



Gaining Ground

Virtual reality therapy helps wounded warriors boost function.

Virtual reality therapy helps wounded warriors boost function

By Danielle Bullen

Vol. 25 • Issue 10 • Page 14

"It's normal physical therapy in a unique environment." That's how Christopher A. Rábago, PT, PhD, Center for the Intrepid, Brooke Army Medical Center in San Antonio, described virtual reality-based physical therapy at a presentation at the APTA's Combined Sections Meeting titled "Virtual Reality-Based Rehabilitation for Injured Service Members," earlier this year in Las Vegas.¹

Together with Walter Reed National Military Medical Center in Bethesda, Md., and Naval Health Research Center San Diego, the Center for the Intrepid is home to a Computer-Assisted Rehab Environment (CAREN), a high-end simulator that takes up an entire room. Using this advanced technology, physical therapists can project scenes onto a screen measuring 180 to 300 degrees in radius, engaging most of the senses and simulating as close to real-world scenarios as possible. "I grew up in San Antonio, which is military-town USA," said Rábago. "I always wanted to serve those who serve." After earning a PhD in biomedical engineering, he came to the Center for the Intrepid in 2009. At one of the foremost rehab centers for wounded warriors, Rábago and his fellow clinicians have excellent technology at their disposal.

Alison Pruziner, DPT, ATC, was fortunate to hear the former chief of physical therapy at Walter Reed speak at her final clinical rotation. Col. Barbara Springer (Ret), PT, PhD, OCS, SCS, mentioned there were research physical therapy opportunities at the medical center. Although she had not previously considered military-based therapy, Pruziner always wanted to conduct research, so she seized the opportunity.

With simulators commonly used in the military as teaching and training tools for the non-injured population, it's no surprise they are being embraced as part of rehab. "We have a group of tools available to help us assess and treat people," Rábago explained. Therapists measure how patients maneuver through their virtual environment and how they react to stimuli in that environment.

"The goals are the same as the ones we have in the clinic," Pruziner explained. "It's just a different modality."



RIGHT: Clinicians at Walter Reed National Military Medical Center think of ideas for new simulations for the

posture, balance and gait training, is a favorite CAREN scenario, especially for those patients rehabbing for community reintegration. (Photos/Courtesy Walter Reed National Military Medical Center)

Recreating Real Life

"The idea behind simulation is to do something as close to real-world as possible in a closed, safe environment," Rábago continued. Depending on the goal of rehab, patients are placed in different virtual settings.

"Each facility applies it to the patient population they have," Pruziner said about the CAREN. A patient rehabilitating for a return to civilian life could use it to engage in sports, such as skiing. "We use all of our resources to make their transitions as smooth as possible," Pruziner said during the CSM talk. Other simulated real-world scenarios include a grocery store, where patients must maneuver a cart and reach for items on shelves, and a city street, where people must identify objects and landmarks as they walk. At Walter Reed National Military Medical Center, the clinical staff comes up with ideas for new applications and shares them with the CAREN developer. Because she's been involved with the system from the start, Pruziner serves as a go-between for the engineers and other physical therapists. Since she is familiar with the system, she can try to help the PTs work their suggestions into applications. Recently, she helped a student design a running feedback application for a return-to-run program.

"Our patients are collaborators," said Rábago. They come in knowing what functional tasks they need to achieve to move back to work, whether transitioning to civilian life or returning to the military. "If we immerse them enough, it starts to become more automatic," he noted. Over time, patients pay less attention to the details of a task and more to the function of their goals.

No matter the situation in the CAREN, the patient stands on a motion platform with built-in treadmill in front of the screen. The additional stability of being harnessed in the CAREN gives patients the confidence to try more difficult tasks.

The platform itself can move or the physical therapists can set the platform steady and have the surrounding environment appear to move. Without needing to go outside and find hills and other varied terrain for patients to climb, they can explore different surfaces and the PT can adjust the grade, adding a level of difficulty.

Combat Readiness

Virtual reality lets PTs do things that are more ecologically valid, like measuring strength and range of motion during the performance of key functional tasks. Wounded warriors can work on dual tasking. Can they perform jobs like moving and recognizing targets simultaneously?

For example, a service member rehabbing to return to duty could be placed on a simulated Afghan street, practicing dismantling IEDs and differentiating between insurgents and civilians when shooting. These situations test their cognitive and emotional readiness for potential return to action.

"The ones that want to return to duty want to focus on agility," noted Pruziner. Rábago explained, "We can put a person in an environment that looks similar to combat environment." That person walks through the terrain and assesses targets, while the physical therapist can embed measures into the system to test shooting accuracy and reaction time. The PT also assesses the service member's heart rate and other physical measures.

Firearm training simulators allow injured service members to manipulate their weapons. They are ideal for training patients with new lower-limb prosthetics to reestablish their proprioception. Many wounded warriors must learn to maneuver with prosthetics prior to discharge.

