‘NeuroGame’ Therapy for the Improvement of Ankle Control in Children with Cerebral Palsy

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BACKGROUND CONCEPTS for Virtual Reality (VR) Gaming Therapy

Based on neuroplasticity and motor learning principles¹
- Task-specific practice
- High intensity repetition
- Salient real-time biofeedback
- Specifically controlled changes in difficulty

Provides fun for home-based program²,³
- Increases services available to families
- Potentially increases adherence to home programs

NEUROGAME THERAPY (NGT)⁴

Surface electromyography (sEMG)
- Provides real-time biofeedback
- Muscle signal controls cursor
- USB Plug and play interface
- Neurochip transform
- Analog (muscle) to digital signal

Commercially available games Peggle™
- No time limits for shots or levels
- Difficulty increases with levels/stages
- New characters with different special powers each stage

SPECIAL FEATURES OF NGT

No active motion required (bridging gap to other VR systems)
Alter signal required (contraction amount) to create movement
Provide “just right” challenge important in therapy
Cloud based interface for remote monitoring & adjustments

STUDY DESIGN

2 pre, 1 mid, & 2 post tests (each 3 weeks apart)
6 weeks of NGT home, after in-lab training
Paired with 5 minute walk immediately after NGT play

PARTICIPANTS

9 Children with cerebral palsy
- 8 – 17 years (mean 12.15, SD = 3.36)
- 3 males, 6 females
- Bilateral involvement of lower extremities
- Ambulatory (GMFCS* levels I – III)
- * Gross Motor Function Classification System

RESULTS/DISCUSSION

All children reported enjoyment of the game and played some of the time
- Not all children played the recommended dose of NGT (3-5 times per week for 25-40 minutes)
- All children showed improvement at least 2 outcomes
- Number of positive changes correlated with amount of game play
- sEMG variables showed more change with children who played NGT more
- Muscle Contraction Force and Selective Control Assessment of Lower Extremities showed most change of other variables
- Few changes seen with gait variables

LIMITATIONS

Small sample size (n=9)
- Some technical difficulties with computers used for NGT at home
- SCALE not sensitive enough
- Reliability of measurements with three weeks between assessments
- Reciprocal recruitment of tibialis anterior not required with NGT as is with walking

CONCLUSIONS

NGT feasible/enjoyable for home use for recruiting tibialis anterior muscles
- Gains correlated with amount of NGT use in home environment

REFERENCE