



ALL ACCESS: PART 1

IMPROVED PROSTHETIC TECHNOLOGY AND USER-DRIVEN INNOVATION ARE OPENING NEW AVENUES FOR ADAPTIVE ATHLETES WHO REFUSE TO ACCEPT LIMITATIONS.

BY CHRIS COOPER

On Dec. 22, 2013, vigilant U.S. Transportation Security Administration agents pulled Kendra Bailey out of a screening line.

Bailey's carry-on contained a length of hollow pipe, a short chain, a leather strap and various connectors. She wasn't up to trouble; Bailey was hoping to do power cleans while visiting a gym on the West Coast.

Bailey is an adaptive athlete who was born without her left arm just below the elbow. She attaches her "stump" to the bar using the leather strap, chain and pipe.

"I use it for kettlebell swings and barbell movements," Bailey said. "The metal pipe is put over the chain to act like a forearm. It works."

Adaptive technology is improving. Still, athletes are pushing the envelope by modifying high-end appliances—adding chains, ropes, cuffs and belts. They make it work through experimentation, guts and spit.

The tools Bailey packs in her carry-on serve one purpose: tearing down any barrier between her and fitness.

INNOVATION CHASES NECESSITY

According to CrossFit Inc. Founder and CEO Greg Glassman, "The needs of Olympic athletes and our grandparents differ by degree not kind." The same is true for those using prosthetic devices: a missing or malfunctioning limb does not erase the need for intense exercise.

Video: [Kate Foster Uneven Bars](#)

If there's a bright spot to the wars in the Middle East, it's been the increased funding for research into prosthetic technology. Elite athletics have benefitted from the resulting prostheses, as have thousands of everyday patients who just want to get on with their lives.

Scott Forrester is a CrossFit athlete and owner of [Forrester Prosthetics](#). He's been building custom prostheses for veterans who do CrossFit, and he'd like all his patients to meet Fran and Grace. His love for the program pushes him to try new combinations of prosthetic devices, and government interest in prosthetics is helping him and others get more and more creative.

"THE MONEY COMING INTO PROSTHETIC RESEARCH IS FIVE TIMES WHAT IT WAS A DECADE AGO."

—SCOTT FORRESTER

"The money coming into prosthetic research is five times what it was a decade ago," he said. "The government has taken an interest in getting these veterans back on their feet. They want these guys to have the best of the best. Some of them are even returning to combat duty after amputation. It's incredible."

The technology allows for microprocessors in joints, more advanced materials and devices that simply fit better. The processors calculate rate of flexion, pressure and joint angle through the amputee's gait. Some will lock the knee during the swing phase; others will signal dorsiflexion in the foot. Resistance inside the joint is created through a series of pneumatics, hydraulics and magnets working together. But the high-tech, self-regulating joints may not be suited to the constantly varied challenges of CrossFit—yet.

"For CrossFit, a guy with an above-the-knee amputation might be using a microprocessor for the knee, but the high-tech feet just aren't robust enough. You'll bust it. But it's amazing what's coming up," Forrester said.

Onboard microprocessors can't keep up with the demands of CrossFit, but mechanical modifications can help a great deal, according to Forrester. Creating a balance between agonist and antagonist muscles during knee flexion and extension is critical, and the requirements are different for a CrossFit athlete with a prosthesis. A full-range-of-motion squat requires a lower "shelf"—a stabilizing bar on the back of the prosthesis—to allow for more knee flexion.

"You have counterpressure between your patellar tendon and the back of your leg; that counterpressure is supposed to be about even. But that limits how much you can bend. So by lowering the point of counterpressure on the prosthesis, you can get down to a full squat, drop for burpees or do knees-to-elbows," Forrester said.

The high-impact aspects of CrossFit also make shock absorption a concern.

"You need something that has an inch or two of vertical shock absorption," Forrester said. "As you put your energy into the foot, it's stored and returned when you jump or step... A regular prosthetic would feel like you're walking on a brick or a piece of wood."

While lower-limb prostheses are designed to bear weight, most upper-limb devices aren't, creating problems in deadlifting a heavy weight or suspending the body from a pull-up bar.

"Upper-limb prosthetics are traditionally designed to hold only the weight of the prosthesis and maybe a bag of dog food. They're not built to hold a 300-lb. deadlift," Forrester said. "You really have to look at the suspension mechanism and how it's held onto your body, and then come up with thicker straps or some auxiliary suspension to add more weight."

