenge of hiking to the summit of Mt. Kilimanjaro, the SideStix, Doherty notes, are definitely an adaptive

tool that occupational therapy clients could benefit from.

“It’s an everyday life event to be able to walk, and some people are permanently walking on their hands,” Doherty says, “or at least every other step like myself. The SideStix are ergonomically designed, have detachable feet, and have a shock system in place to address issues that occupational therapy practitioners see with clients, like preventing long-term

joint problems. This is a device that can be recommended to their clientele.”

Doherty adds that the handles of crutches are the next section that needs to be revamped. The handle diameter on the SideStix accepts most mountain bike handles, and could be a new area for design. “We need to put the same kind of thought into handles that was put into running shoes in the early ‘80s,” she says.

Doherty notes that her design for crutches is also sustainable, which is different than most other crutches. “SideStix is made of high grade materials (aluminum, titanium, carbon fiber) and can be broken down into components for ease of transport and custom designs (i.e., titanium forearm piece and carbon fiber body); has shock housing that can accept a variety of shocks; and has attachable feet for snow shoeing, hiking, climbing, and walking. No other company has a product like this,” she says.

Before she started designing her own 5 years ago, she says she was burning through crutches every 6 months. The United States-based Fetterman Company and Enabling Technologies—inventor of the outrigger ski pole—have put out a solid titanium crutch, which has raised the standards in crutch development.

While still in the prototype stage, and with the first field test under her belt, Doherty says that the next step is to manufacture a small batch of SideStix and have other people test them. The first phase is to have 10 crutch walkers across North America field test SideStix for 1 month.

“I’m a good tester, but I think the more uses you get in a variety of fields, the more information you’re going to get on how to improve your design,” she says.

As she continues to promote her product, Doherty explains that she always impresses upon people the fact that she’s an occupational therapist.

“It allows them to understand my frame of reference,” she says. “I think a lot of people associate occupational therapy with long-term prevention and helping to improve a person’s ability, and I like being associated with that.” ■

Molly Strzelecki is the senior editor of *OT Practice*. Read her blog, Ask Molly, at www.OTConnections.org.

PRACTICE PERKS

Providing OT Using SI Theory and Methods in School-Based Practice

Susanne Smith Roley

Q: I was told by my administrator that sensory-related issues in children are “medical” and not educationally relevant. Does this mean that I cannot use sensory integration (SI) when working in the schools?

A: The division between educational and medical is as difficult and artificial as separating physical and mental health in other practice arenas. SI theory and practice is a long-standing tradition within occupational therapy.¹ The AOTA Statement *Providing Occupational Therapy Using Sensory Integration Theory and Methods in School-Based Practice*² addresses the appropriate and effective use of SI theory and methods within educational settings. This document states that “SI methods are used within occupational therapy when sensory-related issues are suspected to affect a child’s ability to access the general and special education curriculum, behave adaptively, and participate in activities at school” (p. 1).² Practitioners working in this area will be especially interested in the case study examples and a table of relevant studies published over the past 35 years, which are included in this newly revised document.

When working with any client, occupational therapy practitioners bring a unique perspective to understanding people, organizations, and populations and to providing interventions that support engagement in occupation, health, and participation.³ When providing services within educational systems, the key is to adhere to state and federal mandates and regulations such as the Individuals With Disabilities Education Act,⁴ No Child Left

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Behind,⁵ and Section 504 of the Rehabilitation Act⁶ in addition to the professional *Code of Ethics* (2005),⁷ and the domain of occupational therapy. The use of SI theory and methods within the school system to support student learning is consistent with these mandates.

Growing and promising evidence supports the use of SI intervention strategies for educationally relevant outcomes. “Occupational therapy using SI theory and methods is designed to improve a person’s ability to interact adaptively in the environment, learn, behave, and to prevent future adaptive difficulties and thus improve quality of life” (p. 5).² Towards this aim, school-based occupational therapy helps children to achieve both academic and nonacademic goals and objectives. ■

References

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Susanne Smith Roley, MS, OTR/L, FAOTA, is the project director for the USC/WPS Comprehensive Program in Sensory Integration at the University of Southern California, Division of Occupational Science and Occupational Therapy, and the director of education and research at Pediatric Therapy Network.