

Fun and games



Everything from virtual reality gadgets to medicine balls can help improve balance.

by Vicky Uhland

In Tel Aviv, Israel, a woman with multiple sclerosis is inside a huge dome, surrounded by video screens. She begins walking on a treadmill that's on top of a platform. As images flash on the screens, the platform tilts and rotates in response. One minute, the woman is walking uphill on a road through the woods. Moments later, she's navigating bumps in the road.

This supersized virtual reality game is part of National MS Society-funded research conducted by Alon Kalron, PhD, and his colleagues at Tel Aviv University and the Sheba Multiple Sclerosis Center at Tel Hashomer. The study, which was published in 2016 in the *Journal of NeuroEngineering and Rehabilitation*, found that two 30-minute virtual reality sessions a week for six weeks significantly improved balance in people with MS.

Virtual reality is just one of the novel approaches that people with MS are using to increase their balance and mobility. There's also research on how exercise video games help those with MS improve their gait and feel more stable—while also having fun.

“Sometimes traditional balance and mobility exercises can seem boring or hard to keep up with on a daily or weekly basis,” says Kalron, who also has a degree in physical therapy. “But virtual reality and other games can make balance practice more interesting. They're also a way to have fun with your children, grandchildren or other family and friends.”

New research shows that video game-based physical therapy may be particularly effective

for people with MS. But these high-tech approaches do have their limits. Here's a look at how virtual reality and other games help improve balance, stability and mobility; who is likely to get the most benefit from them; and which games are the most effective.

A workout for brain and body

For a long time, scientists thought the acts of balancing, maintaining an upright posture and walking didn't involve the brain, says Daniel Peterson, PhD, assistant professor of exercise science at Arizona State University. But recent research is showing that's not true in humans.

"Think about how if you're walking down the street and you get a phone call from a friend, your walking starts to slow down as you talk. Or how you're more likely to fall when your attention is divided and you're not concentrating on your feet," Peterson says. "Although the research is young, there's evidence to suggest your physical and cognitive domains interact to affect mobility and balance."

A 2015 review of 20 studies published in *BioMed Research International* found that cognitive-motor interference—like walking and talking at the same time—can be influenced by MS. "That's why virtual reality and video games that combine balance exercises with cognitive challenges may be more effective than just balance exercises alone for people with MS," Kalron says. So can low-tech mind/body exercises such as dancing, boxing or something as simple as walking while doing arithmetic in your head.

Why? Society-funded investigator Brett Fling, PhD, assistant professor in the Health and Exercise Science Department at Colorado State University, says there's growing evidence that it has to do with a concept called proprioception.



This treadmill is equipped with measurement capabilities and can track sway, motion and other data for mobility research. Photo courtesy of Motek Medical B.V.

There are three ways your body maintains its balance: through visual cues, such as seeing an obstacle in your path and avoiding it; via the inner ear; and through proprioception. You use your proprioceptive system when you close your eyes and touch your finger to your nose. It also transmits information to your brain from nerve receptors inside your muscles, joints and tendons in your feet and ankles. This information is processed and then sent back to your feet, helping you walk and keep your balance. “Proprioception is the main thing we use to stay upright,” Fling says.

Even though it’s traveling through the longest pathway in the body, the proprioception process from the feet to the brain and then back again is almost instantaneous. But in people with MS, the nervous system may not be able to transmit that information fast enough. The result can be problems with balance or stability.

That’s where virtual reality and video games come in. In 2014, Fling and his team published a study in *Neurorehabilitation & Neural Repair* showing that video games that use the Nintendo Wii Balance Board—like *Ski Slalom* or *Yoga*—might be able to make the proprioceptive pathway function better in people with MS. “The games give you visual stimuli on how to lean your body, which can increase feedback from your feet to your brain,” he says. Dancing or boxing-related video games can do the same thing—especially ones in which you’re able to adjust the level of difficulty so you can start out slow.

Fling says virtual reality games may work in the same way, or they may teach people with MS to compensate for proprioceptive deficits by improving their visual balance system.

