Pediatric Power Mobility: Assessment and Access

Presenter:

WHAT WE WILL BE COVERING TODAY:

— Importance of Early Mobility
— Assessment
— Pediatric Power Wheelchairs
— Access Methods

OBJECTIVES

─ Participants will be able to list three developmental skills impacted by early independent mobility
─ Participants will understand assessment strategies to determine readiness and access method
─ Participants will be able to list three pediatric power wheelchair bases.
─ Participants will be able to list three potential access methods to drive a power wheelchair

IMPORTANCE OF EARLY MOBILITY

Early mobility has been linked through research to key developmental milestones
CONCERNS ABOUT EARLY MOBILITY

Power Mobility is often not recommended for very young children due to:
- Concerns for motor development (interfere with walking, child will “get lazy”)
  - Parent
  - Therapists, MD’s
- Concerns that the child will not understand or be unsafe (who lets their 2 year old go off on their own....?)
  - Parent
  - Therapists
  - Funders

Concerns about funding

NOTES FROM TYPICAL/ATYPICAL DEVELOPMENT

- There is a critical time beyond which a given phenomenon may not appear....the longer the development is delayed, the more difficult it is to simulate....a wait and see attitude may waste valuable time
- Child learns and tests limits, learns “no”
- Learns about self in relationship to other people and objects
- With these opportunities anger may appear overtly or covertly....likely to show anger which is out of proportion to the event

BANUS, B. ET AL. THE DEVELOPMENTAL THERAPIST. CHARLES B. SLACK: NJ. 1979

IMPORTANCE OF EARLY MOBILITY

- RESNA Pediatric Power Mobility Position Paper
- Compilation of expert opinion and summary of related research
- Intended for education, reimbursement and to direct future research
- Available at www.resna.org or www.permobilus.com (under education)

HISTORICAL AND PRESENT ATTITUDES

- Historically, only older children were considered candidates
- Use of a power wheelchair was and in some settings still is seen as a failure of therapy

Wiart, Darrah 2002
DIFFERENT “LEVELS” OF NEED FOR MOBILITY

Children who will never walk
− Severe CP, SMA, Quadriplegia

Children who have inefficient mobility
− Cannot keep up for all activities at an acceptable pace and with acceptable endurance

Children who need mobility earlier in childhood
− Learning to walk, may walk functionally later, but in the meantime...

Children who walk, but lose mobility
− Progressive disorders such as DMD

11/1991

EMOTIONAL AND VISUAL PERCEPTUAL DEVELOPMENT

Use of a power mobility device triggers emotional and visual perceptual development


ARTICLES

EMOTIONAL AND VISUAL PERCEPTUAL DEVELOPMENT

Use of a power mobility device triggers emotional and visual perceptual development


VERY EARLY AUGMENTED MOBILITY

With access to a specialized power mobility device, it is possible for infants with disabilities to have augmented mobility experiences as early as 8 months of age. Children can begin learning to maneuver a power mobility device below 14 months of age and those able to use a joystick have demonstrated competent control as young as 18 to 24 months


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Use of a power mobility device triggers emotional and visual perceptual development


ARTICLES

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ARTICLES

Journal «Early Intervention: Theory and Practice»

St.Petersburg Early Intervention Institute

English
• Italian
• Title and contents Volume 2

PSYCHOSOCIAL ASPECTS ON TECHNICAL AIDS – HOW DOES INDEPENDENT MOBILITY AFFECT THE PSYCHOLOGICAL AND INTELLUCTUAL DEVELOPMENT OF CHILDREN WITH PHYSICAL DISABILITIES?

April 7, 2015. St. Petersburg, Russia

Anna Palkina and Yuriy Gladyshev
Medicinskii Research Center, Saint-Petersburg, Saint Petersburg, Russia

ARTICLES

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MOTOR DEVELOPMENT

- Impact on other forms of mobility
- Research has demonstrated use of power mobility does not reduce gross motor functions


EARLY MOBILITY AND PHYSIOLOGY

Physiological effects
- Demands of ambulation
- Demands of manual wheelchair propulsion
- Demands of power mobility
- Mobility and exercise

PHYSIOLOGY: DEMANDS OF AMBULATION

- Physiological demands are prioritized over functional demands: some children have an aerobic level of exertion with ambulation, can effect concentration, ability to participate.
- Medically fragile children may require all available physical resources for breathing, circulation and digestion
- Power mobility allows conservation of energy, re-directed toward socialization, school, etc.

