Explorer Mini supporting evidence

Maximizing early learning

The Explorer Mini is a power mobility solution designed to aid in the achievement of developmental milestones by introducing self-initiated movement for children with mobility impairments at an earlier age.

Importance of early mobility on development	
Livingstone, R., & Field, D. (2014). Systematic review of power mobility outcomes for infants, children and adolescents with mobility limitations. Clin Rehabil, 28(10), 954-964.	• "The positive impact of power mobility use on overall development in very young children has been supported by a randomized controlled trial [Jones, McEwen, & Neas, 2012] as well as case-studies [Jones, McEwen & Hansen, 2003; Lynch, Ryu, Agrawal, & Alloway, 2009] . In contrast, for older children, there was no change in intelligence quotient (IQ) after six months of power wheelchair use [Bottos et al., 2001]." • "For outcomes related to body structure and function, strong evidence from a smaller number of studies support positive impact on overall development" (p. 959).
Livingstone, R., & Field, D. (2015). The child and family experience of power mobility: a qualitative synthesis. Dev Med Child Neurol, 57(4), 317-327.	• "Power mobility experience promotes developmental change and independent mobility" (p. 321).
Livingstone, R., & Paleg, G. (2014). Practice considerations for the introduction and use of power mobility for children. Developmental Medicine & Child Neurology, 56(3), 210-221.	• "In order to limit the impact of physical disability on overall development, clinicians should consider augmenting independent mobility opportunities around the same age as children typically begin to crawl" (p. 218). • "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" (p. 218). • "For children with minimal mobility experience, a power mobility device can promote overall development as well as functional mobility" (p. 218). • "Many children with severe intellectual and/or sensory impairments can learn to use a power mobility device competently with appropriate practice and environmental support" (p. 219).
Rosen, L., Plummer, T., Sabet, A., Lange, M., & Livingstone, R. (2018). RESNA position on the application of power mobility devices for pediatric users. Assistive Technology, 1-9.	

Early mobility and cognition

Jones, M. A., McEwen, I. R., & Hansen, L. (2003). Use of power mobility for a young child with spinal muscular atrophy. Physical Therapy, 83(3), 253-262.	• Study completed with 20-month-old with SMA: "Within 6 weeks after receiving the power wheelchair, the child operated the wheelchair independently. She showed developmental gains in all domains of the Battelle Developmental Inventory [communication, personal-social, and cognition] and the Pediatric Evaluation of Disability Inventory [positive trends in self-care, mobility, and social function] over 6 months" (p. 253). The authors conclude that the power mobility may have been associated with these changes.
Lynch, A., Ryu, J. C., Agrawal, S., & Galloway, J. C. (2009). Power mobility training for a 7-month-old infant with spina bifida. Pediatr Phys Ther, 21(4):362-368.	• During training period from age 7 months to 12 months, "the infant improved in all driving variables. The infant's Bayley III cognition and language scores also increased at a rate greater than his chronological age" (p. 362).
Teft, D., Guerette, P., & Furumasu, J. (2009). Cognitive predictors of young children's readiness for powered mobility. Developmental Medicine and Child Neurology, 41, 665-670.	• "Twenty-six children with physical disabilities between the ages of 20 and 36 months were evaluated on the cognitive assessment and participated in the wheelchair training and assessment program. A stepwise regression analysis was used to determine which of the cognitive skills predicted wheelchair mobility performance. The cognitive domains of spatial relations and problem solving were found to be significant and accounted for 57% of the variance in wheelchair skills" (p. 665).

Early mobility and communication

Huang, H-H., Ragonesi, C. B., Stoner, T., Peffley, T., & Galloway, J. C. (2014). Modified toy cars for mobility and socialization: Case report of a child with cerebral palsy. Pediatric Physical Therapy, 26(7), 76-84.	• Case report of 21-month-old with cerebral palsy. During 12-week intervention with modified ride on toy car, child showed improved mobility and vocalizations.
Jones, M. A., McEwen, I. R., & Hansen, L. (2003). Use of power mobility for a young child with spinal muscular atrophy. Physical Therapy, 83(3), 253-262.	• Study completed with 20-month-old with SMA: "Within 6 weeks after receiving the power wheelchair, the child operated the wheelchair independently. She showed developmental gains in all domains of the Battelle Developmental Inventory [communication, personal-social, and cognition] and the Pediatric Evaluation of Disability Inventory [positive trends in self-care, mobility, and social function] over 6 months" (p. 253). The authors conclude that the power mobility may have been associated with these changes.
Lynch, A., Ryu, J. C., Agrawal, S., & Galloway, J. C. (2009). Power mobility training for a 7-month-old infant with spina bifida. Pediatr Phys Ther, 21(4):362-368.	• During training period from age 7 months to 12 months, "the infant improved in all driving variables. The infant's Bayley III cognition and language scores also increased at a rate greater than his chronological age" (p. 362).