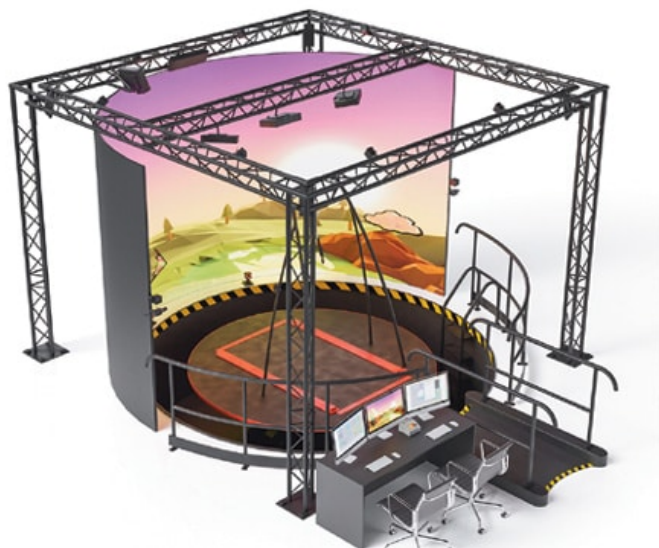
Fling also is studying headphones, such as Halo Neuroscience’s *Halo Sport*, that stimulate the brain’s motor cortex, which helps control movement. At the annual meeting of the International Society for Posture and Gait Research in June, Fling presented research showing that there are significant strength differences in the legs of people with MS. Transcranial direct-current stimulation headphones can increase the amount of time that people with MS can use their weaker leg by stimulating the part of the brain responsible for muscle movement—which may help reduce fatigue and increase mobility.

Fun and games for everyone?

Virtual reality and other high-tech games are best for people who can stand without a mobility aid. But Michelle Cameron, MD, an Oregon Health & Science University associate professor, neurologist and physical therapist, says there are some balance exercises and games that can be done using a single-point cane for support. Dr. Cameron suggests one or two sessions with a physical therapist (PT) to explore which approach is right for you. And then check in yearly with your PT to see if the games you’re using are still applicable, and if there are any new options.

However, finding a PT who embraces video games and other high-tech approaches may take some effort. Alexander Aruin, PhD, professor of physical therapy and bioengineering at the University of Illinois at Chicago, teaches a class on novel approaches for physical therapy. He

notes that virtual reality and video-based balance-training games have only become available in the last five to 10 years.



The future of rehab looks like this. The biomechanical lab known as CAREN allows researchers to monitor motor performance and investigate new treatment options. Photo courtesy of Motek Medical B.V.

Not all physical therapists may be prepared to use the new technology. Some therapists also prefer exercises that don't require their patients to purchase equipment. And even if the therapist is willing, some clinics might not have the money to buy cutting-edge equipment for their patients to try. The Society's listing of physical therapists does not include information specific to their practices. Check with your neurologist and contact recommended physical therapists to find out what they offer.

Financial considerations can also be an issue for people who want to buy home-based gaming systems. Prices are coming down. It's possible to buy a Wii console, Wii Fit Plus software—which includes balance games and yoga—and a balance board for about \$60. Xbox Kinect is pricier—around \$300 for the console plus \$10 to \$40 for each game, but both Fling and Aruin prefer it. "I'm skeptical about Wii because the balance board is so small—there's no place for a cane," Aruin says.

Virtual reality headsets can cost anywhere from \$100 to \$1,000. The cheapest are the ones you can use with a smartphone. While there's little information available on which types are better for people with MS, one study published in 2016 in the Journal of the Formosan Medical Association found that a home-based virtual reality system that uses a touchscreen computer and a balance board was just as effective as traditional exercises for improving balance and mobility.

There are some studies underway to see how people with MS who use a wheelchair or scooter can benefit from virtual reality and other high-tech balance exercises. Aruin says that while you have to be able to stand unassisted to use your legs for balance, it is possible to improve balance in your trunk while seated. This can help you get in and out of a wheelchair and perform tasks like rolling over in bed.

Aruin has a study awaiting publication that involves people with MS repeatedly throwing a medicine ball. After 120 throws, in bouts of 20 to 30 tosses so the study subjects weren't overexerted, the people with MS were able to control their balance better when quickly lifting their arms to their shoulders. "This showed activation of the muscles in the trunk," he says.

Safety is key when you put on virtual reality goggles or pop a yoga game into the Wii console. Make sure you have a partner to spot you if necessary. Do the exercise next to a wall for extra support, and have a chair or railing in front of you in case you need something to hold onto. Kalron says it's also best to start slowly with virtual reality games because they can be disorienting. "It's rare, but some people can have motion sickness, so they need to get used to the feeling."

As with any new exercise regime, talk to your healthcare provider first. If they approve of you doing virtual reality or video-game balance training at home, you might just find yourself working a little harder and longer—and getting better results.

"Traditional physical therapy is very effective, but sometimes it lacks an important component—fun," Aruin says. "When you're doing new, exciting tasks, you are more likely to have the highest level of commitment and involvement."

Vicky Uhland is a freelance editor and writer in Lafayette, Colorado.

Learn more about [traditional approaches to balance issues](#).