The scene in the computer-assisted rehab environment can be adjusted, with the physical therapist adding complexity and changing parameters, forcing the soldier to react quickly, both mentally and physically. Service members will carry a simulated weapon and loaded pack through a virtual terrain. As the treadmill rolls and pitches, they need balance and core strength to maintain their gait. Instead of auditory cues, the physical therapist uses the changes in the treadmill speed and incline to force patients to instinctively shorten or lengthen their stride - whatever best suits their gait needs.

Better Balance

Virtual reality has proven to be a boon for patients with lower-extremity prosthetics. In one non-military case study, a 24-year-old transfemoral amputee underwent virtual reality-based gait training. After 12 sessions, improvements were seen in frontal-plane hip, pelvis, and trunk motion during over-ground walking. The subject also showed up to a 23% decrease in oxygen consumption.²

Another study compared seven transtibial amputees against 27 control subjects. All participants walked over ground and on a treadmill in a computer-assisted rehab environment. Both groups decreased their step times while walking on the treadmill, and showed increased gait variability.³

~~Along with lower extremity amputation, physical therapists at the facilities see many service members~~

Share

"There's always going to be a physical and a cognitive component," Rabago explained. The wounded warriors focus on memory tasks, such as recalling items from a list in a grocery store setting, and executive functioning, such as following directions to get from point A to point B. Within a virtual combat setting, PTs assess how quickly the service members engage with targets.

Time spent in the CAREN lets physical therapists know what to work on and where more practice is needed. "How can we make them more successful at this task?" is the overarching question, according to Rabago.

To get an accurate picture of how patients are progressing, Pruziner recommends using similar scenarios. Physical therapists will work with patients twice a week in four-week increments to see what goals they meet, and then change the scenario so the patient doesn't get bored.

One of the biggest advantages of virtual reality-based rehab is that it doesn't feel like rehab, which increases compliance rates. "We hope that the gaming environment makes it more interesting," said Pruziner.

A small study of mild TBI patients at Naval Health Research Center San Diego showed that wounded warriors who underwent VR-based vestibular rehab self-reported a better sense of balance vs. those who underwent regular physical therapy. In that same study, where the virtual reality group performed four progressively difficult tasks designed to test their balance on the treadmill, there was rapid improvement in functional gait assessment among those who received virtual reality-based rehab.¹

Collaborative Care

Of course, virtual-reality based therapy is not a replacement for traditional physical therapy. Treatment for wounded warriors takes a multi-pronged approach.

You Might Also Like...



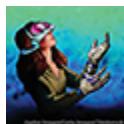
Free Archived Webinar: PTSD

An expert panel discusses how this mysterious condition impacts the rehabilitation experience.



Video: A Resolve to Help

A physical therapist discusses her role following the Boston Marathon bombing.



The Real World?

Virtual reality immerses users in lifelike scenarios to promote neuroplasticity.



Mission: Possible

Getting injured service members back to activity with the 'Return to Run' program.

[Subscribe here](#) for more industry news

"We have a very multidisciplinary team here," Pruziner noted. She works with physical medicine and rehabilitation physicians, other physical therapists and prosthetists. In particular, when an amputee is going through various simulations, she can see whether that person's gait is affected by prosthetic alignment and can recommend adjustments to the prosthetist.

At the Center for the Intrepid, Rabago gets referrals when physicians have trouble identifying or reproducing the cause of a patient's vestibular dysfunction. In addition to referring physicians, he collaborates with other physical therapists and occupational therapists.

Rabago and his colleagues use the virtual environment to assess which measures patients perform poorly on and identify deficits in different domains. They can then focus on those measures during traditional physical therapy sessions and re-test in the virtual environment to gauge improvements.

Of course, not every therapist works in a facility with the resources for a high-end simulator. "If therapists

Share

Rabago advises sound clinical judgment when using these or any tools. Physical therapists can then

Rábago advises sound clinical judgment when using these or any tools. Physical therapists can then prescribe home exercises using standard gaming systems for patients to continue after discharge. Pruziner and other physical therapists are researching whether a computer-assisted rehab environment lets them meet goals more effectively and efficiently. They are determining the validity and benefits of the CAREN vs. lower-cost virtual reality vs. clinical physical therapy. Whether high-end or low-end, virtual reality has proven to be a useful adjunct to traditional PT in helping service members return to as close to normal lives as possible.

References

1. Dominguez J Gottshall K Pruziner A Rábago C. Virtual reality based rehabilitation for injured service members. Presented at American Physical Therapy Association Combined Sections Meeting, Feb. 4, 2014, Las Vegas, NV.
 2. Darter B Wilken J. Gait training with virtual reality-based real-time feedback. *Physical Therapy*. 2011; 91(9): 1385.
 3. Darter B Dingwell J Gates D Wilken J. Comparison of walking overground and in a computer assisted rehab environment. *Journal of NeuroEngineering and Rehabilitation*. 2012; 9:81
- Danielle Bullen is on staff at ADVANCE. Contact: dbullen@advanceweb.com*

Copyright ©2016 Merion Matters
2900 Horizon Drive, King of Prussia, PA 19406 • 800-355-5627
Publishers of ADVANCE Newsmagazines
www.advanceweb.com