Improving Upper Extremity Motor Skills in Children with RTT Using Selected Movements to Control Internet Virtual Reality Computer Games

Pamela Diener, PhD MS OTL
Georgetown University
$225,000.00

Individuals with RTT spend the majority of their day engaged in stereotypies of handwringing/clapping and hand-mouthing which precludes them from using their upper extremities in purposeful tasks such as schoolwork, individual and group play skills, self-feeding, bathing and other activities of daily living. The long-term goal of this project is to improve the quality of life of individuals with Rett Syndrome by decreasing hand wringing/mouthing, improving self-initiated use of the upper extremities and promoting functional upper extremity play skills. The purpose of this pilot project is to improve upper extremity motor skills in individuals with RTT using selected movements to control internet virtual reality (IVR) computer games. The expected outcome will be a novel therapeutic intervention that decreases upper extremity stereotypies that interfere with purposeful arm and hand use and promotes purposeful, goal-directed arm function and associated postural control. The long-term impact will be improved participation of children with RTT via a simple, inexpensive and motivating intervention. The rationale for the project is that the compelling nature of IVR computer games will enable us to develop new and functional movement patterns in persons with RTT such that they will use the patterns to participate more fully in life activities. Our central hypothesis is that the IVR intervention will decrease hand wringing/mouthing and increase hand and arm movements away from the cardinal sagittal body plane (i.e., center line) thereby promoting the development of more functional motor skills.

No optimal treatment parameters for improving motor skills have been established/tested, leaving children with poor to no goal-directed activity of arms and hands. Even elbow extension splints designed to passively keep hands apart to increase arm/hand use, ironically, do just the opposite; the extension that the donned splint imparts prevents normal unilateral and bilateral reaching/grasping patterns for midline manipulation of objects.19 Further, current treatment includes a myriad of random interventions from physical, occupational, hippo-, aquatic, and music therapies. While each is intended to prevent the loss, minimize decline or facilitate the development of skilled function, standard protocols, there is little evidence to support their efficacy individually or in combination. Best practice for skilled arm use and associated postural reactions in girls with RTT thus remains unknown.

A potential solution for therapy to restore and develop motor skills may be through VR activities. VR is a human-computer generated interface creating an immersive and interactive environment for the user 39. Recent meta-analyses or reviews considering therapeutic effectiveness concluded that VR activities are beneficial for motor skill learning in rehabilitation, largely due to the engaging and motivating format.26, 38

The project has five significant features: 1) neuroplasticity - repetitive challenging movements stimulate the molecular pathways of learning and memory in the motor system1 and enhance brain-derived neurotrophic factors; 2) uses affordable, accessible off-the-shelf equipment and materials; 3) client specific - it can be personalized for individual clients and their particular impairments; 4) motivation and engagement - activities can be easily upgraded and changed to provide a continuous movement challenge, prevent boredom, and increase motivation and engagement.