While imperfect, prosthetic science has come a long way in the last 10 years, Forrester said, and clever engineers are starting to find ways to adapt to the demands of functional fitness.

"You can get custom attachments that attach to barbells, dumbbells, medicine balls—you name it. These attachments have a little button, like a quick-disconnect wrist. You press a button and the attachment pops out, and you just click in the next one. You could go from pull-ups to wall balls and not even slow down."

SIMPLE MOVEMENT, ENDLESS ADAPTATION

Two athletes with similar conditions might attempt the same WOD with different prosthetic devices, or none at all, forcing coaches to create modifications on the fly. Objective measurement and standardization can be challenging with different modifications, but it's also created the need for innovation. Competition simply forces coaches, athletes and equipment manufacturers to find solutions.

A leader in the field of competition for adaptive athletes, Concept2 started making modifications to its rowing ergometers to help veterans. Now it sponsors and hosts armies of adaptive athletes at events including the CRASH-B World Indoor Rowing Championships.

When rowing became a Paralympic sport in 2008, its popularity increased. That same year, Rep. Bob Filner of California introduced a bill to fund athletic programs for disabled veterans returning from the wars in the Middle East. Indoor rowing was central to the \$US40-million proposal, and Mark McAndrew of Concept2 was the first coach for many of the veterans.

"We'd set up erg (rowing ergometer) challenges, and an eclectic group of disabled vets would show up at the Olympic Training Center for a week at a time," McAndrew said. "We had fixed (unmoving) seats and standard seats, and we'd have to ad-lib on the spot to figure out how to make it work for them. I'd bring a bunch of different accessories—whatever we could do to get these guys the most exercise."

The International Federation of Rowing Associations (FISA, based on its French presentation) is the governing body for on-water rowing, and it bases its classifications for Paralympic athletes on the boats used in races: trunk and arms only (TA) for three athletes; leg, trunk and arms (LTA) for four athletes; and arms and shoulders only (AS) for individual men and women.

"TA rowers need to row from a fixed seat; they have control of their trunk and core and have at least one good arm and hand. They can hinge at the waist," McAndrew explained. "LTA means they can sit erect in a regular (sliding) seat and have at least one working arm. AS rowers are only able to use the big muscles at the top of their back; they're



Creative adaptive athletes and coaches can experiment with the rowing machine until they find something that works.

Mark Zaragoza

oftentimes spinal-cord injuries or bilateral-hip-disarticulation patients. They don't have the use of their legs or any core strength."

He continued: "Because these categories were developed relative to the boats used in international events, they were somewhat unfair. Since erg racing just measures individual ability, we could further subdivide some of those groups and make it more fair."

The electronics on an indoor rower also allow for some equalization between categories. Meters rowed can be multiplied against a weighted factor depending on disability. This allows a disabled veteran to compete with any other rower or add to a team total in online challenges.

COMPETITION SIMPLY FORCES COACHES, ATHLETES AND EQUIPMENT MANUFACTURERS TO FIND SOLUTIONS.

"We took LTA and pulled out a single-leg-above-the-knee amputee, and that's a separate category. It's not fair to have that guy racing someone who's blind," McAndrew said. "Above-the-knee is a separate group. Intellectually disabled is a separate group. Near-blind and blind are a separate group. 'LTA' acts as a catch-all. It's not perfect, but it's fair."

Further classifications can be found on the [Concept2 Adaptive Classifications page](#).

As the sport of indoor rowing continues to grow, some adaptive athletes are even earning sponsorships to the CRASH-B event in Boston.

"Even if you know you have a disadvantage, it's still rewarding to give it your all. At least the opportunity is there to race," McAndrew said.

For their part, some CrossFit gyms attach a single-arm handle to a rower for those who can't use two arms. Other athletes use only one leg. The fixed path of movement on a rower makes it an ideal tool for experimentation. Try this, then try something else, then work to improve it. Repeat for each individual.



While imperfect, prosthetic technology is quickly improving, opening new avenues for athletes.

Joe Kelley

CREATING A COMPETITIVE STANDARD

Can fitness events offer adaptive athletes the same opportunities to participate and compete by creating factoring formulas? McAndrew believes that as more data is collected, mathematical factoring will become better and better. At CrossFit Rubicon, David "Chef" Wallach and his crew are collecting that data.

