CASE REPORT

Effect of Hippotherapy on Perceived Self-competence and Participation in a Child With Cerebral Palsy

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This case report highlights changes in self-competence and social acceptance, along with changes in functional skills, after an 8-week program of hippotherapy. A 6-year-old girl with mild ataxic cerebral palsy, level I Gross Motor Functional Classification System, exhibited typical impairments in body systems and functions that affected her participation in age-appropriate functional and leisure activities. The child's performance on the Gross Motor Function Measure-66, the Pediatric Outcomes Data Collection Instrument, and the Pictorial Scale of Perceived Competence and Social Acceptance for Young Children were examined at baseline, after the 8-week intervention, and at a 2-month follow-up session. Data at 8 weeks demonstrated positive changes in all areas, with improvements continuing for 2 months after the program's completion. Hippotherapy not only may be an effective intervention to improve functional gross motor development but also may affect perceived self-competence and social acceptance, which may lead to increases in participation for children with mild cerebral palsy. **(Pediatr Phys Ther 2011;23:301–308)** *Key words: activities of daily living, ataxia, case report, cerebral palsy/therapy, child, hippotherapy, female, motor skills, quality of life, self-concept, social desirability*

INTRODUCTION

Cerebral palsy (CP) is a well-known neurological disorder that affects 2 to 3 per 1000 live births.[1] The body system impairments associated with CP are well-defined in the literature.[2] The long-term goal for many children with CP is to become active members of society by achieving their maximum capacity.[3] Reaching maximum capacity includes gaining functional independence as well as autonomy in social, educational, and recreational skills. Interventions should focus on all areas of function—body structures and functions, activity, and participation—to positively affect the child's quality of life.

In 2001, the World Health Organization published the International Classification of Functioning, Disability and Health (ICF).[4] The ICF comprises a biopsychosocial model, which is an enablement-based integration of the previous disablement models that have shaped and guided physical therapy clinical reasoning in the past.[4] Rather than focusing on functional and societal limitations and disability, the enablement model looks at children's participation in desired activities, because they relate to important life situations. Rather than a focus on deficits, an enablement perspective stresses what the child can and does do in the environments that are most relevant to the child.

Participation, as defined in the ICF, is involvement in any life situation[4] and restrictions in participation are any difficulties an individual would experience in those life situations. A key domain of participation that is important to children with CP is the area of mobility.[4] Although the

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literature is replete with reports of investigations of interventions to improve mobility in children with CP, the evidence in support of measuring the effect of these interventions on broader aspects of participation and from the perspective of the child or family is sparse. Several descriptive studies examined how environmental factors can affect participation.[5,6] Morris et al[7] demonstrated the effectiveness of family assessment of participation and found that the manual, movement, and intellectual abilities of individuals with CP were predictive of an individual's physical independence and mobility but not of other domains of participation. Other studies have addressed how children with CP have limited out-of-school contacts with friends and restricted participation in organized social activities.[8] This case report, which describes the effect of a course of hippotherapy for a child with mild ataxic CP, provides an example of 1 possible intervention strategy that could be directed toward increasing self-competence and participation in this patient population.

As defined by the American Hippotherapy Association, hippotherapy is part of a program integrated with other therapies and uses the unique movement of the horse to assist in achieving particular functional goals.[9] Hippotherapy is thought to improve hip and pelvic flexibility, posture, balance, and mobility.[10] The horse's 3-dimensional movements result in responses of the child's trunk that are considered similar to those used in gait.[11] Hippotherapy and the rhythmical movement of the horse also claim a physiological effect on the rider that may facilitate breathing and digestion, promote muscle relaxation, enhance equilibrium and perception, and improve muscle tone.[11]

Hippotherapy typically occurs in a barn, arena, or outdoor location, with the child frequently responding positively to this unique experience in a natural setting. Another potential factor in the positive effect of hippotherapy could be the human-horse interaction acting as a powerful motivator to engage the child as a willing participant in therapeutic exercise activities. Bartlett and Palisano[12] identified motivation as 1 of 4 key constructs perceived by pediatric physical therapists to affect the achievement of motor skills.

