Mobility Prescription: from infancy through adolescence and beyond

Introduction

The mobility needs of children with motor disabilities change with their cognitive, physical, and social development. When prescribing appropriate mobility equipment, these developmental issues need to be considered in the context of child's home, school, and community environments. As well as independent mobility options, many children will need an attendant mobility option for longer distances and for environments and locations where independent mobility is impractical. In this paper, the mobility issues for 3 different age ranges are discussed and further subdivided into options to consider for independent mobility and attendant mobility.

The mobility equipment referred to in this presentation is not intended to be all-inclusive. The examples have been chosen because they are most commonly used by the presenters, based on equipment availability, cost, performance and service. The presenters appreciate that there will be regional differences in equipment options and availability. The examples included are intended to assist the beginning level clinician to choose appropriate equipment that is available in their own locales.

The presentation that accompanies this hand-out will include clinical case studies. The key issues or considerations that will be discussed during the case studies will be bolded in the body of this hand-out. In addition, after each subsection space is included to allow the clinician to make notes as needed.

Mobility Prescription for Infants, toddlers and preschool children

Children who are typically developing, begin to crawl around 8 months of age and to walk around one year. Research has shown that this transition from the pre-locomotor to the locomotor stage has a profound impact on perceptual, emotional and personality development.[1] Conversely, limiting independent movement has a negative impact on the development of children and can lead to passive, dependent behaviour.[2]

For infants with disabilities, there is now a wide array of seating and mobility equipment available. For infants, it may be sufficient to provide additional seating support within commercial baby equipment, but many parents find that this is no longer meeting the needs of their toddlers.

Independent mobility options for the young child

Even if a young child is only able to use a new mobility base part of the time, it is important to provide this independence with a manual or power mobility base.
There are some difficulties in providing efficient manual mobility to young children.

Wheelchairs for young children **need to be able to grow**. Frames designed to accommodate growth **tend to be heavier** and sometimes it is not possible to position the **wheel in an effective position for self-propulsion**. Caster carts position the wheel quite optimally, but are low to the ground and generally only effective indoors on smooth surfaces.

The Quickie Kidz is designed to be a toddler wheelchair and has a **low seat to floor height**, great for preschool environments. It is heavy for its size and the single stroller handle can be difficult for adults to use outdoors. If custom seating is required, it may not be possible to position the wheels optimally.

The Invacare Comet and Zippie GS can be set up with the large wheels in the front. This makes it easier for children to wheel, but difficult for parents to push outside or to go up and down curbs or steps. The weight of the chair relative to the weight of the child is a significant obstacle to independent manual mobility. Chairs like the Panthera Micro weigh less than 8.5lbs but unfortunately don't grow.

Another consideration when choosing manual mobility options for the young user is a stroller handle. Wheelchairs that have been designed with independent wheeling in mind do not always have stroller handles that are tall enough for adults who often have to assist children outdoors.



The Tilite Twist, Zippie Zone and Ki Tsunami Little Wave grow in width and depth and have adjustable axles to help get the wheel in a good position. Although significantly heavier than the Panthera, these are lighter than many other options at 12, 14 and 16 lbs respectively.

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With younger children, **parents may not be emotionally ready** to consider a power wheelchair for their son or daughter. **Therapists may also be resistant** for fear that the child will no longer be interested in improving or maintaining ambulation. Research shows no decline in motor abilities following introduction of a power wheelchair[3] and no difference in motor development between children using power mobility and controls.[4] Some researchers have suggested that the independence engendered by use of power mobility can increase motivation to use existing skills more effectively.[4,5] For those children who have severe physical impairments that will impede them from becoming independent manual wheelchair users (such as children with CP GMFCS Level IV & V, Osteogenesis Imperfecta, Spinal Muscular Atrophy I & II), introduction to a power wheelchair at a young age is recommended.[6]

Transportation of a heavy power wheelchair is frequently a barrier for parents of young children who do not yet have a wheelchair accessible vehicle. Mini powered wheelchairs such as the Invacare Tiger Cub have been designed to be smaller and lighter

weight so that it can be lifted into a vehicle if necessary. However, these often have **limited growth capability** and very small wheels which restricts their use outdoors.


Power wheelchairs like the TDX Spree or Permobil Koala will be **better for outdoor use**. Both these chairs are available with seat elevator and tilt. For children who live in rural communities and want to use the chair outdoors on rough terrain, it may be worth considering putting a small size seat frame onto an adult power wheelchair base.