Jones, M. A., McEwen, I. R., & Neas, B.R. (2012). Effects of power wheelchairs on the development and function of young children with severe motor impairments. Pediatr Phys Ther, 24(2),131-140.	• "This study shows that although children may require extended trials and training to become proficient, power mobility can promote independence and development of young children with severe mobility impairments" (p. 139). • In study, participants (as young as 14 months of age) had improvements in mobility, receptive communication, and self-care skills measured over a 12-month period.
Early mobility and psychosocial development	
Guerette, P., Furumasu, J., & Tefft, D. (2013). The positive effects of early powered mobility on children's psychosocial and play skills. Assistive Technology, 25, p.39-48.	• Study included 23 children between the ages of 18 months and 6 years with various disabilities. Data collection occurred at "wheelchair evaluation, wheelchair delivery, and approximately 6 months later. Significant increases were found in parental perceptions of positive social skills for younger children after receiving a wheelchair; slightly older children showed improvements in social skills before the wheelchair was received; no changes were found in negative social skills" (p. 39). • Social skills measures used: Adaptive Social Behavior Inventory (ASBI; Hogan, Scott, & Bauer, 1992) and the Preschool and Kindergarten Behavior Scales (PKBS; Merrell, 1994).
Jones, M. A., McEwen, I. R., & Hansen, L. (2003). Use of power mobility for a young child with spinal muscular atrophy. Physical Therapy, 83(3), 253-262.	• Study completed with 20-month-old with SMA: "Within 6 weeks after receiving the power wheelchair, the child operated the wheelchair independently. She showed developmental gains in all domains of the Battelle Developmental Inventory [communication, personal-social, and cognition] and the Pediatric Evaluation of Disability Inventory [positive trends in self-care, mobility, and social function] over 6 months" (p. 253). The authors conclude that the power mobility may have been associated with these changes.
Logan, S. W., Huang, H. H., Stahlin, K., & Galloway, J. C. (2014). Modified ride-on car for mobility and socialization: single-case study of an infant with Down syndrome. Pediatric Physical Therapy, 26(4), 418-426.	• Case study of 13-month-old over the course of 28 weeks. • During intervention phase (12 weeks), daily car play sessions of 20-30 minutes with parents, with researcher visiting 1x/week to record 10-minute session. During retention phase, researcher visited 1x/week to record 10-minute session (no ROC outside of this visit). • "Natalie's positive facial expressions increased in general from baseline through retention for each type of play. Natalie's positive facial expressions increased and decreased similarly during Car Play and Natural Play" (p. 421). • "PEDI scores indicate that Natalie's performance of functional skills in self-care, mobility, and social function increased from pre- to postintervention" (p. 424).

Rousseau-Harrison, K., & Rochette, A. (2013). Impacts of wheelchair acquisition on children from a person-occupation-environment interactional perspective. Disability and Rehabilitation: Assistive Technology, 8(1), 1-10.	• The objective of this literature review was to "explore the impacts of wheelchair (WC) acquisition on children's social participation, personal factors and social environment" (p. 1). • "The studies retained (n = 9) indicate generally positive impacts. A trend towards improved participation in personal care, mobility, interpersonal relationships and play was observed" (p. 1). • "This positive impact on participation was also present in the perception of parents of children who received a PWC" (p. 3).
Early mobility and self care	
Jones, M. A., McEwen, I. R., & Hansen, L. (2003). Use of power mobility for a young child with spinal muscular atrophy. Physical Therapy, 83(3), 253-262.	• Study completed with 20-month-old with SMA: "Within 6 weeks after receiving the power wheelchair, the child operated the wheelchair independently. She showed developmental gains in all domains of the Battelle Developmental Inventory [communication, personal-social, and cognition] and the Pediatric Evaluation of Disability Inventory [positive trends in self-care, mobility, and social function] over 6 months" (p. 253). The authors conclude that the power mobility may have been associated with these changes.
Jones, M. A., McEwen, I. R., & Neas, B.R. (2012). Effects of power wheelchairs on the development and function of young children with severe motor impairments. Pediatr Phys Ther, 24(2),131-140.	• "This study shows that although children may require extended trials and training to become proficient, power mobility can promote independence and development of young children with severe mobility impairments" (p. 139). • In study, participants (as young as 14 months of age) had improvements in mobility, receptive communication, and self-care skills measured over a 12-month period.
Logan, S. W., Huang, H. H., Stahlin, K., & Galloway, J. C. (2014). Modified ride-on car for mobility and socialization: single-case study of an infant with Down syndrome. Pediatric Physical Therapy, 26(4), 418-426.	• Case study of 13-month-old over the course of 28 weeks. • During intervention phase (12 weeks), daily car play sessions of 20-30 minutes with parents, with researcher visiting 1x/week to record 10-minute session. During retention phase, researcher visited 1x/week to record 10-minute session (no ROC outside of this visit). • "PEDI scores indicate that Natalie's performance of functional skills in self-care, mobility, and social function increased from pre- to postintervention" (p. 424).
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Early mobility and visual perception