Several relevant studies, including 2 systematic reviews, report on the effectiveness of hippotherapy in children with CP. Researchers have found improvements in posture and motor function following hippotherapy as measured by the Gross Motor Function Measure (GMFM)[13,14] and the Pediatric Evaluation of Disability Inventory.[14,15] The literature also contains evidence of a positive effect on gait, posture, muscle symmetry, and energy expenditure.[13,15-17]

Although the results of these studies demonstrate positive effects of hippotherapy for children with CP and some document statistically significant improvements in function, they do not fully capture the physical, social, and emotional changes that each individual may have experienced. McGibbons and colleagues[13] and Casady and Nichols-Larsen[14] discuss the subjective improvements that may result from hippotherapy, including increased willingness and motivation to perform motor activities and improved self-perception and confidence, but did not objectively measure these improvements in their studies. The systematic reviews by Snider and colleagues[10] and by Sterba[18] highlight the absence of evidence addressing participation as an outcome measure and recommended further research in this area.

Since the publication of those reviews, there have been a limited number of investigations of hippotherapy that focus on participation. Debuse et al[19] used qualitative methods to investigate the perspectives of individuals with CP of all ages who participated in hippotherapy in Germany. Their findings explored a variety of factors including the actual movement experience of being on the horse and the perceived physical and psychological effects of the intervention.[19] To add to the growing evidence in support of hippotherapy, it is the purpose of this case report to describe this child's improvement in function as well as participation as measured by perceived self-competence and social acceptance.

DESCRIPTION OF THE CASE

The child was a 6-year-old girl referred to physical therapy by her orthopedic physician with a specific recommendation for hippotherapy. She has a diagnosis of mild ataxic CP because of a congenital malformation of the cerebellum. Her functional performance was consistent with level I on the Gross Motor Functional Classification System.[20] The child's mother reported a history of ocular motor apraxia, which had resolved over time. Head thrusts and other atypical movements were not evident during examination or intervention. She had no significant medical or surgical history and was not taking any medications at the time of her initial examination. Although she had prior experience with home-based early intervention including physical, occupational, and speech therapies, she was not receiving additional physical therapy during the hippotherapy program, and she did not have prior experience with this type of intervention. Her medical equipment included bilateral foot orthotics.

The child lived in a 2-story house with her parents and 9-year-old sister. She attended a regular preschool in the morning and a school with a language enhancement program in the afternoon. At the time of her initial visit, the child's mother reported that her child had poor endurance during family activities such as taking walks or playing games in the pool. Her mother's reasons for seeking hippotherapy included the desire to have her daughter (1) increase strength as it relates to her ability to participate and keep up with her peers; (2) increase body awareness and balance for running in a straight line; and (3) improving sensory processing, because it relates to putting her hands in contact with sand, dirt, and other textures. Although they were not objectively measured, the initial examination confirmed deficits in skills that use muscle strength, endurance, balance, and awareness of body in

TABLE 1
Summary of Gross Motor Skills

	Baseline	After 8-Week Intervention	At 2-Month Follow-up
Stairs	Unable to alternate feet on the stairs without using a handrail.	Able to walk up- and downstairs alternating her feet without using a handrail. Also able to carry a lightweight item in both hands while walking up stairs alternating her feet.	Able to walk up and down the stairs alternating feet with arms in a low-guard position. Also able to carry a lightweight item in both hands while walking down stairs alternating her feet.
Hopping	Unable to hop on right foot.	Able to hop 1 time on right foot. Able to maintain single-leg balance for 5 s bilaterally.	Able to hop 3 times on her right foot and 2 times on left foot. Able to maintain single leg balance for 10 s on right leg and 7 s on left leg.
Jumping	Unable to keep both feet together when jumping forward. Right leg lands first.	Able to keep feet together when jumping forward or off of a low step. Able to jump forward 21 in.	Able to jump with equal take off and landing, now able to jump forward 35 in.
Endurance	Demonstrates difficulty walking 1 block with her family.	Able to walk 2 miles when on vacation with family. Able to tolerate 45-min therapy session without fatigue.	Able to participate in $\frac{1}{2}$ day of school without fatigue. Able to participate in a 1-h dance class after school.
Balance	Unable to walk forward across a $\frac{3}{4}$-inch line without stepping off.	Able to walk on a narrow line without losing balance and without stepping off the line. Able to walk forward on a balance beam with hand-held assistance and backward with minimal assistance.	Able to walk across a balance beam with contact guard assistance. Able to walk backward along the balance beam with hand-held assistance.

