Exergame training improves motor performance in children with degenerative ataxia: clinical benefits and underlying mechanisms

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The cerebellum is well-known to be essentially involved in movement control, and plays a critical role in motor learning. Therefore, it remains controversial whether patients with inherently progressive degenerative cerebellar disease benefit from motor learning exercises. More specifically, it remains unclear under which conditions and by which mechanisms these patients might improve their motor performance. Here we present evidence from two studies on coordinative learning in patients with cerebellar degenerative disease, demonstrating that these patients highly benefit from coordinative training, and that these improvements in movement control are not due to unspecific changes, but to recoveries in ataxia-specific dysfunctions.

Study 1 used specific commercially available whole-body controlled videogames (“exergames”) as the basis for long-term coordinative training and tested the effects in a rater-blinded intraindividual control design. 10 children with progressive degenerative ataxia were trained for 8 weeks with 3 specifically selected Microsoft Xbox Kinect® video games. This training led to an improvement of 2 points on the SARA scale and was again paralleled by improvements in ataxia-specific dysfunctions such as reductions in the variability of goal-directed leg placement and intralimb coordination.

Study 2 tested whether exergames might even be effective in patients with degenerative ataxia who are already largely wheel-chair bound. A sequentially structured 12-week coordinative training program based on specifically selected, commercially available Nintendo Wii games was applied and tested in a rater-blinded intraindividual control design. As first analyses of several subjects demonstrate, this training led to improvements of up to 4 points on the SARA scale which were most pronounced in posture and residual gait function.

Taken together, these results demonstrate that (1) patients with degenerative ataxia benefit from coordinative training based on either physiotherapy or exergames, (2) that improvements are equal to regaining 2-3 years of natural disease progression, (3) that improvements are due to recoveries of ataxia-specific dysfunctions, and (4) that even subjects with advanced neurodegeneration benefit from these therapies. This innovative treatment might also be applicable to other neurodegenerative diseases, including hereditary spastic paraplegia (HSP).