The Effects of Hippotherapy on a Child with Cerebral Palsy: A Case Study

Madison A. Harris

Kennesaw Mountain High School
Table of Contents

Problem ....................................................................................................................................... 6
Research Design .......................................................................................................................... 6
Purpose ........................................................................................................................................ 7
Significance ................................................................................................................................. 7
Research Question ....................................................................................................................... 8
Literature Review ............................................................................................................................ 8
Posture ......................................................................................................................................... 9
  Research conducted in 1988 ...................................................................................................... 9
  Research Conducted in 1998 .................................................................................................. 10
  Research conducted in 1999 .................................................................................................. 11
  Back Geometry ...................................................................................................................... 12
Gross Motor Functions .............................................................................................................. 12
  Gross motor functions measure ............................................................................................ 13
  Immediate effects on gait ...................................................................................................... 14
  Adductor muscle activity ....................................................................................................... 15
Cognitive Skills ......................................................................................................................... 16
Conclusion .................................................................................................................................... 16
Methodology ................................................................................................................................. 17
  Sampling ................................................................................................................................... 17
  Instrumentation ..................................................................................................................... 18
  Procedure and Time Frame .................................................................................................... 18
  Delimitations ......................................................................................................................... 19
The Effects of Hippotherapy on a Child with Cerebral Palsy: A Case Study

Cerebral Palsy (CP) is a neuromuscular dysfunction caused by lesions in the brain that occur before birth or in prenatal stages (McGee & Reese, 2009; McGibbon, Andrade, Widener, & Cintas, 1998; Sterba, 2007). As a result, children with CP lack muscle tone, which effects control of limbs, head, and overall posture (Bertoti, 1988; Casady, & Nichols-Larson, 2004; McGibbon, Benda, Duncan, & Silkwood-Sherer, 2009). Due to atypical muscle tightness, clinical therapy methods for CP are challenging (El-Meniawy & Thabet, 2011) which has led to Hippotherapy as one treatment strategy for CP (Haehl, Giuliani, & Lewis, 1999; McGee & Reese, 2009; McGibbon, Andrade, Widener, & Cintas, 1998; Sterba, 2007; Violette & Wilmarth, 2009). Researchers promote that the purpose of Hippotherapy is to improve posture, balance, mobility, and function (Kwon et al., 2011; Sterba, 2007; Violette & Wilmarth, 2009); therefore, Hippotherapy seems to be a beneficial therapy treatment for children with CP (El-Meniawy & Thabet, 2011).

Horseback riding was recognized for its therapeutic benefits in 1952 when a former polio patient, Liz Hartel, won the Olympic Grand Prix Dressage after recovering through horseback riding (Casady & Nichols-Larsen, 2004; Violette & Wilmarth, 2009). By the 1960’s, Therapeutic Horseback Riding (THBR) was practiced in Europe to increase strength, balance, posture, and function for disabled people (Casady & Nichols-Larson, 2004). Eventually, Hippotherapy was introduced into therapy to further aid children with special needs (Casady & Nichols-Larson, 2004; Heine, 1997; MacPhail, 1998; McGibbon, Andrade, Widener, & Cintas, 1998).
Problem

Children with CP have difficulty with posture, balance, mobility, and function (Kwon et al., 2011; Sterba, 2007; Violette & Wilmarth, 2009). In order to analyze the effects of Hippotherapy on a child with CP, the research problem was divided into the following subgroups.

- Hippotherapy improves head and neck control in a child with CP (All & Loving, 1999; Bertoti, 1988; El-Meniawy & Thabet, 2011; Heine, 1997; MacPhail et al., 1998).
- Hippotherapy improves trunk alignment in a child with CP (as cited in Sterba, 2002; Bertoti, 1988; Kwon et al., 2011).
- Hippotherapy improves extremity function in a child with CP (Kaufmann et al., 2008; McGibbon, Andrade, Widener, & Cintas, 1998; McGibbon, Benda, Duncan, and Silkwood-Sherer, 2009; Violette & Wilmarth, 2009).

Research Design

In order to investigate the effects of Hippotherapy on a child with CP, a qualitative case study was conducted. Hippotherapy was the only therapy method utilized to solve the general research problem that children with CP have impaired posture, balance, mobility, and function due to atypical muscle tone (Kwon et al., 2011; Sterba, 2007; Violette & Wilmarth, 2009). The general problem was divided into four sub-problems observing changes in head and neck control, trunk alignment, extremity function, and muscle tone from the start of Hippotherapy on November 9, 2011 to the last Hippotherapy session, November 13, 2012. Along with
observational data obtained during Hippotherapy sessions, the child’s mother was interviewed to collect data related to the changes of the child outside of the clinic. To investigate the effects of Hippotherapy on a child with CP, the qualitative data was analyzed and compared to the evaluation of the child conducted on November 2, 2011.

Purpose

The purpose of this case study was to explore the effects of Hippotherapy on one child, Noah, who has spastic quadriplegic CP at McKenna Farms Therapy Services. Researchers propose that Hippotherapy may improve balance, posture, mobility, and function (Kwon et al., 2011; Sterba, 2007; Violette & Wilmarth, 2009). The effects of Hippotherapy on a child with CP was defined as changes in head and neck control, trunk alignment, extremity function, and muscle tone. The goal was to further research on Hippotherapy and CP, so future researchers with sample sizes larger than thirty can generalize the effects of Hippotherapy for children with CP.

Significance

Too few studies have been conducted to solidify effectiveness of Hippotherapy. Many researchers discuss the necessity of a sample size larger than thirty to generalize effects of Hippotherapy (McGee & Reese, 2009; McGibbon, Andrade, Widener, & Cintas, 1998; McGibbon, Benda, Duncan, & Silkwood-Sherer, 2009; Sterba, 2007; Zadnikar & Kastrin, 2011). In addition, researchers also suggest that observing the same type of CP is necessary to generalize effects of Hippotherapy (Casady & Nichols-Larsen, 2004; McGibbon, Andrade, Widener, & Cintas, 1998; McGibbon, Benda, Duncan, & Silkwood-Sherer, 2009); however, collecting a sample size that is thirty or greater becomes difficult when unifying type of CP. Additionally, since the effects of therapy are more likely noticeable long term, researchers have
advised conducting studies for longer periods than six to sixteen weeks (Sterba, 2007). To generalize effectiveness of Hippotherapy on a child with CP, larger sample sizes, longer times frames, and controlling the type of CP are necessary. Therefore, the effects of Hippotherapy on only spastic quadriplegic CP from November 9, 2011 to November 13, 2012 were analyzed.

