e4p Evidence for Practice

Power mobility for school-aged children and adolescents

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Introduction

This document contains a brief overview of information regarding the effectiveness of use and introduction of power mobility with school-aged children and adolescents. It is intended to provide clinicians with relevant background information and to describe the current best level of evidence.

How was the literature review completed?

An electronic search of the following databases was performed in September 2011: CINAHL, MEDLINE, EMBASE and Google Scholar. Keywords used in the search included: 'power/ed mobility', 'power wheelchair' and 'wheelchair/powered'. Studies published in English, including at least one school-aged child or adolescent with a disability and involving an outcome related to the child's use of a power mobility device were included. Two specific intervention questions were identified: What is the impact of power mobility on 1) physical abilities and 2) participation? Studies addressing these questions are included in the attached evidence table (see Appendix 2). The American Academy of Cerebral Palsy & Developmental Medicine (AACPDM) Levels of Evidence (see Appendix 1)[1] were assigned to quantitative studies by two reviewers with consensus scores reported throughout the document.

What is Power Mobility?

Power mobility for this age group means use of a power wheelchair. ***Power wheelchairs*** are defined as 'Wheelchairs powered by electricity that provide mobility and body support for individuals with limited ability to walk'.[2] Power wheelchairs usually support the person in a seated position but may also include powered stand-up features. Power wheelchairs often incorporate powered tilt, but may also include other powered seating functions such as recline, shear adjustment, seat elevation and powered elevating legrests.

Why is Power Mobility so Important?

In the past, power mobility was only considered as a last resort, once all other forms of mobility had been found to be ineffective. More recently, therapists have begun to emphasize meaningful participation rather than exclusively focussing on development of normal movement patterns. Children, with their families and therapists can choose between different mobility options depending on the activity or the environment.[3] For example, many children with cerebral palsy (CP) who choose floor mobility at home, may use a walker at school, but need a wheeled mobility device outdoors or in the community.[4]

In children who are typically developing, the ability to move independently has been shown to influence self-awareness, emotional attachment, spatial orientation, fear of heights and visual/vestibular integration[5] as well as personality traits such as motivation and initiation.[6] Children who have restricted mobility tend to have passive, dependent behaviour and this can have long lasting consequences.[7]

Which Children with Disabilities Need Power Mobility?

Children who have never been able to walk should have already been considered for power mobility during the preschool years. Power mobility should be introduced for children and adolescents who lose the ability to walk or have inefficient mobility. Children with diagnoses such as CP, Gross Motor Function Classification System (GMFCS)[8] levels III or IV; spinal cord injury (SCI), C6 or C7; meningomyelocele,

thoracic level; and orthopaedic conditions such as osteogenesis imperfecta, arthritis and arthrogryposis, present with inefficient mobility.

Children with diagnoses such as acquired brain injury, SCI or deteriorating conditions may lose the ability to walk or develop inefficient mobility. Children with neuromuscular diseases e.g. spinal muscular atrophy type III, Duchenne muscular dystrophy and limb girdle dystrophy, are typically part-time power wheelchair users during elementary school years and are full-time power wheelchair users by adolescence.

What is Efficient Mobility?

Mobility must be efficient and relatively effortless in order for children with disabilities to have the same psycho-social experiences as children who are typically developing.[9] If children and adolescents are exhausted just getting around school they will not be able to devote the same attention to learning as their peers. They need an efficient means of mobility in order to keep up with their friends at school and in the community.

Manual wheelchairs can be difficult to set up to allow efficient mobility for younger children due to the children's small size and weight relative to the size and weight of the wheelchair frame. The wheel position is often compromised because of the need to accommodate future growth. Very few children with CP are able to propel manual wheelchairs efficiently[4] and although manual wheelchairs assist caregivers, power mobility can enhance functional independence.[10]

How Does Mobility Change with Age?

Cerebral Palsy: Children with CP achieve most of their gross motor abilities before the age of five[11] and peak in their motor performance before adolescence. Children at GMFCS levels III to V tend to lose function in adolescence with the greatest changes seen at level IV.[12] Gait pattern tends to deteriorate with increasing age as walking requires more energy with increased body size. The higher the GMFCS level, the more energy is required for walking.[13]

As children enter adolescence, the need to keep up with peers in larger school environments or different recreational settings increases.[14] Power mobility allows adolescents to keep up with peers despite loss of physical abilities and increased environmental demands.[15] Power mobility allows adolescents at GMFCS levels IV and V to get around independently.[16] Environmental and personal factors appear to have a much greater influence over choice of mobility methods for adolescents than for younger children.[9]

