Providing Power Mobility for Children with Multiple, Severe Disabilities: Training Methods and Outcomes

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Disclosure Information
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Speaker Names: Lisa K. Kenyon and John Farris

Disclosure of Relevant Financial Relationships
We have no financial relationships to disclose.

Disclosure of Off-Label and/or investigative uses:
We will not discuss off label use and/or investigational use in our presentation.

Objectives
Upon completion of this session, participants will be able to:
1. Describe the components of power mobility interventions designed to meet the individual needs of children with multiple, severe disabilities.
2. Discuss potential outcomes of power mobility use in children with multiple, severe disabilities.
3. List 3 means by which to evaluate outcomes of power mobility interventions in this unique population.
4. Discuss the potential impact of power mobility training on the spectrum of electroencephalography (EEG) activity in children with multiple, severe disabilities.
Acknowledgment

Thank you to the families who have given their permission to show photographs and videos of their children, to use the children’s first names, and to describe the children’s condition and abilities during this presentation.

The Grand Valley Power Mobility Project: Meet the Team

- Dr. Lisa Kenyon – physical therapist
- Dr. John Farris – engineer
- Dr. Samhita Rhodes – electrical engineer
- Dr. Paul Stephenson – statistician
- Dr. Naomi Aldrich – psychology
- Doctor of Physical Therapy students
- Engineering students - graduate and undergraduate
- Psychology students - undergraduate

Benefits of Power Mobility Use for Children With Mobility Limitations
Potential Benefits of Power Mobility Training in Children With Multiple, Severe Disabilities

Livingstone & Paleg 2014

Power mobility may be beneficial for children with multiple, severe disabilities who may never become capable, community drivers

Benefits of Power Mobility Use

Self-generated locomotor and the use of active decision-making processes within such locomotion are linked to the development of spatial knowledge and navigational skills
Benefits of Power Mobility Use

Passive mobility such as being pushed in a stroller or wheelchair does not have the same benefits as self-generated locomotion.

Benefits of Power Mobility Use

Limitations in the use of self-produced locomotion may result in the development of secondary impairments in such areas as spatial cognition, communication, social development, and other domains influenced by the emergence of independent mobility.


- Power mobility may
  - Enhance alertness in individuals with severe disabilities
  - Stimulate the development of intentional, purposeful driving behaviors
  - Improve cause and effect skills (switch use)
The Grand Valley Power Mobility Project

- Power mobility training program for individuals with multiple, severe disabilities
  - Ages: 9 months to 26 years
    - In Michigan, schools serve children up to 26 years
    - We think we can start younger 😊

Our Power Mobility Devices
Power Wheelchair Trainer

- Rear-wheel drive configuration
- 2 brushed direct current motors
- Powered by two 12-volt batteries
- Can be used with a joystick or switch(es)
- Driving speed is set by the therapist
  - Other programmable features

Trainer with Loading Ramp Extended
Trainer Interface and Controls

Safety Features of the Trainer
- Wheelchair tie-downs
- Customized attendant control unit
  - Therapist can assume full operational control of the Trainer
  - Tethered to the Trainer with a 10-foot cord
- 3 emergency stop buttons
  - 2 on the back of the Trainer
  - One on the attendant control unit

Play & Mobility Device
- Mid-wheel drive configuration
- Powered by one 12-volt lead acid battery
- Uses a commercially available forward-facing car seat
  - Can be tilted back into 3 different semi-reclined positions
Meet a Couple of Our Drivers......
Developing Power Mobility Interventions for Children with Multiple, Severe Disabilities

Power Mobility Training Methods

• Limited research related to this specific population

• Power mobility training methods for children in general mostly based on expert opinion
  – Research detailing the best methods has yet to be conducted

Foundational Concepts

• The therapist is a responsive partner in the training process
  – Therapist doesn’t teach power mobility skills

• The need to create an engaging, playful environment
  – Designed to elicit driving behaviors
Foundational Concepts