Overall, additional studies are necessary to generalize the effectiveness of Hippotherapy. Because Hippotherapy is the least substantiated therapy method, the majority of disabled children in need of therapy cannot afford Hippotherapy (Kaufmann et al., 2008). If further research is conducted on the effects of Hippotherapy for children with CP, more people may be able to afford this treatment strategy (Kaufmann et al., 2008).

**Research Question**

How does Hippotherapy affect a child with spastic quadriplegic CP?

**Literature Review**

The rationale for Hippotherapy is that the three-dimensional movement of the horse replicates the movement of the human pelvis (as cited in Sterba, 2002; Bertoti, 1988; Kwon et al., 2011). For patients who cannot walk independently, this is crucial because the horse enables the rider to experience one thousand to three thousand steps during one Hippotherapy session (Kacie, personal communication, September 28, 2012). With every rise and drop of the horse’s hind legs, the rider’s center of gravity is unbalanced, causing the person to shift weight (as cited in McGibbon, Andrade, Widener, & Cintas, 1998; Ann MacPhail, 1998). For example, when the hind legs of the horse lower—in order to remain on the horse—the rider’s weight needs to shift forward. In addition to enhancing posture, Hippotherapy enables therapists to improve muscle tone in children with spastic CP because the smooth, rhythmical motion and warmth of the horse relaxes the rider’s muscles (Bertoti, 1988; Zadnikar & Kastrin, 2011). Because of improved
Posture

Researchers have investigated effects of Hippotherapy on posture in children with CP by examining posture control and coordination, equilibrium reactions, and back geometry (Bertoti, 1988; El-Meniawy & Thabet, 2011; Haehl, Giuliani, & Lewis; 199; MacPhail et al., 1998). Each researcher hypothesized that Hippotherapy would improve posture in children with CP. El-Meniawy and Thabet examined only children with spastic diplegic CP (2011). In addition, the other three research groups also examined spastic quadriplegic CP (Bertoti, 1988; Haehl, Giuliani, & Lewis; 199; MacPhail et al., 1998). Each researcher concluded that Hippotherapy might improve posture in children with spastic diplegic CP (Bertoti, 1988; El-Meniawy & Thabet, 2011; Haehl, Giuliani, & Lewis; 199; MacPhail et al., 1998), but there were discrepancies on effects of Hippotherapy on children with spastic quadriplegic CP.

Research conducted in 1988. Bertoti conducted the first clinical analysis in 1988 of THBR on posture in children with spastic diplegic and quadriplegic CP. He reported statistically significant improvements in posture of eleven children by means of a posture assessment scale (Bertoti, 1988). Five physical therapists observed each child’s THBR session and rated their alignment, from 0-3, in five areas: head and neck, shoulder and scapula, trunk, spine, and pelvis. After ten weeks of THBR twice a week, eight out of eleven children were able to sit alone more efficiently in addition to standing more symmetrically. Two children slightly improved. The one child who did not show improvements was diagnosed with spastic quadriplegia CP (Bertoti, 1988). From a second study, MacPhail et al. suggested a possibility that as quadriplegia is such a
severe case of CP, when the rider’s center of gravity is unbalanced, realignment is impossible leading to atypical posture strategies (1998).

**Research Conducted in 1998.** In 1998, MacPhail et al. conducted the first quantitative study on children with CP to investigate equilibrium reactions of the rider during Hippotherapy. Refining Bertoti’s methodology, MacPhail et al. analyzed equilibrium reactions in a control group—non-disabled children compared to children with CP. Consistently there were minimum trunk deviations of each non-disabled child, and the children shifted similarly to the pelvic movement of the horse (MacPhail, et al, 1998). MacPhail et al. noticed that children with CP struggled more than non-disabled children to maintain their balance when the horse displaced their center of gravity. Children with diplegic CP attained normal equilibrium 65%-75% of the time; whereas, children with quadriplegic CP reacted normally 10%-35% of the time. Because children with diplegic CP consistently responded positively to movements of the horse, MacPhail et al. concluded that Hippotherapy seemed to be an efficient therapy method. Contrastingly, MacPhail et al. could not conclude that Hippotherapy benefits posture in children with quadriplegic CP as they were unable to realign themselves and compensated abnormally (1998).

MacPhail’s et al. findings contradict Bertoti’s conclusions that Hippotherapy improves posture in children with diplegic and quadriplegic CP (1988). In Bertoti’s study, two children with quadriplegic CP did show improved posture after Hippotherapy. One distinctive difference is that MacPhail et al. used a control group (non-disabled children) gaining a baseline for the results of the disabled patients (1998). In addition, MacPhail et al. was able to decrease bias because he utilized quantitative data as oppose to Bertoti who collected qualitative data. However, while both researchers compiled small samples, Bertoti’s sample nearly doubled that
of MacPhail’s et al. Furthermore, Bertoti analyzed data after the children had experienced one-hour THBR sessions twice a week for ten weeks (1988), but MacPhail et al. acquired his data from one therapy session (1998). Conclusively, Bertoti’s study appears to be substantiated more so than MacPhail’s et al. due to larger sample size. Bertoti (1988) evaluated eleven children with CP and MacPhail et al. (1998) evaluated six children with CP. In contrast, MacPhail’s et al. study appears to be substantiated as well because he collected quantitative data and included control group (1998).