PHYSIOLOGY: DEMANDS OF MANUAL WHEELCHAIR PROPULSION

Manual wheelchair propulsion requires:
- UE strength and coordination; many w/ CP have poor “quality” of muscle
- Hand grip
- Head and trunk control
- Endurance
- High oxygen consumption than typical ambulation
* also consider that many manual wheelchairs weigh close to what some children weigh...
**PHYSIOLOGY: DEMANDS OF POWER MOBILITY**

Power mobility requires:
- Access to the drive controls
- Sufficient endurance (sustained effort) to use the controls throughout the day

**PHYSIOLOGY: MOBILITY AND EXERCISE**

- Mobility and exercise are not the same. People typically seek the most efficient method of getting from point A to B.
- Mobility must be efficient and functional.
- Exercise is a separate activity as it results in fatigue. Fatigue can interfere with mental function.

**EARLY MOBILITY AND DEVELOPMENT**

- Intellectual Development
- Psychosocial Development
- Vision

**INTELLECTUAL DEVELOPMENT**

Cognition/Learning
- Research has demonstrated that early mobility has strong links to learning
- Kids who are independently mobile have increased opportunities to explore and interact with the environment
INTELLECTUAL DEVELOPMENT

When children move independently, they must face spatial problems such as:
- Not colliding with obstacles
- Not falling off the edge of stairs
- Remembering how to get from place to place

Infants who do not have functional mobility:
- Cannot locate hidden objects
- Are not wary of heights
- Are more dependent than peers on vision to control their posture

Older children who do not have functional mobility have:
- Decreased map reading skills
- Difficulty remembering how to get from one place to another
- Difficulty estimating tight spaces
  Simms, 1987; Stanton, Wilson, Foreman, 2002

Experience increases brain development

Onset of mobility improves brain function
PSYCHOSOCIAL DEVELOPMENT

– Learned helplessness is firmly established by age 4 in children without functional mobility

VISUAL DEVELOPMENT

– Perceptual skills, particularly depth perception, develop with independent mobility, typically around the crawling stage
– Perceptual skills are important for learning, i.e. reading and math

QUESTIONS?

Any questions at this time?

ASSESSMENT - **ASSUMING THE CHILD IS APPROPRIATELY POSITIONED ALREADY

– Goals of the family, child and clinician
– Current mobility skills, and where each method is used if more than one method
– Related factors
– Medical issues
– Cognitive/ behavioral issues
– Future Needs
– Age
– Mobility Training
– Justification and Funding issues
GOALS

Child goals
— i.e. “I want a fast wheelchair”

Caregiver goals
— i.e. “I don’t want any more holes in my walls”

GOALS

— Clinician Goals:
  — To determine if the client is an appropriate candidate for a power mobility base
  — To determine the most appropriate:
    Power wheelchair and components
    Actuators
    Access method
  — To justify the recommended equipment adequately to obtain funding
  — To provide or ensure there is access to adequate support/training for a successful outcome

CURRENT MOBILITY SKILLS

— Ambulation with or without assistance
— Manual wheelchair
— Any prior power mobility experience
— What equipment is used in what situations?

RELATED FACTORS

— Transfers
— Seat to floor height
— Accessibility
— Home, school
— Vehicle, school bus
— Seating, if not adequate for power access
— Need for power actuators
— Need to interface other assistive technology
MEDICAL ISSUES

— Motor control
— Muscle tone
— Muscle strength
— Extraneous movement
— Reflexes
— Seizures
— Alertness level

MEDICAL ISSUES

Motor Control
— Volitional, isolated, controlled and repeatable movements
— Utilize as small a movement as possible
— Proportional control requires grading of force and distance of movement

MEDICAL ISSUES

Vision and visual perception
Hearing
Progressive disorders

MEDICAL ISSUES

Muscle Tone
— Low tone may mean limited active range of motion and decreased strength, and difficulty with initiation
— Increased tone often limits midline and midrange control
— Fluctuating tone often results in fluctuating performance!

