Providing Power Mobility Training for Children with Multiple Severe Disabilities

Lisa K. Kenyon, PT, DPT, PhD, PCS
NRRTS Continuing Education Program
December 5, 2018

Disclosures
• Author: Lisa K. Kenyon
  – The author does not have any conflicts to disclose

Objectives

Upon completion of this session, the participant will be able to:

1. Discuss three potential benefits of using power mobility training interventions with children and adolescents who have multiple, severe disabilities.

2. Describe five steps to creating power mobility training programs to meet the individual needs of children and adolescents who have multiple, severe disabilities.

3. Discuss three means by which to evaluate outcomes and expectations for the use of power mobility interventions in this unique population.

4. Discuss the role of an interprofessional team in providing power mobility options and use for children and adolescents who have 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 GV 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
Benefits of Power Mobility Use

- Improved
  - Cognitive skills
  - Communication skills
  - Psychosocial skills
  - Play skills
  - Perceptual skills

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

Livingstone & Paleg 2014

Power mobility may also 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

Play and Mobility Device

PT Interface

User Interface
Meet a Couple of Our Drivers......

Driver #1

Final Switch Positioning
Video – 1st day of Training

Video
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

• 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

Non-Motor Items on the PMTT

• 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”
Video – Ribbon “Carwash”

Other Examples

• Other examples –
  – The zambonie
  – Dress up
  – “Dancing”
  – Dinosaur hunting
  – Twin play
  – Visiting people/hide and seek
  – WWE “Wrestling”
  – Driving to read a book

Other Incidental Examples

• Other examples that were not intentional
  Driving away from Mom when mom approached her to wipe her face
  – Driving “after” students when they ignored her
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

Commercial Power Wheelchair Controller

User Joystick or Switches

Attendant Control Unit

Microcontroller

Shared Control Output Example

No Shared Control

Glass Wall
Shared Control Output Example

Shared Control

Glass Wall

Shared Control Output Example

Shared Control

Glass Wall

Shared Control Output Example

Shared Control

Glass Wall
Shared Control Output Example

Shared Control

Glass Wall

Video
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?”

Praise

Praise should always be sincere, specific, and focused on mastering skills that can be achieved
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”
Training Methods

• Reinforcement & Performance Measures
  • RAISD
  • PMTT

• Individualized & Engaging Environment
  • Opportunities for play and exploration
  • Social interactions
  • Intentional Obstacles

• Responsive Use of Attendant Control
  • Safety
  • Support and guidance
  • Support

• Verbal Prompts & Praise
  • Individualized from information on RAISD
  • Positive
  • Playful
  • Inviting

Reflection

• What went well?
  • What could have gone better?
• Alter access mode or location?
• Appropriate level of engagement?
• Re-administer PMTT?

Reflection

Today’s Session with a Specific Child

What went well?

What should we change for the next session?

Meaningful play?

Adequate stimulation? Too much?

Impact of, fatigue, time of day, etc.?

Assessing Power Mobility Outcomes in Children with Multiple, Severe Disabilities
Outcome Measures

• The Assessment of Learning Powered mobility use
  – Processed-based rather than skills based
  – Captures small incremental changes that are common in this population
• Wheelchair Skills Checklist
• ? Power Mobility Training Tool

A Glimpse of Our Outcomes.....

Outcomes to Date

• Improvements in mastery motivation on the DMQ
• Improvements in social/cognitive skills on the PEDI-CAT
• Improvements in basic power mobility skills
Outcomes to Date

• 6 children have “qualified” for their own power wheelchairs

• 4 other children have used our switch activation data to “qualify” for a trial of an eye-gaze communication device
  – 3 of these children now have their own eye-gaze communication devices

Review the Objectives:
Any Questions?

kenyonli@gvsu.edu

Select References


Select References