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Attendant mobility options for the young child

Even if a child has an independent mobility option, parents may also require an attendant mobility option to bring the child from one place to another or for **environments and locations where independent mobility is impractical**.

For many reasons, parents of infants and toddlers often prefer a stroller mobility base instead of a wheelchair. However, a stroller may not be compatible or age-appropriate in kindergarten. Funding sources often expect mobility bases to last at least 3-5 years. Therefore, it may be appropriate to consider a wheelchair for the 2-3 year old child.

For parents who prefer a stroller, choosing one can be overwhelming as there is now a large variety of strollers available. There are basic strollers that fold, are available with larger wheels for rough outdoor terrain, and provide basic postural support, such as the Convaid Scout. These are generally the **lightest options and the easiest to collapse to put into a vehicle**. This type of stroller is also available in models that have tilt-in-space and can have additional postural support options added, such as the Convaid Safari.

Special needs strollers such as the Ottobock Kimba are available with **highly adjustable seating systems** (e.g. Leckey Squiggles or Mygo) that can also be transferred to a **high-low base** for use indoors. These high-low bases are often very useful in daycare, preschool or kindergarten as well as in the home. Unfortunately, the indoor high-low bases are **not easily transported** due to size and weight. The outdoor high-low bases may be used as an attendant mobility option, but they are quite large for indoor use. Many high-low bases do not have a transit option which may make a wheelchair a more appropriate mobility base.


For those who need an all-in-one stroller, the Convaid Cuddlebug or Advanced Health Care EasyS strollers combine full postural support on a base that tilts, reclines, and has high-low option.

It is important to remember that the more options there are on a special needs stroller, the heavier it will be. It is not uncommon for the stroller base to weigh 20 - 40lbs and the seating system to weigh 20 – 50 lbs, making it **very heavy to lift into a car trunk**. It may therefore be desirable to transport the stroller in a wheelchair accessible vehicle, if a transit option is available. For families without wheelchair accessible vehicles, it may be more practical to have a lightweight stroller with lightweight seating system for everyday outings and a more supportive seating system on a base for indoor use.

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For transportation of a child who has limited ability to self-propel and will mainly use power mobility for independence, more basic growing manual wheelchairs such as the Zippie GS or Invacare MVP Jr may be appropriate. Because this manual wheelchair is not the primary mobility base, funding for it may be problematic.

For children who require attendant mobility most or all of the time, additional wheelchair features may be required. Children who fatigue, need assistance with seated postural control, or require a change of position for comfort or skin integrity may **need tilt-in-space or recline.** There are several tilt-in-space wheelchairs with a range of tilt angles available, such as the Invacare Orbit and Spree XT and the Sunrise Zippie Iris and TS. Tilt-in-space wheelchairs are also available in folding options and are often lighter than some of the special needs strollers. Some tilt chairs also have a recline feature available. The Swingbo is available with tilt and recline and it can be set up for the child who is able to self-propel. This chair is often tippy rearward and may need to be counter-weighted.

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Mobility Prescription for school age children

Mobility equipment for school age children needs to accommodate growth and change in working height over the next few years. Initially, equipment needs to be low to the ground to facilitate transfers or access to tables in the kindergarten and early grade environments. As children grow, mobility equipment needs to facilitate participation with other children and in family and community life. Although it is common practice to use a separate standing frame for upright activities, it may be appropriate at this time to consider a standing wheelchair. This may facilitate more frequent standing both at school and in the home. Transportation in the school bus is often an issue that will need to be considered for the first time and so mobility equipment should be ordered transport ready. Mobility equipment will need to be suitable for the playground as well as indoors and alternate mobility equipment may be needed for outings.

Independent mobility options for the school age child

The Ki Tsunami Little Wave, Ti Twist, and Zippie Zone continue to be wheelchair models that will work well through early elementary school for active wheelers and **offer the most growth in seat width and depth**. As children get a little older, options like the Quickie GT or GP can be considered as they have built in depth growth but if the child grows in width, a new frame needs to be purchased. The GP is also available with a swing away front end, helpful for standing transfers.

Folding options such as the Helio, Breezy, Quickie 2 and LX and Zippie GS may be appropriate for less active wheelers or for children who are transported in the family car or truck. Some wheelchair manufacturers offer a free growth kit within the first couple of years.