**Research conducted in 1999.** Further research was conducted by Haehl, Giuliani, and Lewis one year after MacPhail’s et al. study in order to examine influences of Hippotherapy on posture control and coordination in children with CP (1999). Similar to MacPhail’s et al. study, Haehl and her colleagues initially established baseline data. They reported that non-disabled children with or without horseback-riding experience responded to the horse’s movement with a vertical trunk alignment (1999). In the second phase, Haehl, Giuliani, and Lewis conducted a case study to evaluate one child with spastic diplegic CP and one child with spastic quadriplegic CP. Improving MacPhail’s et al. methodology, Haehl, Giuliani, and Lewis lengthened the duration one weekly Hippotherapy session for twelve weeks. Throughout the study, when horseback riding, the posture of both children similarly resembled that of the non-disabled children (Haehl, Giuliani, & Lewis, 1999). Coordination between the upper trunk, lower trunk, and back of the horse improved in the child with diplegic CP and the child with quadriplegic CP. Contradictory to MacPhail’s et al. conclusions, the child with quadriplegic CP showed improvements in postural control and postural coordination. Additionally, the child with diplegic CP improved functional mobility. MacPhail et al. and Haehl, Giuliani, and Lewis
improved Bertoti’s study by including a control group. Moreover, Haehl and her colleagues further improved MacPhail’s et al. study due to lengthening the time frame.

**Back Geometry.** Recently, in 2011 El-Meniawy and Thabet investigated effects of Hippotherapy on regulation of back geometry specifically in children with spastic diplegic CP. In children with spastic diplegic CP, sitting and standing posture are impaired due to abnormal back geometry (El-Meniawy & Thabet, 2011). Improving the studies by Bertoti, MacPhail’s et al. study, and Haehl’s teams study, El-Meniawy and Thabet enlarged the sample size to thirty children with spastic diplegic CP (2011). Analogous to Haehl’s research group, El-Meniawy and Thabet evaluated each patient’s Hippotherapy sessions once a week for twelve weeks, and similar to MacPhail et al. and Haehl’s team, El-Meniawy and Thabet utilized a control group (2011). In El-Meniawy and Thabet’s study, the control group and the study group significantly improved back geometry when compared to pre-test mean values (2011). El-Meniawy and Thabet concluded that children with spastic diplegic CP had improvement of back geometry through sensory input of the horse during Hippotherapy (2011).

**Gross Motor Functions**

Due to lack of muscle tone, children with CP typically have difficulty with gross motor functions. Past researchers hypothesize that Hippotherapy may improve gross motor functions in children with CP (Casady & Nichols-Larsen, 2004; Kwon et al., 2011; McGee & Reese, 2009; McGibbon, Benda, Duncan, and Silkwood-Sherer, 2009; McGibbon, Andrade, Widener, & Cintas, 1998; Sterba, Rogers, France, & Vokes, 2002). Four research studies were conducted utilizing Gross Motor Function Measures (GMFM) as the primary methodology to analyze improvements in gross motor functions after Hippotherapy (Casady & Nichols-Larsen, 2004;
Gross motor functions measure. McGibbon, Andrade, Widener, and Cintas conducted the first study on effects of Hippotherapy on gross motor function in 1998. The team assessed five children with spastic CP, and each child underwent two Hippotherapy sessions weekly for eight weeks (1998). Casady and Nichols-Larsen studied effects of Hippotherapy on ten children with CP for ten weeks; each child received Hippotherapy once a week (2004). Subsequently, a third research group enlarged the sample size evaluating thirty-two children with bilateral spastic CP to investigate effects of Hippotherapy on gait (Kwon, et al., 2011). In contrast to McGibbon, Andrade, Widener, and Cintas, and Casady and Nichols-Larsen, Kwon et al. focused on Hippotherapy as a supplement to conventional therapy (2011). Kwon et al. distributed the thirty-two participants in two groups; children in the control group received conventional therapy treatment, and children in the study group received Hippotherapy plus conventional therapy (2011). All three researchers utilized GMFM as their primary measurement equipment.

McGibbon, Andrade, Widener, and Cintas reported that all five children significantly improved walking, running, and jumping as indicated by increased Dimension E scores (1998). Similarly, Casady and Nichols-Larsen reported improvements in Dimension E as well as improved sitting, crawling, kneeling, and standing, but children did not statistically significantly improve in Dimension A (2004). Kwon et al. reported statistically significant differences in Dimension E between the control group and the group receiving Hippotherapy (2011). All three researchers noticed significant improvements in walking, running, and jumping in children with various types of CP after Hippotherapy sessions (Casady & Nichols-Larsen, 2004; Kwon et al., 2011; McGibbon, Andrade, Widener, & Cintas, 1998). Therefore, it would seem that

In a separate study, Sterba, Rogers, France, and Vokes evaluated general THBR as opposed to Hippotherapy on effects of gross motor function in seventeen children with CP (2002). Like Casady and Nichols-Larsen, Sterba and his colleagues did not specify the type of CP but studied children with various types of CP (2002). Sterba, Rogers, France, and Vokes collected data for eighteen weeks, every six weeks calculating GMFM values (2002). After eighteen weeks of THBR, Dimension A through D increased, but six weeks following THBR, measurements reduced to the scores after the first six weeks of THBR (Sterba, Rogers, France, & Vokes, 2002). As a result, Sterba and his colleagues could not conclude statistically significant improvements in lying and rolling (similar to Casady and Nichols-Larsen’s results), sitting, crawling, kneeling, and standing (2002). In Dimension E, the same category that McGibbon’s research group, Casady and Nichols-Larsen, and Kwon et al. revealed improvements, Sterba’s research team discovered statistically significant improvements (2002). With conflicting results, one may conclude that Hippotherapy and THBR improves gross motor functions of walking, running, or jumping in children with spastic diplegic and quadriplegic CP (Casady & Nichols-Larsen, 2004; Kwon et al., 2011; McGibbon, Andrade, Widener, & Cintas, 1998; Sterba, Rogers, France, & Vokes, 2002).