When Wallach was planning his Working Wounded Games, his simple desire to provide competition for injured veterans brought him to face a daunting task: creating fair movements for athletes with a host of modifications.

CrossFit Rubicon, owned by Wallach, is a testing ground for adaptive athletes. Soldiers from Walter Reed Army Medical Center are frequently referred to Wallach after their therapy is complete, and his adaptive athletes do the same workouts as every other CrossFit athlete, though their membership rate is different.

"It costs a dollar a month (for adaptive athletes)," Wallach said. "We don't take quarters."

When Wallach began looking for comparative data, he was immediately stonewalled.

“There wasn’t anywhere to find that data, nowhere to go and exchange workouts,” he said. “Where’s the community where athletes from any adaptive sport can get on and say, ‘This is how I do it,’ or say, ‘I’m a left-leg-above-the-knee amputee and use a Cheetah Foot (a popular orthotic) when I run?’”

A consummate fixer, Wallach started his own database, called the [Crossroads Adaptive Alliance](#).

"MY VISION OF CROSSFIT AND WHAT WE DO WITH THE WORKING WOUNDED GAMES WAS ABOUT INCLUSION NOT EXCLUSION."

—DAVID WALLACH

“My vision of CrossFit and what we do with the Working Wounded Games was about inclusion not exclusion, integrating not segregating, leveling the playing fields,” Wallach said.

Wallach worked for months to build a tool that would measure the output level of various athletes with a wide array of injuries. But eventually, he threw it out. Trying to compare athletes with traumatic brain injuries (TBI) to athletes with upper- or lower-extremity injuries produced obvious challenges.

“If you have one prosthetic vs. another prosthetic, is that two categories of athletes?” he said. “That’s not competition. It’s like the old dude at the bodybuilding show who always wins because he’s the only one in his category. It’s great, but it’s not competition.”

Wallach’s solution was to let each athlete more or less choose his or her workouts, a novel concept for fitness competition. He created five to 10 workouts that favored upper-extremity amputees, another batch suited more for lower-extremity amputees, and yet another group that would work for athletes with brain injuries. The workouts

for the latter group were characterized by minimal changes in blood pressure and limited movements that had athletes getting up off the ground. In the end, he had about 19 events.

Next, Wallach varied loads, time domains and rep schemes for each adaptation to equalize work output. Each event was tested by Rubicon athletes. Able-bodied athletes attempted the workouts using only one leg or one arm, fixed seats and sliding seats, and partial and full ranges of motion. Men and women did the same events using different loads and time domains until Wallach was sure he could deliver a series of fair events.

“What’s the horsepower *this* workout is generating?” he asked. “What’s the total? How do we change the workouts between athletes so that all of them, regardless of adaptation, are putting out the same work?”

He continued: “We had a few hundred athletes doing this stuff for weeks, collecting data to come up with these multipliers. One-handed deadlifts, versions of Helen, anything we could do to come up with comparative math. How do we compare your efforts at X movement?”

Wallach then presented the full list of events to the athletes who were registered for the Working Wounded Games. They were given only outlines, not rep schemes or time domains and other details.

“We said, ‘Here are X number of workouts. You need to choose the ones that are in your toolkit. Which would you want to see come out of a hopper to showcase what you can do?’” he said.

Athletes were allowed to choose five of Wallach’s events that played to their strengths. From those, Wallach chose three for each. Each athlete didn’t know which three he or she would perform at the Working Wounded Games, and the competitors didn’t know the time domains or the loads. Wallach also created a giant finale workout for everyone to perform at once.

“We had the workouts planned for the day, as chosen by the athletes, and one finale that they would all do,” he said. “It was an 8-minute AMRAP row for calories on a Concept2. The seat didn’t move. We called it the No-Slide-Row—no one could use their legs.”

By allowing the athletes to choose between workouts that had similar outputs, Wallach could crown a winner.

“We created a broad enough spectrum of movement that if I picked A, B and C or D, E and F, I’m still putting out the same output but maybe not the same workouts. I came



Joe Kelley



Clever programming can help level the playing field so adaptive athletes can compete against each other.

Mark Zaragoza

up with some multipliers from all of the age and gender classes within international rowing,” Wallach said. “That leveled the playing field between men and women, height, age.”

For example, Wallach could multiply the calories of a woman of one height by 1.29 to rank her against a male of a certain height and age.