space. The child had difficulties negotiating steps without a handrail while using a step-over-step pattern. She was unable to hop on her right foot and only able to hop once on her left foot, and she was unable to generate a 2-foot takeoff and landing when jumping. She had limited walking endurance with difficulty keeping up with her family for distances greater than 1 block. She was able to run for a distance of 50 feet in 5 to 6 seconds but had difficulty running in a straight line. She exhibited a posterior pelvic tilt and used her upper extremities to maintain postural alignment on moveable surfaces (eg, therapy ball or the horse). She was able to balance on each foot for a maximum of 5 seconds with increased postural sway. Specific activity limitations, which affected her ability to perform age-appropriate gross motor functional skills, are noted in Table 1. The child and mother participated in the creation of short-term goals, which are listed in Table 2.

TABLE 2
Child's Short-term Goals

1. Child will be able to ascend and descend a flight of stairs alternating her feet while carrying a lightweight object (5-10 lb).
2. Child will demonstrate age-appropriate gross motor play skills including ball skills, climbing on playground equipment, jumping, hopping, and running.
3. Child will demonstrate improved trunk and extremity strength, timing of trunk cocontractions, and balance as evidenced by:
   - Independently walking backward on an 8 × 4 ft balance beam.
   - Hopping forward 5-10 times on each lower extremity.
   - Demonstrating the ability to skip.
   - Stepping sideways or forward over a 10 in high obstacle keeping both feet together.
   - Demonstrating the ability to lift heavy objects, pour herself a drink, and open a jar.
4. Child will increase endurance so that she can walk up to 3 blocks or climb 3 flights of stairs.

DESCRIPTION OF OUTCOME MEASURES

The child's change in performance was assessed through a variety of outcome measures. The hippotherapy clinic had established procedures to increase the variety of patient data collection tools to capture information on all aspects of functioning and regularly used several types of measures with the children attending hippotherapy. The therapist used 3 specific measures because of their relevance for this child's needs. These measures were thought to be helpful in demonstrating progress toward the short-term goals set at the initial examination.

Gross Motor Function Measure–66

The GMFM is a commonly used, valid, and reliable measure of change in motor function in this population.[21] GMFM-66 item is a shortened version of the GMFM that decreases administration time, improves interpretation of total score and change scores, and allows calculation of standard error and confidence intervals.[22] These improvements to the GMFM aid its accuracy for assessing outcomes in both clinical and research settings. The GMFM-66 is a standardized assessment of a child's ability in 5 domains: (1) lying and rolling; (2) sitting; (3) crawling and kneeling; (4) standing; and (5) walking, running, and jumping. A therapist rates performance on a scale that indicates the amount of each task the child can do independently. It has a reported reliability of 0.99.[22] The GMFM-66 provided a method for measuring the child's activity limitations.

Pediatric Outcomes Data Collection Instrument

The Pediatric Outcomes Data Collection Instrument (PODCI) is a parent-reported, patient-based assessment

for children aged 2 to 18 years.[23] The instrument measures functional health and efficacy of treatment for patients following orthopedic surgery. The PODCI includes 5 domains of health and well-being including upper extremity and physical function, transfers and basic mobility, sports and physical function, pain and comfort, and happiness. The instrument also includes a measure of global function, which combines the mean scores of the first 4 of the domains.[23] Parents or caregivers complete the questionnaire and then return it for scoring. The questionnaire consists of 86 questions including yes or no questions and questions scored on a scale reflecting how easily or how often a child performs an activity. The American Academy of Orthopedic Surgeons provides methods for calculating the standardized and normative scores for the PODCI based on its Normative Data Study. The normative scores are presented on a scale with a mean of 50 and a standard deviation of 10. These scores provide an opportunity to compare a child's individual score with that of a healthy population.[24] This test's internal reliability ranges from 0.75 to 0.92.[25] The literature reports concurrent validity with the GMFM and the Child Health Questionnaire.[23,25]

