Virtual Reality Training to Improve Balance and Coordination in Children with Developmental Coordination Disorder

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Abstract

- Developmental Coordination Disorder (DCD), a common childhood condition, affecting motor performance of five to 15% of children (Wilson, 2005). Currently there is no clear effective treatment intervention. In this project, a new, innovative method of balance training that combines traditional approaches with a virtual reality video game is proposed.
- The hypotheses are:
  - Virtual reality (VR) training with coaching will improve balance and coordination in children with DCD.
  - Secondly, the child’s self concept will increase and parent-reported behavior problems will decrease following training.
- One subject has completed the protocol. Results show improvement in certain areas of balance, but mixed results were present in other measures.

Hypotheses

- Virtual reality (VR) training, using PlayStation 2 and game AntiGrav, will improve balance and coordination in children with DCD.
- Secondly, the child’s self concept will increase and parent-reported behavior problems will decrease.

Participants

Inclusion

- Motor incoordination
- Ages 7-12, both genders
- IQ normal range

Exclusion

- Evidence of:
  - Cerebral Palsy
  - Attention Deficit Hyperactivity Disorder
  - Severe Behavior Disorders
  - Autism Spectrum Disorders

Methods

- Within subject control design
- Data collection
  - Baseline 1
  - Inclusion/Exclusion criteria testing
  - Motor and psychological testing
- Baseline 2
- Repeat motor testing
- Begin intervention x 4 weeks
- Post-intervention
- Repeat motor and psychological testing
- Follow-up
- Repeat motor testing

Intervention

One-on-one coaching with physical therapist using:
- Virtual Reality Game
  - 4 weeks at home
  - 30 minutes/session
  - Coaching 2 days/week
- CO-OP method
  - Guided, active problem solving approach using “Goal, Plan, Do, Check”

Dependent Variables

Motor

- Movement Assessment Battery (M-ABC)
  - Primary outcome variable
  - Assess: - Manual dexterity
  - Ball skills
  - Static/dynamic balance
- Sensory Organization Test
  - Quantifies balance assessing sensory systems
  - Vision
  - Proprioception
  - Vestibular

Psychological

- Self-Concept
  - Multidimensional Self Concept Scale (Bracken, 1992)
    - Child self-report
  - Behavioral
    - Behavioral Assessment System for Children (BASC-2 PRS) (Reynolds & Kamphaus, 2004)
      - Parent-report
  - Treatment Effectiveness and Treatment Acceptability Evaluation (Kelley et al., 1989)
    - Parent and child-report

Results

Motor

- One subject has completed protocol
- Sensory Organization Test
  - No significant change
- Motor control test
  - Improved post-intervention with continuation into follow-up
- Adaptation (Toss up and down)
  - Improved from Baseline 1 through follow-up
- Movement ABC
  - No significant change

Psychological

- BASC-PRS
  - From Baseline 1 to follow-up externalizing, internalizing and behavior symptoms index increased
  - From Baseline 1 to follow-up adaptive skills decreased
- MSCS – Child (Standard Score)
  - From Baseline 1 to follow-up, the child’s perception of self-concept decreased
- TEI – Parent and Child
  - Both parent and child rated their satisfaction with the intervention highly

Discussion

Motor

- Although there were improvements in the motor control and adaptation tests of the EquiTest, these may be due to a learning effect of repeated exposure to testing.
- Lack of a change in the M-ABC or SOT may be a result of the severity of motor impairment of this subject.

Psychological

- Two different raters (mother and father) scored the BASC-2, which may have influenced the reliability of the test.
- Child showed off task behavior and moved quickly through baseline 2 and follow-up tests; therefore, the reliability of the test results are in question.

Conclusions

- Virtual reality training did not show significant improvement in balance and coordination, or child self-concept and parent assessed behavioral ratings in a child with DCD.
- Further data is needed to evaluate the effectiveness of the intervention in children with DCD.