Power mobility options for school age children usually involve using a small size seat on an adult base. The Invacare TDX SP, Quickie Xperience and Quantum 6000 are high end mid-wheel drive options with **good indoor and outdoor capabilities**. The Quantum 610 is suitable for younger and less adventurous drivers.

Rear wheel drive options such as the Invacare Torque and Quickie Xplore may be preferred for rough outdoor terrain, but do not have as smooth a ride and are less easily maneuvered in smaller spaces such as in a wheelchair van or bathroom.

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Attendant mobility options for the school-age child
The Zippie GS is a popular chair due to its **growth capabilities**. **Tilt-in-space** wheelchairs like the Zippie TS or Spree XT are available in **folding** and non-folding models. The Zippie Iris is very stable and can be set up in a **variety of seat-to-floor heights** to facilitate transfers, foot propulsion and also self-wheeling.

Other chairs provide unique or specific features that may be appropriate for the child. For example, the Kids Rock chair by Kids Up allows flexion and extension at the hips and knees, which may improve comfort and sitting tolerance, particularly for children with marked lower extremity extensor tone.

In rural communities, all terrain strollers may be desired to allow the child to participate in **community outings that are not wheelchair accessible**. Most of these strollers are available for children up to 100lbs (e.g. Special Tomato, or Baby Jogger Special Needs). Models such as the Axiom are available for larger clients (up to 200lbs) but tend to be difficult to push unless the attendant is quite tall. As children get bigger and heavier, the transfer into/out of this type of stroller can be quite challenging.

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Mobility prescription for adolescents and young adults
As children move into adolescence, mobility choices will now include adult as well as paediatric equipment. However, it is still important to consider that the young adolescent is still likely to grow in width and length.

Independent mobility options for the adolescent
It is not unusual for adolescents with physical impairments to have changing mobility needs or abilities into their adulthood. Some children with motor impairments lose gross motor function as they reach adolescence.[7] They may also develop pain[8] which may change their choice of independent community mobility to a light-weight rigid manual chair or a power wheelchair.[9]

Clinicians need to consider how their clients will keep up with peers and function when they leave high school and home to go on to college or employment. Perhaps more than ever, adolescents will need to consider the impact of their mobility base on their fatigue and/or independence. Adolescents who are considering post-secondary education should consider the impact of getting around a larger campus on their fatigue or independence.

Transportation options to/from college, work, and around their community need to be considered. If wheelchair accessible public transportation is not an option, an adolescent may want to have a light-weight folding chair that peers can put into the trunk of a car. Alternately, if the adolescent will be driving a car, the manual wheelchair may need to be light and easy for the driver to pack into the car. Examples of ultralight chairs include the Panthera U2 Light and rigid TiLites. If the adolescent is driving a wheelchair accessible van and using a power wheelchair, it will need to be easily maneuvered into a tight space.

If the adolescent will be primarily using a manual wheelchair, it is important to consider options that allow for greater independence around their home and community. The lightest weight rigid wheelchairs allow for maximum wheeling efficiency but offer little growth or modification once the chair has been made to a custom configuration. Therefore, it is crucial that the specific wheelchair configuration is done when significant change in body structure or function are no longer anticipated.

An elevating seat wheelchair will allow the user to have **greater access to objects** that would otherwise be out of reach. Importantly, this also allows the adolescent to be higher for **social interaction**. Add-on options, such as the Free Wheel Attachment can maximize participation and independence in a **variety of environments and weather conditions**.

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If the adolescent will be using a power wheelchair as his/her primary means of mobility, it is important to consider features that may have not have been important before. For example, power wheelchairs that have a sit-to-stand option will allow the user to **independently stand** throughout the day. This will permit the adolescent to be at peer height for **social interaction** as well as improving his or her **ability to access the environment** (not to mention, to provide the physical benefits of weight bearing and position change).

When a sit-to-stand power chair is not an option, a seat elevator may be an appropriate alternative. This option is available on several power wheelchairs. Sometimes a seat elevator can be used to **assist with standing transfers**.

Although it may not have been a necessity previously, **power tilt** may now be an important consideration for the adolescent who will be in his/her power wheelchair throughout the day without the ability to independently off-load or weight shift in the chair. The power tilt often promotes good **skin integrity** while improving **sitting comfort and tolerance**. A few degrees of anterior tilt may also assist with **standing transfers**. Adolescents with more complex disabilities with issues of **pain, muscle tone, and pressure** may also use recline and elevating leg-rests with the tilt.