The Pictorial Scale of Perceived Competence and Social Acceptance for Young Children

The Pictorial Scale of Perceived Competence and Social Acceptance for Young Children (PSPCSAYC) is an instrument that quantifies self-perceived qualities of young children up to age 7 years.[26] When completing the PSPCSAYC, the child reviews 24 pictures representing opposite situations, and the child chooses the picture that is most like them. The instrument has 4 separate scales: cognitive competence, physical competence, peer acceptance, and maternal acceptance. The child rates 6 items per scale, with the highest score of 4 indicating most competent and most like him or herself and the lowest score of 1 indicating least competent and most like him or herself. The highest score for each scale is 24. There are 2 versions of this instrument, 1 for children in preschool and kindergarten and 1 for children in first and second grades. The preschool and kindergarten version was the most appropriate for the child in this case report. Reliability of the total scale is greater than 0.80.[26] The developers of the PSPCSAYC established convergent validity by asking children about their responses after administering the test. They found a pattern of convergence between the initial perception and the child's reasoning afterward.[26]

DESCRIPTION OF INTERVENTION

The child received hippotherapy 2 times a week, for 8 weeks totaling 16 sessions. After week 5, she took 1 week off for a family vacation. She then completed the final 3 weeks of intervention. Sessions were 45 minutes in duration. Hippotherapy, with a focus on postural control, trunk cocontraction, postural alignment, and upper and lower extremity strengthening, occurred for approximately 30 minutes. The remainder of the session included approximately 10 minutes of land-based therapeutic exercise including balance, coordination, and strengthening activities and 5 minutes for setup and wrapup of each session. The family was instructed in simple exercises similar to what was done on land to encourage carry-over and practice at home. The Appendix (Supplemental Digital Content 1, available online at http://links.lww.com/PPT/A24) provides a description of activities and the progression used throughout the intervention sessions.

The same physical therapist provided all intervention sessions and gathered all measurements at baseline, at the end of intervention, and at the 2-month follow-up. This therapist, who has experience and training in the principles of hippotherapy, used her clinical judgment to select a horse specifically for this child. The horse exhibited equal anterior to posterior as well as lateral and rotational movement to emphasize symmetrical movement input. The horse was an appropriate size with a stride that elicited an appropriate amount of postural challenge for the child. The child wore an American Society for Testing and Materials–approved helmet and a gait belt when mounted. Using a lead rope attached to the horse's halter, an experienced horse handler led the horse. The child sat on a fleece bareback pad. The physical therapist walked along one side and a volunteer sidewalker along the other side. The therapist directed the horse handler to modify equine movement as needed. The therapist assisted the child into a variety of positions on the horse including forward astride, rear astride, side sitting, quadruped, and tall kneel. To achieve tall kneeling, the therapist and the sidewalker each give support with hand holds on the child's hands (Figure) and on the child's lower legs as they contacted the horse's back. The child used the stirrups to practice standing and squatting activities, and the reins to practice upper extremity movement activities. The therapist provided assistance and cueing to maintain postural alignment during all activities.

Fig. Example of a child supported in tall kneel on a horse during hippotherapy.

Baseline Performance on the Horse

Initially, the child sat on the horse with a posterior pelvic tilt and required bilateral upper extremity support and moderate assistance to maintain a neutral pelvic alignment and prevent excessive trunk sway when in forward astride. She demonstrated delayed postural responses when the horse started walking or stopped. She required assistance to transition from standing in the stirrups to sitting. With assistance, she was able to assume quadruped on the horse but only maintain it for 10 seconds while the horse walked forward.