Anderson, D., Campos, J., Witherington, D., Dahl, A., Rivera, M., He, M., … Barbu-Roth, M. (2013). The role of locomotion in psychological development. Frontiers in Psychology, 4(July), 440.	• Children who are independently mobile develop vision skills related to spatial relations directly through exploration of their environment. Children whose locomotion is limited to passive movements are in a state of "visual idle".

Developmentally inspired seating

The Explorer Mini is an ergonomic device with multiple weight bearing surfaces to help promote safe, stable upright postures. The intuitive design provides just the right amount of support enabling young children with mobility impairments opportunities to develop strength, endurance and postural control.

Use of saddle seat

Reid, D.T. (1996). The effects of the saddle seat on seated postural control and upper-extremity movement in children with cerebral palsy. Dev Med Child Neurol, 38:805-815.	• Looked at 6 children aged 2.5 – 7yrs old with CP to compare the effects of flat-bench versus saddle-bench seating on postural control and reaching motions. • "The saddle bench allowed significantly better postural control" and "the data suggests that the saddle seat may help such children develop and maintain seated postural control and upper-extremity movement patterns."
Stavness, C. (2006, August 31). The effect of positioning for children with cerebral palsy on upper-extremity function: A review of the evidence. Physical and Occupational Therapy in Pediatrics, Vol. 26, pp. 39–53. https://doi.org/10.1300/J006v26n03_04.	• "Evidence supports that children with CP should be fitted for wheelchairs that place them in a FSP (Functional sitting position, which includes; orientation in space of 0-15 degrees, a hip-belt, an AO (abduction orthosis), footrests, and a cut out tray, with the addition of a sloped forward seat of 0-15 degrees, to improve upper-extremity function. The exact seat angle and orientation in space within the 0-15 degrees range should be determined on an individual basis."

Use of midline joystick

Liu, W.-Y., Chen, F.-J., Lin, Y.-H., Kuo, C.-H., Lien, H.-Y., & Yu, Y.-J. (2014). Postural alignment in children with bilateral spastic cerebral palsy using a bimanual interface for powered wheelchair control. Journal of Rehabilitation Medicine, 46(1), 39–44. https://doi.org/10.2340/16501977-1233.	• 20 children with bilateral spastic cerebral palsy, 11 with diplegia, 9 with quadriplegia, and 14 typically developing children drove powered wheelchairs in both unilateral and bimanual conditions. • Conclusion: results suggest that bimanual interface might be beneficial for promoting symmetrical postural alignment in some children with bilateral spastic CP.