MEDICAL ISSUES

Muscle Strength
— For active range of motion
— For activation
— For sustained activation
— Limit active range and force required
— Watch patterns of movement, especially for proximal weakness, ie, using the trunk to obtain arm placement
MEDICAL ISSUES

Extraneous Movement - movement disorders

- Athetosis or fluctuating tone: often control is best away from midline and at end ranges, stabilize adequately to allow isolated control
- Tremoring: decrease sensitivity if using proportional control
- Dystonia: often have to watch movement patterns and be careful about blocking them, allowing them to stabilize as they need

MEDICAL ISSUES

- Reflexes: some children use these patterned movements for function
- If they are unable to move away from the patterned movement once they initiate them, try not to place an access method in the path of a reflexive movement for activation or release
  - i.e. ATNR, Rooting

Using ATNR

Blocking effects of STNR
MEDICAL ISSUES

Seizures
  – If a client has high seizure activity, a power wheelchair may not be appropriate
  – Make sure the access method is released during a seizure
  – Make sure the client can drive safely after a seizure
  – Supervision

MEDICAL ISSUES

Alertness Level
  – Is the client alert during driving?
  – Persons with head injuries often have periods of agitation and sub-aroused states

MEDICAL ISSUES

Vision and Visual Perception
  – Persons with low vision can often drive functionally, particularly indoors and in familiar environments
  – Blind drivers: canes, echolocation, sensors and programming
  – Field cuts and left sided neglect
  – Perception: depth perception often doesn’t develop fully until a person moves independently (chicken and egg)

MEDICAL ISSUES

Hearing
  – Hearing impairments are not usually a limiting factor in driving
  – Client will need to compensate with vision and judgment
MEDICAL ISSUES
Progressive Disorders
- Access method may change as condition progresses
- ASL/Switch-IT! Lease programs, loan closets

COGNITIVE ISSUES
- See Criteria handout
- Cause and effect
- Stop and go concepts
- Directional concepts
- Judgment
- Problem solving
- Following directions
- and... Motivation

FUTURE NEEDS
- Progressive disorders
- Growing bodies
- Growth of wheelchair frame
- Children: growing minds
- Mobility needs change with age
- Environments, distance, independence
- Work requirements
- Need for weight shifts

POWER SEAT FUNCTIONS
- Tilt
- Recline
- ELRs
- Elevators
- Standers
- Why important?
- RESNA Position Papers
AGE

— How young is too young?

AGE

— Research has demonstrated that children can drive a power wheelchair at 18 months (Butler, 1984)
— It is cognitively easier to drive with 3 switches (using hands) than a joystick at a young age
— Borrow a kid and get a baseline!

MOBILITY TRAINING

— As part of the evaluation process

RESOURCES FOR TRAINING

— www.wheelchairskillsprogram.ca: evaluation, safety and training strategies for powered and manual chairs. Provides written and video materials. (Kirby and Smith)
— Toys R Us
ASL REMOTE STOP SWITCH

JUSTIFICATION AND FUNDING ISSUES

The evaluation report
– Justifications - what works
– Justifications - what doesn’t work
– Talk to those suppliers!
– Photos and Video

ASSESSMENT QUESTIONS?

Any questions at this time?

POWER WHEELCHAIR BASES
NOTE
Clinician/supplier need to ensure they have tried the wheelchair base configurations, rear, mid and front, so they can understand the maneuvering style involved with each.

PEDIATRIC POWER WHEELCHAIRS
- Front wheel
- Mid-wheel
- Rear wheel

ADULT POWER WHEELCHAIRS
- Many adult wheelchairs fit older children and teens
- Some of the MWD bases have smaller turning radius’ than some pediatric bases

BASE ELECTRONICS
- Will vary with manufacturer
- Will have different “feel” and method of accessing commands, especially with digital controls
FRONT WHEEL DRIVE BASES
- Permobil K300 PS, Jr
- Permobil F300
- Permobil C300 Corpus Jr

MID WHEEL DRIVE EXAMPLES

REAR WHEEL DRIVE EXAMPLES

PERMOBIL K450 MX
- Replaced the Robo
- Seat elevator
- Tilt (45 degrees)
- Only chair that allows floor access
Any questions at this time?

NOTE

The clinician and supplier must trial any method of access they wish to use for a child. This will allow them to understand the cognitive, perceptual and motor requirements needed for that control. This obviously assists with choosing controls as well as training.
ACCESS METHODS: PROPORTIONAL

- Joysticks: can be positioned multiple places on the body
- The smaller and weaker the movements used to access joysticks, more difficult it is on uneven surfaces

JOYSTICK - HAND

- Proportional joystick control requires grading of force and distance of movement
- Grading requires co-contraction of the flexors and extensors
- Difficult for clients with abnormal muscle tone

JOYSTICK HANDLES WHEN STANDARD DOES NOT WORK

- Larger handles may reduce muscle tone
- Goal post style designed for poor grasp
- Can be used for joysticks at other body areas

JOYSTICK - TOUCH PADS

Switch
IIT Touch Pads

HMAC tablet control
**HMC TOUCHLESS FINGER JOYSTICK**

- Proportional Control
- Fiberoptic light

**JOYSTICK - CHIN**

- Can be mounted on a swing away arm or bib
- Can lead to repetitive stress injuries of the jaw or cervical area