**Immediate effects on gait.** Without GMFM, McGee and Reese conducted a study to evaluate immediate effects of Hippotherapy on gait in children with spastic CP (2009). McGee and Reese evaluated nine children and gathered data related to each child’s gait parameter before and after one Hippotherapy session using an electronic instrument called GAITRite Gold Walkway System. No statistical significance was established when comparing pre-ride and post-
ride data; therefore, McGee and Reese were unable to conclude that Hippotherapy improves gait in children with spastic CP. The discrepancy between McGee’s and Reese’s findings compared to McGibbon and his colleague’s, Casady and Nichols-Larsen’s, Kwon’s et al., and Sterba and his colleague’s findings are explained by one distinctive difference—McGee and Reese collected data after one Hippotherapy session as opposed to multiple sessions. If children with spastic CP participated in only one Hippotherapy session significant improvements in gait were not present (McGee & Reese, 2009).

**Adductor muscle activity.** Later in 2009, McGibbon, Benda, Duncan, and Silkwood-Sherer conducted another study to examine immediate effects of Hippotherapy, but unlike Sterba and his colleagues, McGibbon and her colleague’s did not focus on gait, but rather they evaluated adductor muscle activity in children with spastic CP. The researchers divided the study into two phases; phase one, immediate effects and phase two, long-term effects (2009). For phase one, the researchers studied forty-four children with spastic CP randomly distributed into two groups—barrel sitting and Hippotherapy. Although Sterba, Rogers, France, and Vokes could not conclude any statistically significant improvements in gait after one Hippotherapy session, McGibbon and her colleagues concluded that children participating in ten minutes of Hippotherapy show significantly more adductor muscle symmetry than do children participating in barrel sitting (2009).

After the research team established immediate improvements in adductor muscle activity, they evaluated long-term effects of Hippotherapy on adductor muscle activity in children with spastic CP to determine sustained benefits of Hippotherapy (2009). For phase two, six children with spastic diplegic or quadriplegic CP were observed for thirty-six weeks—a longer period than any aforementioned study (2009). The time frame was divided into three, twelve-week
periods that would alternate weeks of Hippotherapy with weeks of no Hippotherapy (2009). Researchers used GMFM to measure the participants, and reported that gross motor function improves through Hippotherapy (2009) which was similar to McGibbon and her colleagues, Casady and Nichols-Larsen, Kwon et al., and Sterba and her colleagues, McGibbon, Duncan, Benda, and Silkwood-Sherer. Furthermore, four of the six participants displayed improvements in adductor muscle symmetry while walking (2009). Supplementing previous findings, McGibbon and her colleagues concluded that immediate and long-term effects of Hippotherapy include improved adductor muscle symmetry in children with spastic CP (2009).

**Cognitive Skills**

Although posture and mobility are the primary focuses of Hippotherapy, researchers also believe Hippotherapy improves respiration and speech (Heine, 1997; Violette & Wilmarth, 2009). When trunk muscles are strengthened, respiration improves which results in better speech (Heine, 1997). Additionally, the rider practices higher level motor planning while on the horse in order to execute tasks (Heine, 1997). In 2001, a case study was conducted on the effects of THBR on a child with multiple disabilities (as cited in Violette & Wilmarth, 2009). After THBR the child not only improved in gross motor functions and posture, but also attention span and verbal communication were increased (as cited in Violette & Wilmarth, 2009).

**Conclusion**

Past researchers have theorized that Hippotherapy benefits children with CP by improving posture, gross motor functions, and cognitive skills. Researchers agree that the motion of the horse when walking replicates that of the human pelvis thus benefiting posture, balance, and gait (as cited in Sterba, 2002; Bertoti, 1988; Kwon et al., 2011). Furthermore, researchers agree that the smooth, rhythmical motion and warmth of the horse calms the rider
therefore decreasing muscle spasticity (Bertoti, 1988; Zadnikar & Kastrin, 2011). Additional researchers also agree that Hippotherapy improves cognitive skills, specifically speech (Heine, 1997; Violette & Wilmarth, 2009). There is a discrepancy on effectiveness of Hippotherapy for children with quadriplegic CP. Bertoti (1988), and Haehl, Giuliani, and Lewis (1999) concluded that Hippotherapy improves posture in all forms of CP, while MacPhail et al. (1998) could not conclude that Hippotherapy improves posture for quadriplegic CP possibly because of the severity of the disability. Additionally, one research team, McGee and Reese concluded no immediate effects of Hippotherapy on CP (2009), yet a second research team, McGibbon, Benda, Duncan, & Silkwood-Sherer concluded the benefits of Hippotherapy for children with CP to be immediate and long-term (2009).

Methodology

In this research study, effects of Hippotherapy on a child with CP were investigated as children with CP have difficulty with posture, balance, function, and mobility (Bertoti, 1988; El-Meniawy & Thabet, 2011; Sterba, 2007; Zadnikar & Kastrin, 2011), and past researchers suggest that Hippotherapy improves those impairments (Kwon et al., 2011; Sterba, 2007; Violette & Wilmarth, 2009).

Sampling

Because therapists at McKenna Farms Therapy Services treat a wide variety of disabilities, collecting patients with identical cases of CP was not feasible, and thus a large sample size (more than thirty participants) was not achievable. As a result, a case study was conducted to evaluate only spastic quadriplegic CP. McGibbon suggests that a case study is beneficial because subjects are able to serve as their own control, and case studies are useful when evaluating a person with a unique or rare case (1998), as is the particular child
participating in this research project. The case study child was recommended by occupational therapist, Mrs. Kacie because of the child’s unique case of CP and consistency with weekly Hippotherapy sessions. Before the research study, the mother of the chosen child was addressed about her child’s participation in the study and consent was documented. In addition, for ethical purposes, the child was addressed by his first name, Noah, rather than his full birth name. As this study only evaluated one child, the case study child did not represent the population and the results only pertained to Noah, the child being observed.