OUTCOMES

At the end of the 8-week intervention, the therapist made several clinical observations about the child's progress and improvements. By the end of the intervention, the child was able to sit forward astride the horse with a neutral pelvic tilt and an upright trunk posture with contact guard assistance to minimal assistance. The child demonstrated the ability to maintain postural control without upper extremity support when the horse would stop and start, with minimal assistance from the physical therapist. With supervision, she was able to independently complete stand, squat, and sit transitions with improved control. She was also able to maintain quadruped and tall kneel on the horse for 2 minutes with minimal assistance.

The child made improvements in the gross motor skills related to her short-term goals. Table 1 provides documentation of these changes over time. The results of the initial baseline examination, end of program examination, and 2-month follow-up examination for each outcome measure demonstrate several positive changes (Tables 3 through 7).

Activity Limitations

Change scores for the GMFM-66 comparing baseline with performance at the end of intervention and at follow-up indicated improvements primarily in the domain of walking, running, and jumping (Tables 3 and 4). Using the GMFM-66 Gross Motor Ability Estimator, interval scores were obtained and confidence intervals calculated. The most notable change in the overall GMFM-66 interval score occurred between the baseline and follow-up examinations, demonstrating just a small overlap in the 95% confidence interval. The change in GMFM-66 interval scores from baseline to the end of intervention and from the end of intervention to follow-up far exceeded the minimal clinical important difference (MCID) for large effect sizes (MCID large = 2.7) as determined by the work of Oeffinger and colleagues.[27] Specific improvements noted on GMFM-66 items included increased single-leg stance and increased ability to take steps along a ¾-in-wide line. The child attained the ability to jump down off a low step with both feet simultaneously. She also gained the ability to walk up and down 4 steps while alternating her feet without support. While completing the reevaluation, the child was very proud of her accomplishments and abilities. After assessing single-leg stance, she reported "my bad leg turned into my good leg," indicating that she was now able to maintain single-leg stance on her right leg for a longer period than her left leg.

TABLE 3
GMFM-66 Scores

Domain	Baseline*	After 8-Week Intervention[a]	At 2-Month Follow-up[a]
Lying and rolling	100	100	100
Sitting	100	100	100
Crawling and kneeling	100	100	100
Standing	95	95	97.4
Walking, running, and jumping	87.5	93	94.4
Total	96.5	97.6	98.2

[a]All scores out of a possible 100.

TABLE 4
Gross Motor Ability Estimator Interval Scores

	Baseline	After 8-Week Intervention	At 2-Month Follow-up
GMAE score	77.46	84.05	87.99
Change score	NA	6.59	3.94
Standard error	2.17	2.7	3.41
95% Confidence interval	73.21-81.71	78.76-89.34	81.31-94.67

Abbreviations: GMAE, Gross Motor Ability Estimator; NA, not applicable.

Participation

The greatest effect was found on the PODCI, which contains some elements to measure participation. The child's baseline normative scores were considerably below the normal average (mean of 50, standard deviation of 10) on 3 of the 6 scales—upper extremity and physical function (> 3.5 SD below the mean), sports and physical function (> 3.5 SD below the mean), and global function (>2.5 SD below the mean). The child showed improvement in all 3 of the subscales at the end of the intervention; and by the 2-month follow-up, her normative scores on all 3 of the scales were within 0.5 standard deviations of the reported mean (see Tables 5 and 6 for individual standard scores and normative scores). Likewise, examination of the change in normative scores from baseline to the end of intervention revealed that the MCID for large effect sizes was exceeded for the domains related to upper extremity and physical function (5.8), sports and physical function (7.3), and global function (7.2).[27]

With respect to the upper extremity and physical function scale, the child was able to complete activities such as lifting heavy books and pouring a half-gallon of milk. Opening a jar became easier for the child, per the parent's report. These changes contributed to greater independence at home. In the area of sports and physical

TABLE 5
Pediatric Outcomes Data Collection Instrument Scores

	Baseline[a]	After 8-Week Intervention [a]	At 2-Month Follow-up[a]
Upper extremity scale	50	83	88
Transfers and basic mobility	93	100	98
Sports and physical function	60	78	95
Pain/comfort	100	100	100
Happiness	95	100	95
Global	76	90	95

[a]All scores out of a possible 100.