Nilsson, L., & Nyberg, P. (1999). Single-switch control versus powered wheelchair for training cause-effect relationships: case studies. Technology and Disability, 11, 35–38.	• "These case studies suggest that to promote understanding of simple cause-effect relationships for individuals functioning at an early developmental level, it may be more effective to have the individual drive a powered wheelchair, than to operate switch controlled toys or apparatus." • "The activity provides visual and auditory sensations, kinesthetic and vestibular sensations, and from this total bodily experience arises alertness. The joystick is placed in front of the driver rather close to the body making it easy to touch or hit the joystick accidentally. When the caused effect engages the whole body and changes the position in space, the individual is stimulated to repeat the activity. The accidental activity slowly grows more conscious, leading to active manipulation of the joystick to cause the effect, motion."
Minimal postural supports	
Hadders-Algra, M., Brogren, E., & Forssberg, H. (1996). Training affects the development of postural adjustments in sitting infants. In Journal of Physiology.	• Study to look at whether daily balance training can affect the development of postural adjustments in 20 healthy sitting infants assessed at 5-6, 7-8, and 9-10 months of age. • "Training consisted of toy presentation in the border zone of reaching-without-falling. Special attention was put on sideward and semi-backward reaches." • "Daily balance training can accelerate the development of postural control. The effect occurred at both levels of the postulated postural CPG model, i.e. training facilitated selection of the most complete, direction-specific response pattern and it accelerated the development of response modulation."
Harbourne, R. T., Willett, S., Kyvelidou, A., Deffeyes, J., & Stergiou, N. (2010). A Comparison of Interventions for Children With Cerebral Palsy to Improve Sitting Postural Control: A Clinical Trial.	• Compared 2 interventions for improving sitting postural control in infants with CP. • Infants with delays were randomly assigned to receive a home program (1 time per week for 8 weeks; mean age_15.5 months) or a perceptual-motor intervention (2 times per week for 8 weeks; mean age_14.3 months). • "Perceptual-motor intervention sessions were more dynamic and variable than the home program sessions." • "Infants in the perceptual-motor intervention group developed postural control toward the values in infants with typical development, as measured by the COP variables, to a greater degree than the infants in the home program group."

Independence through exploration

The Explorer Mini gives very young children with mobility impairments the opportunity to increase their independence through exploration. Its intentional design, approachable aesthetic and growth adjustability encourages self-initiated independent movement.

Bottos, M., Bolcati, C., Sciuto, L., Ruggeri, C., & Feliciangeli, A. (2001). Powered wheelchairs and independence in young children with tetraplegia. Developmental Medicine & Child Neurology, 43(11), 769–77.	• "PWCs can aid independence and socialization and the majority of children can achieve a good enough driving competence, even those with severe learning disability or motor deficit. PWCs should not be viewed as a last resort but as a means of providing efficient self-locomotion in children with a severe motor deficit" (p. 769).
Butler, C. (1986). Effects of powered mobility on self-initiated behaviors of very young children with locomotor disability. Developmental Medicine & Child Neurology, 28, p. 325-332.	• "Children with severely delayed or restricted locomotion therefore need a substitute form of locomotion, beginning as near to age one as possible. This mobility must be functional, I.e. so that spontaneous initiative to explore and achieve is not hampered by the effort of moving" (p. 326). • "This study reports the effects of powered mobility on the self-initiated behavior of six children with various disabilities who, between 23 and 38 months of age, learnt to use motorized wheelchairs in less than three weeks. Using a multiple baseline design, two-hour observation periods were video recorded at 10-day intervals before and after they achieved independent mobility. Frequency of self-initiated interaction with objects, spatial exploration and communication with caregiver were analyzed. Three children increased all three types of behavior; one increased in two types but decreased in interaction with objects; and two increased in spatial exploration only" (p. 331).
Deitz, J., Swinth, Y., & White, O. (2002). Powered mobility and preschoolers with complex developmental delays. American Journal of Occupational Therapy, 56(1), 86–96.	• Authors conclude that "use of a powered mobility riding toy increased the number of self-initiated movement occurrences... during free play" (p. 86) for the two children in the study with developmental delays, including spastic quadriplegia.
Huang, H-H., Ragonesi, C. B., Stoner, T., Peffley, T., & Galloway, J. C. (2014). Modified toy cars for mobility and socialization: Case report of a child with cerebral palsy. Pediatric Physical Therapy, 26(7), 76-84.	• Case report of 21-month-old with cerebral palsy. During 12-week intervention with modified ride on toy car, child showed improved mobility and vocalizations.
Jones, M. A., McEwen, I. R., & Neas, B.R. (2012). Effects of power wheelchairs on the development and function of young children with severe motor impairments. Pediatr Phys Ther, 24(2),131-140.	• "This study shows that although children may require extended trials and training to become proficient, power mobility can promote independence and development of young children with severe mobility impairments (p. 139)." • "We recommend that clinicians discuss power mobility with families, not as a last resort, but as one of the options available to support early independent mobility" (p. 139).