• For children who have multiple, severe disabilities, accidental activation of a joystick or switch may lead to the development of
  – Cause and effect skills
  – Intentional, purposeful driving behaviors

Foundational Concepts

• Contemporary theories of motor control and neural plasticity
  – Specificity of training
  – Repetition
  – Individually engaging environment
  – Individually meaningful activities

Individualizing PM Interventions

1. Identify motivational and reinforcement factors
2. Generate child-specific goals
3. Create an engaging environment
4. Responsive use of an attendant control unit
5. Individualized verbal and physical prompts
Reinforcement Assessment for Individuals with Severe Disabilities (RAISD)

- Gathers information related to potentially reinforcing stimuli and activities for each child
  - Parent/Caregiver/Teacher interview
    - Focused and brief
  - Identifies a child’s likes and dislikes


Reinforcement Assessment for Individuals with Severe Disabilities (RAISD)

- Includes 10 open-ended questions
  - “What (physical play and movement) activities do you think (your child) most enjoys?”
  - “What are the things you think (your child) most likes to listen to?”
  - “What (tactile) activities do you think (your child) most enjoys?”
Reinforcement Assessment for Individuals with Severe Disabilities (RAISD)

- After each question, probing questions are asked to gain additional information about the child’s preferences
  - Examples: “What specific songs are his favorite?”
  “What does she do when she plays with her brother?” Etc.

Power Mobility Training Tool - PMTT

- Used to identify basic power mobility skills in children who have multiple, severe disabilities
  - Can be used with children who use switches or other alternative access methods
- Guides therapists in promoting the emergence of basic power mobility skills in children with multiple, severe disabilities

Power Mobility Training Tool - PMTT

- Not intended to determine who “qualifies” for power mobility
- Not intended to be used as an outcome measure
- Consists of
  - 12 items scored on a 5 point scale
    - 4 non-motor items and 8 motor items
  - 1 non-scored item
  - 2 items that are scored dichotomously
Scoring the PMTT

0: Does not attempt the skill or the skill is not demonstrated or not observed

1: Requires manual assistance/prompts to demonstrate the skill.

2: Without manual assistance/prompts, demonstrates the skill <50% of the time.

3: Without manual assistance/prompts, demonstrates the skill 50-90% of the time.

4: Without manual assistance/prompts, demonstrates the skill >90% of the time.

Non-Motor Items on the PMTT

• Cause and effect concepts
  – Appears to recognize the correlation between the access method (switch or joystick) and
    • Movement of the power mobility device
    • Moving the power mobility device in different directions

• Stop and go concepts
  – Appears to recognize that the switch or joy stick must be released to stop the power mobility device
Non-Motor Items on the PMTT

• Visual skills
  – Appears to notice large obstacles within 10-15 feet of the power mobility device when the power mobility device is in motion

Motor Items on the PMTT

• Activation of the access method
  – Demonstrates the motor ability to activate a switch or joystick to move the power mobility device in any direction

Motor Items on the PMTT

• Stop and go abilities
  – Demonstrates the motor ability to
    • Activate a switch or joystick to move the power mobility device in any direction
    • Sustain activation of the access method (switch or joystick) to move the power mobility device for >5 seconds.
Driving Function Items on the PMTT

- Demonstrates the ability to move the power mobility device
  - Forward at least 5 feet
  - To the right
  - To the left
  - In reverse

Driving Function Items on the PMTT

- Maneuvers the power mobility device to avoid large obstacles in the path of the device

Non-Scored Item

If the child is using switches to drive the power mobility device, **how many switches** did the child use at the same time during the session?
Dichotomous Items

• Is the child **optimally positioned** in the power mobility device?

• Does the child **appear motivated** to drive the power mobility device?