Power wheelchairs come in three drive-wheel styles: front, mid-wheel and rear wheel. In this age group, the adolescent's personal preference is paramount. This preference may be based on the "ride" of the chair, previous power wheelchair experience, and/or the primary environment or intended use of the chair. Some clients will have always used rear wheel drive and therefore prefer the way it drives. Adolescents who play power soccer often prefer rear wheel drive as they get more swing on the ball. Many clients choose mid-wheel drive as it tends to have a smoother ride and is more maneuverable indoors than rear wheel drive. Front wheel drive is less common, but may be useful for maneuvering into tight spaces such as a van. It is recommended to trial the power wheelchair on various terrains and slopes to ensure that the chosen chair will be able to work well where it will be used.

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Attendant mobility options for the adolescent

Adult wheelchairs are also available in folding and rigid versions and can be set up to facilitate transfers, foot propulsion and self-wheeling. More **durable, folding, and light weight options**, such as the Helio, TiLite Aero X, and Quickie 2, are important considerations for chairs that need to be **transported in the back or trunk** of a vehicle. **Ease of attendant use** and **maneuverability outdoors** will affect the choices of wheels and casters. A few all-terrain options are available, such as the Hippocampe wheelchair, but transfers may be more problematic with the stroller style mobility devices.

For adolescents who are not able to wheel or who can foot-propel indoors, the Quickie Iris, Invacare Solara, or PDG Bentley tilt chairs may be appropriate. All three chairs can be set up low to the ground for foot propulsion. The Iris and Solara chairs have the "centre of gravity" tilt systems which allow for greater stability when a heavy user is in tilt. The tilt feature may be needed for client fatigue and/or postural control, particularly when going

on long outings in the community.

For the adolescent who is able to wheel indoors for only short distances an ultra-light manual wheelchair will probably not be necessary. Instead, a manual wheelchair that can be set up to facilitate self-propulsion, transfers, and yet is durable may be more appropriate. The Quickie 2, Quickie GP, and Aero X (swing-away front end) have all of these features.

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Summary

Many factors need to be considered when prescribing a mobility base for youth with motor impairments. For younger children, parent and care-giver issues are often the predominant influence on choice of mobility base. As children grow, participation with peers and in their community becomes a primary influence on choice of mobility base. For adolescents and young adults, clinicians will likely need to consider mobility options that may not have been important previously. Clinicians will need to collaborate with youth and their families, considering all of the developmental, social, and environmental issues in order to ensure the prescription of an appropriate mobility base.

References

1. Campos JJ, Anderson DI, Barbu-Roth MA, Hubbard EM, Hertenstein MJ, Witherington D. Travel broadens the mind. Infancy 2000; 1:149-219.
2. Butler C. Augmentative Mobility: Why do it? Physical Medicine & Rehabilitation Clinics of North America 1991; 2:801-15.
3. Bottos M, Bolcati C, Sciuto L, Ruggeri C, Felicangeli A. Powered wheelchairs and independence in young children with tetraplegia. Developmental Medicine & Child Neurology 2001; 43:769-77.
4. Jones M. Effects of power mobility on the development of young children with severe motor impairments. Doctoral dissertation: University of Oklahoma, 2004.
5. Paulsson K, Christofferson M. Psycho-social aspects on technical aids – How does independent mobility affect the psychosocial and intellectual development of children with physical disabilities? 2nd International Conference on Rehabilitation Engineering. Ottawa: RESNA, 1982; 282-6.
6. Hays R. Childhood motor disabilities: clinical overview and scope of the problem. In: K. Jaffe. Childhood Power Mobility: Developmental, Technical, & Clinical Perspectives. Washington, DC: RESNA, 1987; 1-10.

7. Hanna S, Rosenbaum P, Bartlett D, et al. Stability and decline in gross motor function among children and youth with cerebral palsy aged 2 to 21 years. Developmental Medicine & Child Neurology 2009;51:295-302.
8. Bartlett D, Hanna S, Avery L, Stevenson R, Galuppi B. Correlates of decline in gross motor capacity in adolescents with cerebral palsy in Gross Motor Function Classification System levels III to V: an exploratory study. Developmental Medicine & Child Neurology 2010;52:e155-e160.
9. Roehrig S, Like G. Factors affecting shoulder pain in adolescents and young adults with spina bifida. Pediatric Physical Therapy 2008;29:224-232.

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