Jones, M. A., McEwen, I. R., & Hansen, L. (2003). Use of power mobility for a young child with spinal muscular atrophy. Physical Therapy, 83(3), 253-262.	• Study completed with 20-month-old with SMA: "Within 6 weeks after receiving the power wheelchair, the child operated the wheelchair independently. She showed developmental gains in all domains of the Battelle Developmental Inventory [communication, personal-social, and cognition] and the Pediatric Evaluation of Disability Inventory [positive trends in self-care, mobility, and social function] over 6 months" (p. 253). The authors conclude that the power mobility may have been associated with these changes.
Livingstone, R., & Field, D. (2015). The child and family experience of power mobility: a qualitative synthesis. Dev Med Child Neurol, 57(4), 317-327.	• "Power mobility may facilitate independent exploration from a young age. These early exploratory behaviours have a positive impact on overall and psychological development" (p. 317).
Livingstone, R., & Paleg, G. (2014). Practice considerations for the introduction and use of power mobility for children. Developmental Medicine & Child Neurology, 56(3), 210-221.	• "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" (p. 218). • "For children with minimal mobility experience, a power mobility device can promote overall development as well as functional mobility" (p. 218).
Logan, S. W., Hospodar, C. M., Feldner, H. A., Huang, H. H., & Galloway, J. C. (2018). Modified ride-on car use by young children with disabilities. Pediatric physical therapy, 30(1), 50-56.	• Single subject case series, three children younger than 2 participated in 24-week study. "Two of the 3 children demonstrated clinically significant gains in mobility skills as measured by the Pediatric Evaluation of Disability Inventory."
Logan, S. W., Huang, H. H., Stahlin, K., & Galloway, J. C. (2014). Modified ride-on car for mobility and socialization: single-case study of an infant with Down syndrome. Pediatric Physical Therapy, 26(4), 418-426.	• Case study of 13-month-old over the course of 28 weeks. • During intervention phase (12 weeks), daily car play sessions of 20-30 minutes with parents, with researcher visiting 1x/week to record 10-minute session. During retention phase, researcher visited 1x/week to record 10-minute session (no ROC outside of this visit). • "Once Natalie was provided with daily opportunities to drive during the intervention period, her independent mobility increased, often to 100%, for the remaining sessions including the retention period (Figure 2). Natalie's total driving time also increased during the intervention period and was maintained through the retention period" (p. 421). • "PEDI scores indicate that Natalie's performance of functional skills in self-care, mobility, and social function increased from pre- to postintervention" (p. 424).
Rousseau-Harrison, K., & Rochette, A. (2013). Impacts of wheelchair acquisition on children from a person-occupation-environment interactional perspective. Disability and Rehabilitation: Assistive Technology, 8(1), 1-10.	• The objective of this literature review was to "explore the impacts of wheelchair (WC) acquisition on children's social participation, personal factors and social environment" (p. 1). • "The studies retained (n = 9) indicate generally positive impacts. A trend towards improved participation in personal care, mobility, interpersonal relationships and play was observed" (p. 1).

Exploration made easy

At only 52 lbs, the Explorer Mini is a lightweight, easy to transport power mobility device that empowers families and children to explore and learn in home and community environments.

Berry, E., McLaurin, S., Sparling, J. (1996). Parent/ Caregiver perspectives of the use of power wheelchairs. Pediatric Physical Therapy, Vol. 8.4.	• While this study included elementary to young adult aged individuals (and their caregivers), it does highlight potential barriers to successful power wheelchair use including lack of transportation making it difficult to use the device in a community setting, desire for a smaller chair for ease of maneuverability in the home setting, performance over varied terrains, and width of aisles in store settings. Results from this study may indicate a smaller/ easily transportable chair may result in increased use of the device outside the school setting. • Livingstone, R., & Field, D. (2014). Systematic review of power mobility outcomes for infants, children and adolescents with mobility limitations. Clinical Rehabilitation, 28(10), 954-964. • "Common concerns expressed by parents related to the weight, storage, transportation and technological difficulties of using power mobility equipment and stress the importance of a good match between the device, the user and the environment" (p. 961).
Tefft, D., Guerette, P., & Furumasu, J. (2011). The impact of early powered mobility on parental stress, negative emotions, and family social interactions. Physical & Occupational Therapy in Pediatrics, 31(1), 4-15.	• While findings suggest self-initiated power-mobility has a positive impact on the family, parents expressed concern most over "weight" and "ease of adjusting" power mobility device. This may suggest a device that is lighter and easier to adjust than a traditional power wheelchair may further reduce parental stress and negative emotions surrounding powered mobility devices for children.