**Instrumentation**

Throughout the research study, qualitative data were collected weekly along with the presiding occupational therapist’s notes and observations on the child from November 9, 2011 to November 13, 2012. Observations of changes were recorded in four sub-problems: head and neck control, trunk alignment, extremity function, and muscle tone. The mother of the child was interviewed to obtain the child’s progress outside of the Hippotherapy sessions. According to presiding occupational therapist, Mrs. Kacie, in a qualitative study, a parent review is an efficient instrumentation method because improvements in daily activities are revealed to the researcher and long-term effects of Hippotherapy can be noted (personal communication, October 23, 2012). Therefore, a parent-review of the child was utilized to supplement the observational data recorded during Hippotherapy.

**Procedure and Time Frame**

Although this research study was conducted from August 2012 to November 2012, the qualitative data began at the onset of the child’s Hippotherapy sessions, November 9, 2011, to November 13, 2012, the last Hippotherapy session observed. By expanding the data to the beginning of Hippotherapy, conclusive results may be feasible as the effects of therapy are seen
long-term (Kacie, personal communication, October 23, 2012). The procedure of the case study involved observing the child weekly on Tuesday during his hour-long Hippotherapy sessions. During the session, one therapist walked along the left side of the horse administering the therapy session, and a side-walker walked along the right side of the horse providing the child with necessary assistance. The horse served only as a therapy instrument, and one person led the horse at the therapist’s discretion. The same occupational therapist administered every Hippotherapy session for this case study.

In addition to the presiding occupational therapist’s observational data from the Hippotherapy sessions, an interview with the child’s mother was completed to provide information of the patient’s condition before and after experiencing Hippotherapy as well as the effects of Hippotherapy outside of the clinic. The conversational interview was tape-recorded to avoid misinterpretations and inaccurate recordings. From observations during weekly Hippotherapy sessions and an interview with the child’s mother, qualitative data was utilized to investigate the effects of Hippotherapy on a child with CP from November 9, 2011 to November 13, 2012.

**Delimitations**

For the purposes of this research project, the sample was delimited to one child with spastic quadriplegic CP age five years old to analyze one variation of CP. Past researchers that analyzed multiple forms of CP were not able to conclude the effects of Hippotherapy on CP due to inconsistent results between children with diplegic CP and children with quadriplegic CP (Bertoti, 1988; MacPhail et al., 1998). To avoid inconclusive results, a case study was conducted. Therefore, the type of CP analyzed was controlled, and rare case of CP, as in Noah’s case, was observed.
The same therapist administered the Hippotherapy sessions while utilizing one horse to maintain identical goals and objectives throughout the research study. The research study was delimited to qualitative data due to unavailability of technology that quantitatively measures improvements. Hippotherapy was the only therapy method observed and evaluated. Although Noah received additional therapies throughout the research study, only Hippotherapy was observed and analyzed at the conclusion of the research study. Moreover, the observations during Hippotherapy were delimited to four specific areas: head and neck control, trunk alignment, extremity function, and muscle tone to analyze the entire scope of effects of Hippotherapy on a child with spastic quadriplegic CP.

Analysis Plan

Prior to beginning treatment, therapists evaluate patients to determine the child’s baseline and areas that need improvement. In order for therapists to make conclusions from observational studies, goals are established based on therapy evaluations, and therapists focus therapeutic activities toward the goals formulated in the evaluation. For this case study, Mrs. Kacie evaluated Noah on November 2, 2011 to discover the needed areas of improvement. November 9, 2011 was the first Hippotherapy session. Subsequently, the child was seen at noon on Tuesday every week for one-hour Hippotherapy sessions. After each Hippotherapy session, Mrs. Kacie recorded the child’s progress, and the observations were organized into the four sub-groups: head and neck control, trunk alignment, extremity function, and muscle tone.

Statistical analysis could not be conducted, as this research project was a qualitative study. Therefore, qualitative data were analyzed through the child’s observational progress during Hippotherapy sessions as well as throughout daily activities from the parent review. Bias was decreased by utilizing several instrumentation methods; multiple people observed the child’s
progress. Observations were recorded honestly and with detail to further decrease bias, and the presiding occupational therapist oversaw all data collected (Kacie, personal communication, October 2012). The analysis process was continuous, beginning at the start of the research project to the conclusion. All of the qualitative data collected through observations during Hippotherapy and the parent review were compared with the first evaluation of the case study child to analyze his progress after experiencing Hippotherapy (Kacie, personal communication, October 2012).

Validity and Reliability

One child was evaluated, and therefore, there is no external validity; the results were not generalizable to other children with CP (Isaac & Michael, 1971). Concerning internal validity, the child was maturing, and therefore, controlling progress through maturation was impossible (Isaac & Michael, 1971). However, there was no alteration in the process of observing the child and collecting data. The same therapist observed Noah thus keeping the data consistent. From controlling the type of CP and utilizing a parent-review, valid results pertaining to the case study child with spastic quadriplegic CP were obtained (Kacie, personal communication, October 23, 2012). Content validity was established by dividing the general problem into sub-problems (Mehrens & Lehmann, 1987). Rather than only observing changes in one area of improvement, four areas of proposed benefits of Hippotherapy were observed. By analyzing four sub-groups, the multiple, proposed benefits of Hippotherapy were effectively covered (Haehl, Giuliani, & Lewis, 1999).

Under the same conditions, it may be possible to replicate the results of this study because the type of CP was controlled to spastic quadriplegic CP. A child with an identical diagnosis as Noah should perform similarly to Noah’s performance in this case study. With
future similar studies, researchers would be able to achieve external validity through corroboration. When considering the controlled environment and instrumentation, there is high reliability. Contrastingly, human beings cannot be completely controlled and variations in characteristics of individuals (mental, emotional, and physical health) should be taken into account when replicating this case study (Isaac & Michael, 1971).

Assumptions

It was assumed that the presiding occupational therapist recorded data accurately avoiding bias. In addition, information about the child collected from the parent review was assumed to be valid and accurate. Without assuming the truthfulness of the therapist’s data and parent-review, this research study could not proceed (Simon, 2011). The presiding occupational therapist was certified to administer Hippotherapy, and the leader of the horse was trained with horses. Furthermore, the goal was to analyze the behavioral patterns of the child and examine the possible relation to the theory that Hippotherapy affects children with CP positively (Bertoti, 1988; Kaufmann et al., 2008; Kwon et al., 2011; Sterba, 2007; Zadnikar & Kastrin, 2011).