**MINI PROPORTIONAL JOYSTICK**

- Clinical Indicators:
  - Requires small travel distance
  - Requires minimal force to move and sustain joystick
  - Can be fragile
  - MEC includes reset (push downward)

**MINI PROPORTIONAL JOYSTICKS**

HMC
MINI PROPORTIONAL JOYSTICK

- Designed for clients who cannot grasp a joystick handle
- Stiff

MUSHROOM JOYSTICK
ASL OR SWITCH IT! PLAYSTATION DRIVE CONTROL

- No joke!
- Controls power wheelchair, seat functions and mode changes

JOYSTICK - PROPORTIONAL HEAD CONTROL

- Pushing back moves wheelchair forward
- Sustained pressure required to continue movement
- Can lead to increased muscle tone and difficulty stopping

JOYSTICK SPECIFIC PARAMETERS

- Short throw
  Use with caution with mini joysticks
- Sensitivity
- Changing axes
- Neutral Zone/Deadband
- 3 direction

DIGITAL ACCESS METHODS

- Single switch scanning
- 2, 3, 4 or 5 switch combination
- Sip and puff
- Head Array (proximity)
- 4 switch array (proximity)
- 2 or 4 switch fiberoptic array
- Analog Digital Drive system
- Sip and puff/ head array combination
- Eye Gaze
SWITCH DRIVING

- 1 switch: scanning
- 2 switch: iQ and QLogic, Forward, Left, Right and Reverse (Reset on QLogic)
- 3 switch: Forward, Left, Right
- 4 switch: Forward, Left, Right and Reverse or Reset
- 5 switch: Forward, Left, Right, Reverse and Reset

THE SMALLER AND WEAKER THE MOVEMENT(S) NECESSARY FOR ACCESS, THE MORE DIFFICULT TO MAINTAIN THE ACCESS METHOD RELATIVE TO THE CLIENT, ESPECIALLY IF POWERED SEATING IS USED
SINGLE SWITCH SCANNING

- Clinical Indicators:
  - Only 1-2 switch sites can be found
  - Client can see and monitor display

ANY 2, 3, 4 OR 5 SWITCH COMBINATION

- Can be used anywhere, even multiple sites. Often just use 3 switches for forward, left and right

SIP ‘N PUFF

Clinical Indicators:
- Little control of head or extremity
- Good oral motor control, lip closure, intact palate
- Full directional control and speed control
- Can only be used in “cruise control”, must have reliable “stop” switch

ASL HEAD ARRAY (PROXIMITY)

- 3-5 proximity switches in a tri-pad headrest
- Clinical Indicators:
  - Fair to good head control
  - Little extremity control
STEALTH HEAD ARRAY

- Suboccipital pad can increase stability of the head

PROXIMITY ARRAY

- Clinical Indicators:
  - Fair upper extremity control
  - Accommodates larger movement
  - Eliminates a plane of movement

ASL 4 SWITCH FIBEROPTIC ARRAY

- Small targets
- Accommodates very small movements with no force
- Typically placed by finger or thumb
- Cables are fragile

AN EXAMPLE

Farid
- Age 8
- SMA, type 1
- Driving with:
  - Forward: 1 fiberoptic switch under right index finger
  - Left: 1 fiberoptic switch under left index finger
  - Right: 1 proximity switch by left medial knee
  - Reset: 1 proximity switch by right medial knee
ANALOG DIGITAL DRIVE SYSTEM: COMBINATION HEAD ARRAY AND JOYSTICK

- Left and Right pads active on the head array
- Forward and Reverse active on the joystick

ASL

FARID DRIVING

ASL SIP AND PUFF HEAD ARRAY: COMBINATION SIP AND PUFF AND HEAD ARRAY

- Left and Right pads active on the head array
- Any puff is Forward
- Any sip is Reverse
**SIP ‘N PUFF HEAD ARRAY**

**ASL EYE GAZE CONTROL SYSTEM**

- Uses eye gaze and a computer screen
- Operates seat functions
- EADL functions

**THE FUTURE**

- Voice (approved by the FDA now)
- Brain Wave
- Computer Directional Control

**WHAT TO DO NEXT:**

- Get to know your suppliers
- Get to know the products
- Arrange for manufacturer inservices
- Borrow equipment
- Drive!
- Program!
Questions?

CONTACT INFORMATION

For more information please visit our website at:
www.numotion.com

Numotion
Customer Care Center
800-500-9150

Thank You!