Meningomyelocele: As children with meningomyelocele get older they tend to use wheeled mobility or a combination of ambulation with assistive devices and wheeled mobility, depending on the environment or activity. In a historical review of adolescents and young adults with spina bifida, more young adults were full time wheelchair users in comparison to adolescents. More than half the participants in their study used manual or power wheelchairs for at least one environment.[17]

Muscular Dystrophy: Adolescents and young adults with muscular dystrophy gradually become weaker and have difficulty using a standard joystick. Changing the driver control to a more sensitive joystick or touch pad can restore the ability to drive a power wheelchair independently.[18] A retrospective review suggests that: postural support should be provided early on while the individual is still walking; tilt and recline should be ordered with the first power wheelchair to assist with issues of pain and pressure relief; and programmable electronics should be included to accommodate changing methods of drive control and integration of other assistive technologies.[19]

Will Using Power Mobility Cause Children and Adolescents to Lose Physical Abilities?

Parents and therapists often fear that use of power mobility will cause children and adolescents with disabilities to lose interest in physical activity or to lose physical abilities. One research study including

school age children found no change in motor abilities after 6-8 months of power mobility use.[20] (evidence level IV)

Adults with arthritis showed no differences in walking ability (on the 6 minute walk test) between subjects using power mobility and controls over a three month period.[21] A retrospective study of 89 adults found no statistically significant weight gain in first time power mobility users over a 1 year period.[22]

How Does Power Mobility Enhance Participation?

Several qualitative studies and one quantitative study have reported outcomes related to participation.

- Power mobility enhances ability to keep up with friends which enhances participation and increases self-confidence and self-esteem.[23] (evidence level V)
- Power mobility may enhance control, independence and participation in age appropriate and meaningful activities.[24]
- Technical aids such as power mobility enhance participation in play but environmental barriers may limit opportunities.[25]
- Assistive devices including power mobility allow participation with peers. At school, the attitudinal and physical environment encourages device use, but at home, floor or assisted mobility may be preferred.[26]
- Power mobility facilitates increased independence and participation in outdoor and social activities.[27]
- Power mobility enhances freedom, peer interaction and play. Length and quality of training is a major factor in facilitating successful power mobility use.[28]
- Adolescents need efficient and independent mobility options in order to participate with peers. Independent power mobility is a primary therapy goal for adolescents at GMFCS level V.[29]

Do Children or Adolescents Need Certain Cognitive Readiness Skills to Benefit from Power Mobility?

Readiness assessments such as the Pediatric Power Wheelchair Screening Test (PPWST)[30] were developed to identify which children were likely to develop competent driving skills within a short period of time. This assessment is not appropriate for children with multiple and complex disabilities who may need to use switches or access methods other than a joystick.[31] Qualitative research demonstrates that there is a continuum of power mobility skills beginning with learning the concept of movement, progressing to developing control of steering and later to becoming a proficient power wheelchair user.[32] Children with IQ below 55 have been shown to be capable of learning to drive[20] although it may take children functioning at early developmental levels more time and opportunities for practise in order to gain competence.[33]

What is the Best Way for Children and Adolescents to Learn Power Mobility Skills?

School-aged children or adolescents who do not have significant cognitive limitations will typically learn to use a power wheelchair competently within a very short period of time. Proficient use in all environments develops only with time and experience. Additional training for outdoor and more complex environments has been suggested as being important for safety in adolescence.[27] For children with limited hand function, an alternative access method to using a joystick may be necessary. An assessment with a therapist experienced in alternate access for power mobility may be helpful in establishing the most appropriate access method.

Children with complex developmental delays may need a long period of training to develop power mobility skills.[33] Length of time and environmental support has been found to correlate strongly with achievement of successful driving skills.[20] Clinicians should consider introducing power mobility for any child or adolescent who has inefficient independent mobility in order to enhance participation in family, school and community life.

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Appendix 1: American Academy of Cerebral Palsy & Developmental Medicine - Levels of Evidence (December 2008)