Scope and Limitations

Research with sample sizes larger than thirty is essential in order to generalize the effects of Hippotherapy to a larger population (McGee & Reese, 2009; McGibbon, Andrade, Widener, & Cintas, 1998; McGibbon, Benda, Duncan, & Silkwood-Sherer, 2009; Sterba, 2007; Zadnikar & Kastrin, 2011). However, a case study involving one child was the only feasible choice for this research project due to the differences between disabilities. No other child at McKenna Farms Therapy Services had an identical case as Noah; therefore, a case study was implemented. Secondly, at the forty-first session, the horse utilized for this research project was injured and began walked with a limp. Consequentially, the horse had to be changed two sessions before the
conclusion of this research study. Changing the horse could negatively affect Noah’s progress, and therefore, the last two therapy sessions were not considered when analyzing the final results (Kacie, personal communication, November 2012).

Results from this research study pertained only to the case study child, Noah, and thus, the effects of Hippotherapy on CP could not be generalized but only suggested to others with CP. Consequently, the goal of this case study was to corroborate past research and provide recommendations for future research that could eventually generalize the effects of Hippotherapy on children with CP.

**Data and Analysis**

Noah’s diagnosis is unique; born a twin at twenty-eight weeks, Noah presented more normal APGAR scores than his brother and showed no signs of CP (Rebecca, personal communication, November 27, 2012). However, at one month old, Noah became ill (the CDC could not identify the illness) causing his kidneys, liver, and lungs to fail. The doctors put him on a ventilator, and within four days, Noah had to be resuscitated eight to ten times. Afterwards, “he was described as being blue and arching;” the doctors proposed because his brain did not receive enough oxygen (Rebecca, personal communication, November 27, 2012). Meanwhile, Noah was also struggling with a cleft palate and his lungs were filling up with fluid, as his esophagus was not refluxing properly; both complications required surgery. At four months old, a second episode of lack of oxygen to Noah’s brain occurred, and his mother believes this was the onset of CP (personal communication, November 27, 2012). At this time, Noah went without breathing for nine minutes—long enough for brain damage (Rebecca, personal communication, November 27, 2012). The doctors reported Noah to be “near death” during his second episode; he was placed on a ventilator for two to three weeks. Due to Noah’s
complications, he spent six months in the hospital after birth, and at age one and a half, Noah was diagnosed with spastic quadriplegic CP (Rebecca, personal communication, November 27, 2012).

After the second episode in which Noah did not receive enough oxygen, his mother noticed abnormalities in Noah’s development. She described the shape of Noah’s hands as “angular,” “funny looking,” and “odd” (Rebecca, personal communication, November 27, 2012). These descriptions illustrate Noah’s high muscle tone or spasticity, the particular case of CP studied in this research project. In addition, Noah’s mother “didn’t feel like he was kicking” normally or having “spontaneous movement” (Rebecca, personal communication, November 27, 2012). Noah’s legs were impaired, and from an early age, one could notice the lack of ability in his lower extremities that inhibit his ability to walk today. His mother explained that Noah was impaired the most at his head/neck area and right side of his body. Additionally, Noah had asymmetrical tonic neck reflex (ATNR) which negatively affects his head and arm ability. After receiving the background information (baseline for this research project) through the parent-review, the four sub-groups were developed and analyzed for improvements from Hippotherapy.

**Head and Neck Control**

Prior to beginning Hippotherapy, Noah struggled significantly with controlling his head in an upright position, and according to his mother, head and neck control was Noah’s weakest area (personal communication, November 27, 2012). There are no exercises to strengthen the neck; however, through proper midline alignment and upright positioning during Hippotherapy, it is suggested that head and neck control will improve (All & Loving, 1999; Bertoti, 1988; El-Meniawy & Thabet, 2011; Heine, 1997; MacPhail et al., 1998).
**Observations.** At the first Hippotherapy session, Noah required complete assistance for neck control and presented difficulty with independently extending his head. By the fifth Hippotherapy session, Noah could independently extend his head for one to two seconds. Throughout the research study, Noah continued to increase the time he could independently hold his head in an extended position. During the nineteenth session, April 25, 2012, Noah was able to extend his head at a forty-five degree angle for five to seven seconds. Additionally at the nineteenth session, Noah could independently turn his head to specific stimuli (people or objects).

In addition to the increased ability to maintain his head in an extended position, Noah gained ability to bring and hold his head in normal midline placement. These changes were observed towards the later portion of the research study beginning on the twentieth Hippotherapy session on May 9, 2012. On May 31, 2012 (two sessions later), Noah demonstrated an increased ability to bring his head to the midline for three to four seconds for four trials. On the twenty-third and twenty-sixth session, Noah required maximum assistance at the head to maintain midline alignment and upright positioning; however, on the thirty-third session, he required fluctuating assistance. At the end of the research study, Noah still needed assist at the head to maintain midline and upright positioning.

With verbal cuing while on the horse, Noah further demonstrated improvements in head and neck control. Compared to not being able to lift his head prior to Hippotherapy, Noah showed improvements in his ability to lift his head. During the twenty-fifth session on July 3, 2012, Noah could bring his head up twenty-five percent of the time when asked by the therapist. At the fortieth session, Noah could hold his head upright for five seconds for five trials when prompted by the therapist’s verbal cuing. Moreover, during the forty-first session on November
6, 2012, Noah could hold his head for five seconds for seven trials when prompted by the therapist’s verbal cuing.

During the Hippotherapy sessions, the therapist would place Noah in various positions on the horse to further aid his head and neck control. On the tenth session, while sitting reversed on the horse, Noah demonstrated an increased ability to maintain his head in a neutral position and bring his head to the midline. Four sessions later, Noah also showed an increased ability to maintain his head in a neutral position and bring his head to the midline when lying prone on the horse. In addition to lying prone and sitting reversed, it was observed on the seventeenth session that Noah’s head and neck control increased when sitting sideways on the horse. When Noah was side sitting, he also showed an increased engagement in neck control. During the eighteenth session, April 18, 2012, the therapist reported Noah to have had an “amazing session!” He was able to maintain his head in a neutral position and bring his head to the midline when lying in prone and supine. When in supine, Noah again demonstrated periods of ability to maintain his head at a neutral position on the last Hippotherapy session on November 13, 2012.