TABLE 6
Pediatric Outcomes Data Collection Instrument Normative Scores[a]

Scale	Baseline	After 8-Week Intervention	At 2-Month Follow-up
Upper extremity	14	43	46
Transfers and basic mobility	41	53	49
Sports and physical functioning	13	35	53
Pain/comfort	55	55	55
Happiness	54	57	54
Global functioning	24	45	52

[a]Normative Scores are based on a mean of 50, standard deviation of 10.

TABLE 7
The Pictorial Scale of Perceived Competence and Social Acceptance for Young Children Scores

	Baseline[a]	After 8-Week Intervention[a]	At 2-Month Follow-up[a]
Cognitive competence	24	24	24
Peer acceptance	18	18	19
Physical competence	18	20	20
Maternal acceptance	22	24	23

[a]All scores out of a possible 24.

function, the child's mother reported that riding a bike, walking up 3 flights of stairs, and walking more than a mile were easy for her child following intervention. At the initial examination, the child could not walk more than 3 blocks or climb more than 3 flights of stairs. At follow-up, the child's parent reported that she was able to walk the entire boardwalk at the beach during a family vacation. The improvement in her endurance allowed her to keep up with her family and participate in an activity she was not able to do prior to intervention. The child also began playing with friends often and her mother felt that she could now easily participate in competitive level sports for her age.

Other improvements in participation can be found within the PSPCSAYC. After intervention, the child's self-assessment on this measure yielded higher ratings in the areas of physical competence and maternal acceptance (Table 7). Specifically, the child felt that she was "good" at running following intervention. She also reported that her mother read to her more. At the 2-month follow-up, the child showed improvement in the area of peer acceptance and a decrease on her maternal acceptance score. When the child was asked about this, she reported that she did not play with her mother as much now because she played with her friends more.

DISCUSSION

Hippotherapy is a therapeutic intervention used by therapists to enhance a child's ability to carry out functional activities and participate in life situations that improve quality of life. The ICF model provides a theoretical framework for physical therapists to use when intervening for a particular health condition.[5] Designing an intervention plan with a focus on enhancing activity and participation enables therapists to affect a child's ability to participate in life situations that are meaningful for the child. Hippotherapy is an intervention that allows therapists to work on improving activity performance, while the child participates in what they might believe is a fun and recreational activity. As an intervention, hippotherapy can be highly motivating and provides an opportunity for children to challenge themselves and work harder than they might ordinarily do in more traditional therapy settings. One of the authors (S.M.) has received comments from children and families who attend hippotherapy and preliminary analysis of qualitative data from an unpublished study of another of the authors (R.L.D.) support this concept.

This case study demonstrates that hippotherapy may have influenced the child's functional ability, level of participation, and sense of self-competence as demonstrated by changes in the outcome measures. Despite the fact that many of the motor tasks that were tested were not actively practiced during intervention, the child showed improvements in her GMFM-66 scores across the 3 measurement intervals. One possible explanation for these changes could be that improved strength, balance, and coordination, which were a focus of the intervention sessions, carried over to the functional motor tasks of the GMFM-66. At the 2-month follow-up, the child's mother attributed much of her daughter's success to gains in muscle strength. She later reported that her daughter made the transition to kindergarten and negotiating the school bus without difficulty and did not qualify for school-based therapy services.

These positive changes may also be associated with the child's increased social activity with her family and peers. Following hippotherapy, the child was able to walk longer distances with her family, perform daily tasks with less assistance from her parents, and participate more with peers in sport-related activities as indicated on the PODCI. She also reported increased maternal acceptance, per the PSPCSAYC. A positive relationship between the child and the horse was evident and her ability to bond with the animal may have given her a sense of empowerment. Completing activities when on a horse not only motivated the subject but also gave her the confidence she needed to

attempt challenging skills off the horse. The child's mother also reported that her own confidence in her daughter's abilities increased following intervention. As she observed her daughter complete challenging tasks on the horse, she felt empowered to help her daughter try new activities. When on a family vacation following 5 weeks of intervention, she allowed her daughter to keep up with the family and walk the length of the boardwalk instead of getting a ride on the trolley. Her daughter's success with this activity may have helped her continue to challenge her daughter throughout the rest of her intervention and following the end of the program.