Findings from the PMTT are used to create child-centered goals for power mobility training

Example 1
Sample Findings on the PMTT

- Using only one switch
- Inconsistent switch activation
  - Does not appear to understand the connection between pressing the switch and moving the power mobility device

Sample Goal Areas

- (Child) will increase the number of switch activations demonstrated in a session by 50%.
- (Child) will drive the power mobility device 5 feet to obtain a desired object or to interact with a preferred person.

Sample Progression Goals

- (Child) will progress to using 2 switches to drive the power mobility device
- (Child) will drive the power mobility device 25 feet to obtain a desired object or to interact with a preferred person.
Create an Individualized & Engaging Environment

• Based on
  – The findings from the RAISD
  – The goals drafted from the findings of the PMTT

Example 1

Findings from the RAISD

• **Enjoys music especially traditional children’s songs**
• Likes the feeling of ribbons on her face
• **Enjoys kisses and praise from Dad**
• Seems to prefer the color red
Sample Goal Areas

• (Child) will increase the number of switch activations demonstrated in a session by 50%.

• (Child) will drive the power mobility device 5 feet to obtain a desired object or to interact with a preferred person.

Create an Individualized & Engaging Environment

• Sample activities:
  – Singing songs
  – Use of an iPod playing children’s songs: “Let’s find the music”
  – Driving to Dad to get kisses and praise
  – Playing with the large red therapy ball
  – Driving through the ribbon “car wash”

Responsive Use of Attendant Control

• Used for
  – Safety
  – Maneuvering
  – Encouraging problem solving
Responsive Use of Attendant Control

- Used for
  - Safety
  - Maneuvering
  - Encouraging problem solving

**Achieved through shared control**

Shared Control

The electronic capability to modify the direction and motion of the power mobility device by combining inputs from both the user and attendant control units without having to stop or interrupt the child’s driving.

![Shared Control Schematic](image)

- **User Joystick or Switches**
- **Microcontroller**
- **Commercial Power Wheelchair Controller**
- **Attendent Control Unit**
Shared Control

• When to use & when not to use
  – When is it best for the attendant to take over driving?
    • Safety
    • Other situations?
  – When is allowing a “safe” collision most beneficial?

Shared Control

• Appears to be most helpful for children
  – Learning cause and effect concepts
  – Who become easily frustrated or discouraged
• Appears most helpful in the early stages of learning
• Great for minimizing safety concerns

Shared Control

• Accompanying verbiage
  – Letting the child know who is driving
    • “I stopped you”
    • “I am driving now”
Verbal Prompts

- Short and concise
  - Consistency important for each child

- Directed at an activity or task
  - “Go get a kiss from Mom”
  - “Here’s your (favorite toy)”
  - “Let’s find the next dinosaur picture”

Verbal Prompts

- Combined with other communication strategies as needed
  - Signs
  - Gestures
  - Etc.

Verbal Prompts

- Also used to draw attention to objects and people in the environment
  - **Example:** Patting the wall and saying “Here’s the wall”
  - **Example:** “I hear someone coming down the hall”
Praise

• Information from the RAISD is used to individualize praise and feedback
  – “Some children really enjoy it when others give them attention such as a hug, a pat on the back, clapping, saying “Good job”, etc. What forms of attention do you think (your child) most enjoys?”

Process Praise

• Focuses more on behavior and effort rather than on personal attributes

• Shown to
  – Enhance motivation
  – Prevent the development of learned helplessness

Process Praise

• Examples:
  – “Hurray! You got your (favorite toy)”
  – “Great stopping!”
  – “That was a great turn!”
Process Praise

• Always positive, never negative
• Example: child runs into a wall
  – Positive voice: “You found the wall”

Reflection

What went well?
Meaningful play?
Today’s Session with a Specific Child
Adequate stimulation? Too much?
Impact of, fatigue, time of day, etc.?
What should we change for the next session?

A Glimpse of Our Outcomes.....
Changes in EEG Spectra in Response to Power Mobility Training

Review the Objectives:
Any Questions?

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