**Parent-Review.** Currently, Noah is still working on strengthening his head and neck control. His mother has seen some improvements in his ability to hold his head upright; however, due to lack of exercises that increase neck strength, Noah is still working on holding his head in a normal upright position (Rebecca, personal communication, November 27, 2012).

**Trunk Alignment**

One of the primary qualities Hippotherapy is suggested to improve is trunk alignment, as the pelvic movement of the horse replicates that of humans (Kwon et al., 2011; Sterba, 2007; Violette & Wilmarth, 2009). Because Noah cannot walk, he never exercises his pelvic muscles (Rebecca, personal communication, November 27, 2012). During Hippotherapy Noah’s pelvic
muscles will be exercised from the horse; up to three thousand steps can be stimulated during Hippotherapy (Kacie, personal communication, October 23, 2012). The following observations were recorded during Noah’s Hippotherapy sessions.

**Observations.** On the first day of Hippotherapy, November 9, 2011, Noah needed complete assistance to change and maintain positions on the horse. Two therapists on either side of the horse were required to stabilize Noah. Noah tolerated sitting in prone, supine, forward, and reverse positions. By the seventh week of Hippotherapy, Noah still needed complete assistance to change positions but only needed minimum to moderate assistance to maintain positions. During the Hippotherapy session on January 18, 2012, Noah became fatigued when trying to maintain positions, and therefore, needed maximum assistance. By week twelve of Hippotherapy, Noah demonstrated an increased ability to maintain his head in a neutral position and bring his head into the midline; however, he presented increased flexion in the hips causing difficulty when placed in a normal sitting position on the horse.

Contrastingly, on the twenty-fifth week, July 3, 2012, Noah demonstrated significant improvements. He presented increased core strength and ability to maintain sitting in an upright position. Furthermore, when the therapist supported his trunk, Noah was able to keep his head upright for twenty seconds, lowering and raising his head occasionally. Six weeks following, Noah continued to tolerate proper placement of the trunk at the midline. On October 16, 2012, Noah presented increased engagement at the core when sitting sideways on the horse.

**Parent-Review.** At the conclusion of this study, Noah still needed support at both hips to maintain alignment, as he shifted to the left due to an abnormal head turn position to the right caused by ATNR. However, Noah required less support from the therapist to maintain positions due to an increase in his core strength and proper trunk alignment throughout the duration of
Hippotherapy. By the end of this research study, only one therapist was required to assist Noah on the horse, and a side-walker replaced the second therapist. Additionally, Noah’s mother reported that she has noticed significant improvements in Noah’s trunk after participating in Hippotherapy; “I have seen trunk control improve a whole bunch” (Rebecca, personal communication, November 27, 2012).

**Extremity Function**

As Noah has quadriplegic CP, all four of his extremities are impaired (Rebecca, personal communication, November 27, 2012). He is unable to walk independently, and due to ATNR, his upper extremities do not function normally. Noah’s mother described him to struggle more with the right side of his body than the left (personal communication, November 27, 2012). Hippotherapy is suggested to improve mobility, therefore helping all four extremities (Kwon et al., 2011; Sterba, 2007; Violette & Wilmarth, 2009). Additionally, if muscle tone is decreased during the smooth rhythmical movement, spasticity is overcome and the child can work on improving extremity function (Kacie, personal communication, October 23, 2012). Changes in Noah’s extremity function were observed during Hippotherapy.

**Observations**. At the third Hippotherapy session, Noah could maintain lying in supine with his hands placed at the midline of his body with moderate assistance to open and close his hands. Additionally, Noah showed an increased ROM at the ankles, knees, and hips. During the seventh session, the therapist observed normalized muscle tone specifically in the hands and right upper extremity. Noah presented poor control of upper extremities and increased flexion in hips causing difficulty when sitting during the twelfth session, but by the seventieth and eighteenth sessions, Noah presented an increased control of his upper extremities being able to independently bring his arms to the midline and clasp his hands together. Furthermore, at the
twenty-ninth session, Noah was able to extend his legs as oppose to maintaining them in an abnormal flexed position. On the twenty-fourth session, Noah was able to bring his hands over his right knee; his arms were locked at the elbow to promote weight shifting and weight bearing equally on the left and right side. It was noted on the thirty-third session that Noah continued to bear his weight through the upper extremities; however, during this session, the therapist had to assist Noah with opening and closing his hands in a fist. Noah had an increased difficulty with grasping and releasing objects on the thirty-sixth session, and required additional therapist handling to inhibit extensor tone. The following session, Noah demonstrated an increased tolerance for lying in supine, and he attempted to bring his hands to the midline.

ATNR significantly inhibits Noah’s extremity function. However, while riding the horse, Noah demonstrated a decreased influence of ATNR. The therapist would help Noah turn his head to the left to address the ATNR that affected the right side of his body. During the thirty-eighth session, it was noted that when Noah crossed the midline with his upper extremities, ATNR became engaged limiting the functional use of his hands. Therefore, the therapist had to assist his upper extremity movement. While during the seventh session Noah presented a decreased influence of ATNR, during the forty-first session, Noah presented an increased influence of ATNR. This negative change could be a result of having to change horses the forty-first week of the research study.

**Parent-Review.** Prior to changing horses, Noah showed improvements in extremity function at various times throughout the research study. His mother claimed that Noah continues to work on his upper extremity function, but she has seen improvements (Rebecca, personal communication, November 27, 2012). Originally, Noah could not maintain his hands clasped together at the midline. After participating in Hippotherapy, his mother noticed that Noah could
Muscle Tone

The type of CP Noah was diagnosed with is spastic CP (Rebecca, personal communication, November 27, 2012). He has atypical muscle tightness causing immobility.