Limitations

There are a number of potential limitations to this case report. Since this was not a controlled study of hippotherapy, it is not possible to determine whether the child's improvements were primarily due to the hippotherapy intervention or to other external causes. For example, the intervening therapist formed a positive relationship with the child throughout the 8 weeks of intervention. The child's increased confidence and ability to work hard may have been a result of this encouraging relationship. Another factor to consider is the mother's belief that hippotherapy was going to help increase her daughter's function. The parent may have been positively biased when scoring the parent-report outcome measure at the end of intervention and at follow-up. While these are possible causes for the improvements observed, it is also possible that the uniqueness of the hippotherapy intervention may have had a positive effect on the child's and mother's increased confidence.

Although improvements were made on the PSPCSAYC, readers should interpret these results carefully. Given that a child's perception can present challenges to the establishment of validity, the authors of this scale caution that children rate each picture on the basis of their own interpretation, which may differ from how others may interpret the same picture.[26] These authors referred to research that indicates that a child's own self-concept is not fully developed until the age of 8 years. Young children often confuse what they are with what they wish to be. Interpretation of this outcome measure must be made within the context of its development and limitations. In addition, the authors also caution that this is an assessment of a child's perceptions and not a true measure of social ability.[26] We feel that the child in this report did understand all the pictures and had a good sense of her abilities. Regardless of these limitations, valid measures of self-concept and perceived self-competence should be sought and considered as methods of measuring the outcomes of physical therapy interventions.

FUTURE IMPLICATIONS AND CONCLUSIONS

Although there have been several studies on the effects of hippotherapy on a variety of body structures and functions, and activity outcomes, little information has been reported regarding the effect of this intervention on factors related to participation or self-competence. Measures of perceived self-competence, social acceptance, and quality of life are important to include in clinical practice and in research. Evidence to date is lacking in support of hippotherapy's potential effect on participation or quality of life.[10]

This case report demonstrated that simple outcome measures that capture some of the elements of participation can be easily incorporated into examination and follow-up. The change scores on these outcome measures may help to connect improvements in activity performance and increased participation, self-competence, social acceptance, and quality of life. The findings of this case report indicate that integrating hippotherapy into physical therapy intervention appeared to increase this child's self-competence and participation. Future research studies should not only focus on quantifying improvements at a body structures and functions level but also measure participation and elements of self-competence.

REFERENCES

1. Morris C. Definition and classification of cerebral palsy: a historical perspective. *Dev Med Child Neurol.* 2007;109(suppl):3-7.
2. Rosenbaum P, Paneth N, Leviton A, Goldstein M, Bax M. A report: the definition and classification of cerebral palsy April 2006. *Dev Med Child Neurol.* 2007;109(suppl):8-14.
3. Miller F. *Cerebral Palsy*. Singapore: Springer Science & Business Media Inc; 2005.
4. World Health Organization. *Towards a Common Language for Functioning, Disability and Health: ICF*. Geneva, Switzerland: World Health Organization; 2002. http://www.who.int/classifications/icf/training/icfbeginnersguide.pdf. Accessed September 23, 2009.
5. Mihaylov S, Jarvis S, Colver A, Beresford B. Identification and description of environmental factors that influence participation of children with cerebral palsy. *Dev Med Child Neurol.* 2004;46(5):299-304.
6. Hammal D, Jarvis S, Colver A. Participation of children with cerebral palsy is influenced by where they live. *Dev Med Child Neurol.* 2004;46(5):292-298.
7. Morris C, Kurinczuk J, Fitzpatrick R, Rosenbaum P. Do the abilities of children with cerebral palsy explain their activities and participation? *Dev Med Child Neurol.* 2006;48(12):954-961.
8. Blum R, Resnick M, Nelson R, Germaine A. Family and peer issues among adolescents with spina bifida and cerebral palsy. *Pediatrics*. 1991;88(2):280-285.
9. American Hippotherapy Association. Hippotherapy as a treatment strategy. American Hippotherapy Association, Inc, Web site. http://www.americanhippotherapyassociation.org/aha_hpot_tool.htm. Published 2007. Accessed February 2, 2010.
10. Snider L, Korner-Bitensky N, Kammann C, Warner S, Saleh M. Horseback riding as therapy for children with cerebral palsy: is there evidence of its effectiveness? *Phys Occup Ther Pediatr.* 2007;27(2):5-23.
11. Riede D. *Physiotherapy on the Horse*. Madison, WI: Therapeutic Riding Services; 1988.
12. Bartlett DR, Palisano F. Physical therapists perceptions of factors influencing the acquisition of motor abilities of children with cerebral palsy: implications for clinical reasoning. *Phys Ther.* 2002;82(3):237-248.
13. McGibbons NH, Andrade CK, Widener G, Cintas HL. Effect of an equine-movement therapy program on gait, energy expenditure, and motor function in children with cerebral palsy: a pilot study. *Dev Med Child Neurol.* 1998;40:754-762.
14. Casady R, Nichols-Larsen D. The effect of hippotherapy on ten children with cerebral palsy. *Ped Phys Ther.* 2004;16(3):165-172.

