CLINICAL EDITORIAL

Clinical Commentary:
Advances in Power Mobility for Children and Adults with Non-Ambulant Cerebral Palsy

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Power mobility devices include ride-on toys, specialty devices for young children, platform training devices, sit-to-stand power wheelchairs and power wheelchairs. This clinical commentary will discuss recent advances in technology and changes in philosophical approach that influence their use with children and adults with cerebral palsy or similar conditions.

In addition to the stigma, where a power wheelchair may be perceived as a "last resort," the most widely reported challenges are the size and weight of the device, transportation, and home and community accessibility. For young children (and their parents) these issues are particularly challenging. The "ON-Time" mobility framework proposes that children have the right to age-appropriate mobility opportunities and equitable developmental experiences.1 This means that developmentally appropriate power mobility options are needed before 12 months of age.

Although modified ride-on toys have been used since the 1980s, their use has grown exponentially since publication of the first technical report in 2012 from the University of Delaware,2 and the development of Go Baby Go programs worldwide. Most toys are adapted with a single-switch, the controls cause an initial jolt that is difficult for some children to tolerate and steering is challenging even with adaptations. More complex adaptations such as proportional joysticks and graded speed modulation, 3 and line-following capabilities for children with severe visual impairments using single-switch control,4 are now available in some settings. The technical support available particularly influences their use with children who need more complex seating or alternate control options.

Limitations in the functionality of ride-on toys include their size and large turning radius. Dual control toys are more maneuverable and have been successfully used with children as young as 10 months with spinal muscular atrophy. Seating and handle adaptations suggested,5 may also be suitable for some young children with cerebral palsy. The Explorer Mini is available in Europe and has been available in the U.S. since 2020.6 It addresses many of the functionality concerns of modified ride-on toys, but the joystick position cannot be adjusted, and the postural support is limited. It is also much more expensive than ride-on toys, limiting widespread use. Shriners Children's in Utah developed a Babybug, suitable for children from 8 months to 18 months in their state to address ON-Time mobility.

In 2003, the term "Driving to Learn" was introduced: a new approach for children and adults with cognitive disabilities who made developmental gains even if they didn't meet criteria for power wheelchair prescription. This led to the development of the Assessment of Learning Powered mobility use and the accompanying learning strategies (https://lisbethnilsson.se/en) that address the whole learning continuum from the novice, who doesn't understand the connection between the joystick and device movement, and the expert, who uses the power wheelchair to participate in daily life. Assessment of Learning Powered mobility facilitating strategies are increasingly reported as the approach used in power mobility training for young children and those with complex disabilities.

Platform training devices are often used for initial training with children and adults who are not typical power wheelchair candidates. They can be shared by several individuals, as users remain in their own seating and wheelchair systems. A recent development is the IndieGo (https://www.theindiego.org/). These devices, however, are expensive and often are only available in institutional and research settings. Portable platform devices that are low-cost, such as the Carry-Loco (https://www.mech.usp.ac.jp/~maw/KLP2016/home.html), currently only available in Japan, could increase power mobility training opportunities for complex populations.

For individuals with cerebral palsy who are unable to use a proportional joystick, head-arrays are commonly used. Eye gaze controls are commercially available with products such as Ability Drive (https://www.tolt.tech/products) that work through the user's augmentative and alternative communication tablet or

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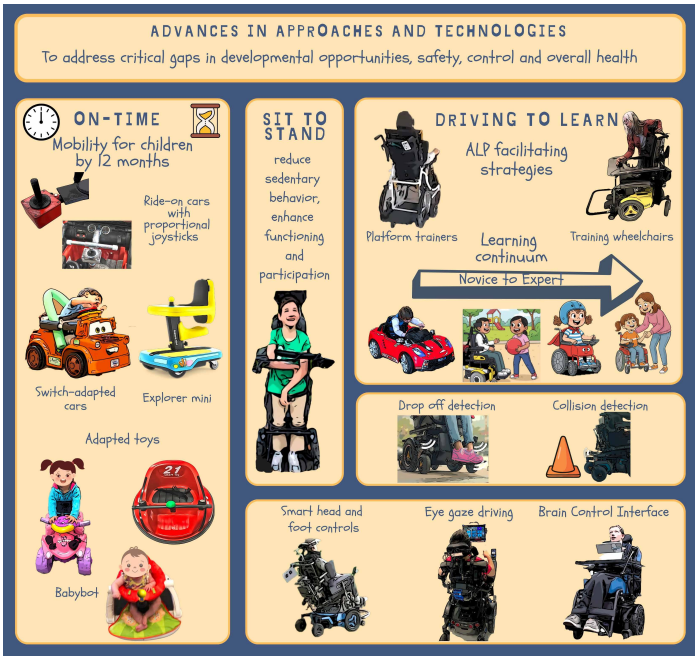

Advancements in power mobility.

device. However, use outdoors is not recommended due to sunlight interference. Research into brain control interface technologies for power mobility suggests that children can improve their Assessment of Learning Powered mobility phase and achieve meaningful goals following training in a lab setting, although setup and calibration can take more than 20 minutes each time.7 This can be frustrating for the user, suggesting that further development of this technology is still needed.

Individuals with severe dystonia and dyskinesia, often use alternate access sites (body parts) and/or control methods. CoMoveIT (https://comoveit.com/en/) was developed through a research program in Belgium and combines head and/or foot sensors with artificial intelligence and machine learning. The system aims to accurately distinguish between intended (volitional) commands and involuntary movements. CoMoveIT is not yet available in North America.

Intelligent driver assistance systems can help to address safety concerns. LUCI (https://luci.com/) is a sensor-based collision avoidance system that also avoids drop-offs, and unsafe slopes. This system may be very beneficial for those with additional sensory or cognitive impairments, or erratic control due to movement disorders. There are, however, difficulties with funding due to the high-cost, and the system may limit purposeful maneuvers or diminish the perception of complete control.

Incorporating sit-to-stand into the power wheelchair may help address the negative secondary health effects of sedentary behavior for individuals with non-ambulant cerebral palsy. Most evidence is reported for individuals with muscular dystrophy, however recent reports include children with cerebral palsy as young as 5 years,8 and children and adolescents using head-array as well as proportional joystick.9 Evidence to date suggests that while sit-to-stand power wheelchairs provide physical, functional and psycho-social benefits, they may not always replace the need for a separate stander to meet weight bearing and contracture prevention goals.

Recent advances in power mobility technology and approaches can support the ON-Time provision of power mobility interventions for infants and young children, provide mobility and learning opportunities for children and adults not typically considered as potential power wheelchair users, and help address critical gaps in developmental opportunities, safety, control and overall health. Some technologies are available now, while others remain a hope for the future. We need to advocate for development and research, and for increased availability of the right products at the right time for our clients, through funding or loan programs as appropriate.

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