

Hand Therapy Video Games

Using Video Games to Foster Pediatric Hand Function



Motivating kids with physical disabilities to do occupational therapy exercises at home can be challenging. It got a little easier this summer for one of Cleveland Clinic Children's occupational therapists, Anna Curby, MS, OTR/L. For six weeks, Curby helped two children with hemiplegia caused by cerebral palsy gain motor skills using a home-based treatment of hand therapy video games in combination with Contralaterally-Controlled Functional Electrical Stimulation (CCFES).

"We can give kids all the exercises and checklists in the world, but they have school and friends and other things that distract them," says Curby. "But when we say, 'Your home exercise program is to play video games twice a day,' that's appealing!"

Curby utilized an intervention developed by Michael Fu, PhD, an investigator with the Cleveland FES Center, a research assistant professor at Case Western Reserve University and a member of the bioscientific staff at MetroHealth Medical Center. "There aren't a lot of intervention options for kids with cerebral palsy who have hand hemiparesis to improve their motor skills and hand function," says Fu. "Our goal was to take what we've learned from working with stroke patients and try to impact other forms of hemiplegia."

Fu's research, funded by a training grant from the National Institutes of Health, initially focused on rehabilitation for adult stroke patients. As a post-doctoral

researcher, Fu joined a group at the FES Center led by Jayme Knutson, PhD, associate director of regulatory affairs at the center, an assistant professor in Case Western Reserve University's School of Medicine, a senior staff scientist at MetroHealth Medical Center and the director of research at MetroHealth Rehabilitation Institute of Ohio. The group is using CCFES, a novel neurotherapeutic application of surface electrical stimulation, to help stroke survivors recover voluntary hand function and ankle dorsiflexion.

Fu's contribution to the group was to develop custom therapy video games that could be used in conjunction with CCFES. The games, which are played by opening and closing the paretic hand, facilitate motor practice based on learning principles such as goal-oriented movement, intense repetition and task variation.

Curby first heard about the intervention during an in-service educational session led by Knutson at Cleveland Clinic Children's rehabilitation hospital. "I sat in the presentation thinking, 'Oh, my goodness! I could use this for my kids,'" recalls Curby. "I was excited about the possibilities." She contacted Fu that day and proposed they work together.

Throughout the summer, Curby met with two cerebral palsy patients with hemiplegia twice a week for two hours during the first three weeks, then once a week for a two-hour session the remaining three weeks. CCFES enabled the



Right-impaired feasibility trial participant plays the marble maze using CCFES

children to open their paretic hand by stimulating finger and thumb extensors with surface electrodes. The stimulation was proportional to the degree of the unimpaired hand opening as detected by an instrumented glove worn on that hand. Volitional opening of the non-paretic hand produces stimulated opening of the paretic hand. The games the children played included paddle ball, skee ball, sound tracker (following a moving track generated by different songs) and marble maze (guiding marbles out of a maze and into a bucket).

“It was really fun to sit in a treatment session with the kids,” says Curby. “Six weeks is a fairly short treatment period, but we saw improvements in both kids.” One of the patients had a moderate level disability. Prior to the CCFES-mediated video game intervention, he didn’t use his paretic hand. By the end of the summer, he was using that hand to pick up things. “Because he was able to play video games that were exciting to him, he figured out really quickly how to use his unaffected hand to help move his affected hand,” says Curby. “It was amazing to watch

him gain awareness of that whole limb!”

The other patient is more severely affected by his disability. Though he still doesn’t independently open his hand without stimulation, he has begun using his arm, shoulder and elbow in ways he never has before, says Curby. He recently picked up a ball using two arms during an occupational therapy session, something he never did before the intervention. “I can only imagine the benefits if we’re able to use this treatment over a longer period of time with kids with a moderate disability” says Curby. “For any kid, there’s big potential.”

Fu agrees that the results are encouraging. He is currently applying for grants to conduct a larger, controlled study to ascertain why they are getting results and how they can design and optimize the treatment for a more general population of cerebral palsy patients. “We have some ideas on why the stimulation is helping, but we really need to do more experiments,” says Fu. “If we can figure it out, maybe we can provide targeted therapies for kids with impaired hand function.”

For more information about FES research and programs
info@FEScenter.org | www.FEScenter.org | (216) 231-3257

About the Cleveland FES Center

The Cleveland FES Center is a consortium of the Louis Stokes Cleveland VA Medical Center, MetroHealth Medical Center, Case Western Reserve University, University Hospitals, and the Cleveland Clinic Neurological Institute. With their support, researchers, engineers and clinicians collaborate together to develop innovative solutions that improve the quality of life of individuals with neurological or other muscular skeletal impairments. Through the use of neurostimulation and neuromodulation research and applications, the Cleveland FES Center leads the translation of this technology into clinical deployment.