‘NeuroGame’ Therapy for Rehabilitation in Children with Cerebral Palsy

Torey Gilbertson1, PT, DPT; Dianne Rios1, OTR/L, DSc; Katherine Miller1, SPT; Karli Gutman1, DPT; Hanna Prange1, SPT; Oliver Orr2; Robert Price1, MSME; Chet Moritz1,3, PhD; Sarah W. McCoy1, PT, PhD

1 Department of Rehabilitation Medicine, 2 Undergraduate, 3 Department Physiology & Biophysics, University of Washington, Seattle, WA

BACKGROUND CONCEPTS
for Virtual Reality (VR) Gaming Therapy

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

- Provides fun for home-based program
  - Increases services available to families
  - Potentially increases adherence to home programs

NEUROGAME THERAPY (NGT)

- Surface electromyography (sEMG)
  - Neurochip transform from analog to digital signal
  - Provides real-time muscle activity biofeedback
  - Muscle signal controls computer cursor movement
  - USB Plug and play interface
  - Functions like mouse wheel for control of cursor
  - Uses commercially available and popular video game(s)

SPECIAL FEATURES OF NGT

- Therapist choice of targeted muscles
  - Agonist/antagonist pair
  - Bilateral muscles for reciprocal isolation
  - 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

OTHER STUDIES/FUTURE DIRECTIONS

- NGT for adults post stroke, traumatic brain injury, and spinal cord injury
  - Agonist/antagonist wrist muscles
  - Collection of kinematic data to assess functional walking carryover after LE protocol

UPPER EXTREMITY PILOT STUDY

- 4 Children (8-13 y/o, 2 boys)
  - Unilateral arm involvement
  - Wrist flexors/extensors
  - Agonist/antagonist pair
  - 2 pre and 2 post tests
  - 5 weeks of NGT use
    - 3-4 weeks at home

RESULTS

- Game Play sEMG data (Fig. 3)
  - All children showed improvements
  - Less consistent with flaccid paresis
  - sEMG during active movements
    - Inconsistent improvement following NGT
    - Retention low in second post test
  - Active Range of Motion (AROM) (Fig. 4)
    - All children showed improvements
    - Degree of change varied
    - Shriner’s Hospital Upper Extremity Evaluation (SHUEE)
      - Scores showed little change
      - Perhaps measure not sensitive enough
  - Amount of game play
    - All children were adherent to protocol
    - All Children reported enjoyment of the game

ADVANTAGES OF USING PEGGLE™

- No time limit for any shot or level
- Difficulty of game increased with advanced levels
- Introduction of new characters after every 5 levels
- Each character has special power
- Commercially available so can compete with friends/siblings

REFERENCES


Author Correspondence: Torey Gilbertson: gilbet@uw.edu