15. Haehl V, Giuliani C, Lewis C. Influence of hippotherapy on the kinematics and functional performance of two children with cerebral palsy. *Pediatr Phys Ther*. 1999;11(2):89-101.
16. Bertotti D. The effect of therapeutic horseback riding on posture in children with cerebral palsy. *Phys Ther*. 1988;68(10):1505-1511.
17. Benda W, McGibbons NH, Grant KL. Improvements in muscle symmetry in children with cerebral palsy after equine-assisted therapy (hippotherapy). *J Altern Complement Med*. 2003;9(6):817-825.
18. Sterba J. Does horseback riding or therapist-directed hippotherapy rehabilitate children with cerebral palsy? *Dev Med Child Neurol*. 2007;49:68-73.
19. Debuse D, Gibb C, Chandler C. Effect of hippotherapy on people with cerebral palsy from the users' perspective: a qualitative study. *Physiother Theory Pract*. 2009;25(3):174-192.
20. Palisano R, Rosenbaum P, Bartlett D, Livingston M. *Gross Motor Function Classification System—Expanded & Revised*. CanChild Centre for Childhood Disability Research, McMaster University. 2007. http://motorgrowth.canchild.ca/en/GMFCS/resources/GMFCS-ER.pdf. Accessed March 29, 2010.
21. Russell DJ, Rosenbaum PL, Avery L, Lane M. *Gross Motor Function Measure (GMFM-66 and GMFM-88) User's Manual: Clinics in Developmental Medicine, No. 159*. London, England: Mac Keith Press; 2002.
22. Russell D, Avery L, Rosenbaum P, et al. Improved scaling of the gross motor function measure for children with cerebral palsy: evidence of reliability and validity. *Phys Ther*. 2000;80(9):873-885.
23. Daltroy LH, Liang MH, Fossel AH, Goldberg MJ. The POSNA pediatric musculoskeletal functional health questionnaire: report on reliability, validity, and sensitivity to change. *J Pediatr Orthop*. 1998;18(5):561-571.
24. American Academy of Orthopedic Surgeons. Outcomes instruments and information: understanding outcomes scoring, normative study, and reliability/validity. http://www.aaos.org/research/outcomes/outcomes_documentation.asp. Accessed March 29, 2010.
25. McCarthy ML, Silberstein CE, Atkins EA, Harryman SE, Sponseller PD, Hadley-Miller NA. Comparing reliability and validity of pediatric instruments for measuring health and well-being of children with spastic cerebral palsy. *Dev Med Child Neurol*. 2002;44(7):468-476.
26. Harter S, Pike R. The pictorial scale of perceived competence and social acceptance for young children. *Child Dev*. 1984;55:1969-1982.
27. Oeffinger D, Bagley A, Rogers S, et al. Outcome tools used for ambulatory children with cerebral palsy: responsiveness and minimum clinically important differences. *Dev Med Child Neurol*. 2008;50:918-925.