Level	Group Intervention Studies	Single Subject Research Designs (SSRD)
I	Systematic review of randomized controlled trials (RCTs) Large RCT (with narrow confidence intervals) (n>100)	Randomized controlled N-of-1 (RCT) Alternating treatment design (ATD) Concurrent or non-concurrent multiple baseline design (MBDs) (generalizability if the ATD is replicated across three or more subjects and the MBD consists of a minimum of three subjects, behaviours, or settings. These designs can provide causal inferences)
II	Smaller RCTs (with wider confidence intervals) (n<100) Systematic reviews of cohort studies "Outcomes research" (very large ecologic studies)	Non-randomized, controlled, concurrent MBD; (generalizability if design consists of a minimum of three subjects, behaviours, or settings. Limited causal inferences)
III	Cohort studies (must have concurrent control group) Systematic reviews of case control studies	Non-randomized, non-concurrent, controlled MBD; (generalizability if design consists of a minimum of three subjects, behaviours or settings. Limited causal inferences)
IV	Case series Cohort study without concurrent control group (e.g. with historical control group) Case-control study	Non-randomized, controlled SSRDs with at least three phases (ABA, ABAB, BAB, etc); (generalizability if replicated across three or more different subjects. Only hints at causal inferences)
V	Expert opinion Case study or report Bench research Expert opinion based on theory or physiologic research Common sense/anecdotes	Non-randomized controlled AB SSRD; (generalizability if replicated across three or more different subjects. Suggests causal inferences allowing for testing of ideas)

Appendix 2: Evidence Table of Intervention Studies

		Sampling	Outcomes			
Citation	**Study Design**	**Subjects & Size**	**Outcome of Interest**	**Measure Used to Assess**	**ICF Component[34]**	**Results/Findings**
Quantitative research						
Bottos et al[20]	Before and after case series Evidence level IV	25 children aged 3-8 years with CP using a power wheelchair for 6-8 months	Effect on intelligence quotient (IQ), motor level, independence and driving ability	Gross Motor Function Measure (GMFM) Canadian Occupational Performance Measure (COPM) Power Mobility Program[30]	Body Structure & Function Activity and Participation	Increased independence. 21/27 able to drive including 7/13 with IQ below 55
Wiart et al.[23]	Cross-sectional/ Survey Evidence level V	66 participants who had received a power wheelchair before 18 years of age. 52 completed with assistance from parent or caregiver proxy	Extent and locations of power mobility use. Barriers and facilitators to use of power mobility	Structured telephone interview. 22 closed-ended questions and 4 open-ended questions	Activity and Participation	Physical barriers at school and/or work adversely affected power mobility use. Transportation difficulties and difficulties using wheelchair within the home were the most common barriers. Power mobility allowed freedom and facilitated play with other children
Qualitative research						
Berry et al.[28]	Mixed methods, qualitative and quantitative survey	Caregivers of 36 children aged 5-23 years with a disability who had received mobility equipment	Caregiver's perspectives on their children's use of power mobility	Semi-structured interviews, 4 interviewed in person, 31 interviewed by telephone	Activity and Participation	Power mobility fostered independence, increased peer interaction and ability to play. Need to consider environmental accessibility highlighted. Training was a major factor in successful use.
Evans et al[27]	Qualitative interviews – using a qualitative framework approach	18 young people aged 10-18 years with disabilities who had been provided with an electric powered indoor-outdoor wheelchair (EPIOC)	User's perceptions of experiences with EPIOC use after 10-19 months of use	A priori interview topics based on items from the EuroQol EQ-5D with open ended questions	Activity and Participation	Increased independence and participation in age appropriate activities. Suggested additional safety training for using the EPIOC in different environments

		Sampling	Outcomes			
Citation	**Study Design**	**Subjects & Size**	**Outcome of Interest**	**Measure Used to Assess**	**ICF Component[34]**	**Results/Findings**
Huang et al.[26]	In person interviews – no specific approach identified.	15 children with CP aged 7-15 years, their parents and teachers	Users', parents' and teachers' perceptions of assistive devices and their use	Semi-structured interviews	Activity and Participation	Assistive devices helped increase participation with peers. Devices were used more at school than at home. Contextual factors were important considerations.
Palisano et al.[29]	Phenomenology	10 youth with CP aged 17-20 years	Adolescents' experiences of mobility in their daily lives	Semi-structured interviews	Activity and Participation	Mobility was important for self-sufficiency. Safety and efficiency influenced mobility choices. Environmental and Personal factors influenced choices.
Skar[25]	Grounded Theory	8 children with physical disabilities aged 6-11 years	Children with disabilities perceptions of their technical aids in play situations	Semi-structured interviews at home or school depending on child's choice.	Activity and Participation	Children did not perceive any limitations caused by their technical aids. Barriers to play were mainly environmental.
Wiart et al.[24]	Phenomenology	5 mothers of children with physical disabilities who use power mobility	Parents' experiences and perceptions of their children's experiences with power mobility	Semi-structured interviews in the homes of participants	Activity and Participation	Power mobility increased personal control, independence and participation in age appropriate activities. Positive effect on others' attitudes. Children developed more 'legitimate' peer relationships.