“And it worked out pretty good; we’re still learning,” he said.

Wallach’s Wounded Warrior Games are inspiring because he’s not scared to try new things. As long as the athlete is safe, he allows him or her to guide the process of exercise discovery.

HOW TO BUILD AN ADAPTIVE PROGRAM

The desire to train adaptive athletes isn’t lacking in CrossFit gyms. CrossFit’s broad array of movements frequently requires formulating new approaches to exercise for a variety of athletes, and CrossFit coaches have become adept at finding solutions on the fly. The key, most say, is in the assessment.

“First, ask the athlete, ‘What do you want to do here? What can you do now? Do you use crutches or a prosthetic? How do you function in normal life?’” Bailey said.

“A WELCOMING AND INCLUSIVE ATMOSPHERE MAY BE AS IMPORTANT AS THE PHYSICAL WORK.”

—DAVID WALLACH

“There’s nothing that supplants an open and honest conversation with the athlete. Talk to their physician, their orthopedic surgeon,” Wallach echoed. “Be willing to fuck it up. Be conservative and ambitious at the same time (when trying new things).”

Learning is key, as is leaning on experts around you and your athletes.



Adaptive athletes have proven they have the courage to try just about anything. All they need is a creative coach to guide them.

“Try to educate yourself about their condition,” Bailey continued. “Reach out to Shriners’ Hospitals, veterans’ hospitals. Don’t try to come up with the answers yourself if you don’t know them.”

Common sense is also an asset.

“Start with a basic assessment,” Forrester said. “Walk them through all the motions. See what they can and can’t do. If they say it hurts, stop. The last thing I want is a guy coming in with a big sore on his leg, because then he has to take four weeks off while it heals.”

Wallach suggests three main principles for training an adaptive athlete. The first is communication and identification: finding out what the athlete wants to do and what he or she can do at present. Wallach recommends regular conversation and evaluation, but he has a very CrossFit measure of success: “If you’re able to carry a heavier weight (a) long distance quickly, it’s working. If any of those metrics aren’t working, reassess.”

Second, Wallach recommends keeping records and collecting data—no problem for CrossFit athletes used to logging workouts and tracking their progress.

Third, Wallach says it always has to be fun.

“As zealous as we are about the data, as adamant as we are about the structure of the format and mobility, the geometry of the athlete, a lot of adaptive athletes are coming from a place where they weren’t accepted. A welcoming and inclusive atmosphere may be as important as the physical work,” he said.

Bailey agreed: “Even though I’ve lived with this (challenge) my entire life, I still have those days of, ‘Why me? This sucks.’ But then I have that reminder that people see what I do and draw some kind of passion from me or inspiration; it’s all worth it.”

Rather than trying to plan substitutions for movements in advance, all three agree that the simplest approach is to

ask the individual athlete. Simple questions can often yield the best result.

“What should we do in place of wall ball today?”

COURAGE NEEDS A COACH

When an adaptive athlete visits a CrossFit gym for the first time, it would be nice to have a simple database of recommended movements and scaling options. A standardized list, an equation or a bolt-on solution would be ideal.

So far, none exists.

But Bailey, Wallach and scores of other coaches are compelled to find solutions to the many challenges posed by adaptive athletics. And with those solutions come the rewards of seeing people access their athleticism.

“People say that talking to me or training with me has helped them, (and) it helps me to know that people are doing way more incredible stuff than I’m doing—people motivating me by figuring out how to do stuff that I haven’t yet. It’s been the best gift ever,” Bailey said.

Wallach, too, has found great personal reward: “I’ve never felt more fulfilled. My capacity to bitch has been reduced to nothing. That’s an extraordinary life change. My capacity for change is their fault.”

He added: “This is what I’m doing for the rest of my life.”

Simply, it’s about giving strong people a chance.

“I don’t want someone of fortitude to be put in a corner,” he said.

For these athletes and coaches, courage isn’t fleeting; it’s born of a long process of trial, error, retrial and growth. Many adaptive athletes on the sidelines already possess the fortitude of which Wallach speaks and require only an outlet. When creative, dedicated coaches and athletes collaborate to find solutions, CrossFit can be that outlet. ■

ABOUT THE AUTHOR

Chris Cooper is a writer for CrossFit. He owns [CrossFit Catalyst](#) in Sault Ste. Marie, Canada.