Second to helping trunk alignment, past researchers theorize that the warmth and smooth rhythmical movement of the horse relaxes the rider and decreases muscle spasticity (Bertoti, 1988; Zadnikar & Kastrin, 2011). Progress in Noah’s muscle tone was observed throughout Hippotherapy. For the parent-review, no information was collected on changes in muscle tone.

Observations. Between the first and second session of Hippotherapy, Noah demonstrated no changes in muscle tone; however, by week three, Noah demonstrated decreased abnormal muscle tone as well as increased relaxation while riding the horse. Noah presented improvements in head and neck control, trunk alignment, and extremity function because of decreased muscle spasticity. On April 25, 2012, the therapist recorded that Noah’s ATNR decreased, and on June 19, 2012, the therapist addressed Noah’s ATNR by helping him turn his head to the left. Throughout the twenty-sixth Hippotherapy session, Noah showed intermittent tonal changes. Furthermore, on the thirtieth session, August 14, 2012, Noah’s abnormal muscle tone decreased allowing more free movement of the upper extremities. Six sessions later, Noah did not show improvements in muscle tone and required additional therapist handling to inhibit extensor tone. Conversely, the following Hippotherapy session, Noah presented relaxed tone after ten minutes of slow rhythmic movement, and on the thirty-ninth week, October 23, 2012, Noah presented good overall muscle tone.
Summary and Conclusion

From prior research, Hippotherapy is suggested to improve posture, balance, mobility, and function in children with CP because the pelvic movement of the horse when walking replicates the pelvic movement of humans (Kwon et al., 2011; Sterba, 2007; Violette & Wilmarth, 2009). Past researchers also suggest that the smooth, rhythmical movement of the horse coupled with its body warmth relaxes the rider, and therefore benefits children with spasticity by decreasing abnormal muscle tone (Bertoti, 1988; Zadnikar & Kastrin, 2011). The goal was to analyze the effects of Hippotherapy on a child with spastic quadriplegic CP to continue past research and aid future researchers in generalizing the effects of Hippotherapy to all children with CP.

The general research problem was divided into four sub-problems (head and neck control, trunk alignment, extremity function, and muscle tone) to effectively analyze the possible areas Hippotherapy is suggested to improve (Haehl, Giuliani, & Lewis, 1999). In order to unify the type of CP evaluated, a case study was conducted on one child, Noah, with a unique case of CP (Casady & Nichols-Larsen, 2004; McGibbon, Andrade, Widener, & Cintas, 1998; McGibbon, Benda, Duncan, & Silkwood-Sherer, 2009). Additionally, to gain conclusive results pertaining to Noah, qualitative data were collected from the first Hippotherapy session, November 9, 2012, when Noah was four years old to the last Hippotherapy session, November 13, 2012, when Noah was five years old (McGibbon, Andrade, Widener, & Cintas, 1998). By observing Noah once a week for one-hour Hippotherapy sessions, forty-two days of data were collected. A parent-review was also conducted to collect data on Noah’s diagnosis, condition prior to Hippotherapy, and changes observed outside of the clinic (Kacie, personal communication, October 2012).
Collecting and analyzing data was a simultaneous and continuous process, as this was a qualitative study (Kacie, personal communication, October 2012). Each sub-group was analyzed independently, although the effects of Hippotherapy on CP overlapped (Kacie, personal communication, October 2012). After analyzing the parent-review and observations collected during Hippotherapy, conclusions were drawn on the effects of Hippotherapy on a child with spastic quadriplegic CP.

**Head and Neck Control**

The effects of Hippotherapy on head and neck control for a child with spastic quadriplegic CP were analyzed. Prior to Hippotherapy, Noah could not independently hold his head upright due to lack of neck control (Rebecca, personal communication, November 27, 2012). However, throughout this research study, it was observed that while riding the horse, Noah improved his head and neck control, and his mother reported improvements as well. During Hippotherapy, Noah incrementally increased his ability to extend and hold his head in an upright position. Starting at one to two seconds, Noah was eventually able to hold his head upright without therapist assistance for five to seven seconds. Off the horse, his mother reported that she believes Noah can hold his head upright for two minutes if he is motivated (Rebecca, personal communication, November 27, 2012). The horse provided the motivation Noah needed to work on improving head and neck control as well as increasing Noah’s core strength through the horse’s gait. Noah is still working on improving his head and neck control, but at the end of this research study, he did show improvements from his starting point on November 9, 2011.

**Trunk Alignment**

The effects of Hippotherapy on trunk alignment for a child with spastic quadriplegic CP were analyzed. Due to CP, Noah cannot walk independently, and therefore, he never exercises
the pelvic muscles utilized when walking (Rebecca, personal communication, November 27, 2012). Throughout this research study, Noah demonstrated improvements in proper trunk alignment due to the horse exercising his pelvic muscles during Hippotherapy (as cited in Sterba, 2002; Bertoti, 1988; Kwon et al., 2011). Prior to Hippotherapy, his mother described Noah’s back to be a “c” shape (Rebecca, personal communication, November 27, 2012). At the conclusion of this study, Noah was able to maintain an upright sitting position with increased core strength. Furthermore, Noah required less assistance from the therapist to maintain sitting supine, prone, forward, and reverse on the horse (Kacie, personal communication, November 2012). Noah’s mother claimed the primary desire for Hippotherapy was to assist proper trunk alignment, and she has noticed out of all four sub-groups that Noah improved the most in trunk alignment after participating in Hippotherapy (Rebecca, personal communication, November 27, 2012).

**Extremity Function**

The effects of Hippotherapy on extremity function for a child with spastic quadriplegic CP were analyzed. Extremity function encompasses all four extremities as Noah has quadriplegic CP. Noah’s mother reported that before Hippotherapy, Noah’s hands were in an “angular” shape, and ATNR limited free upper extremity movement (Rebecca, personal communication, November 27, 2012). From observations during Hippotherapy, Noah demonstrated improvements in extremity function. Noah increased control of his upper extremities and was able to maintain his hands clasped at his midline. Moving his clasped hands upwards from the pubic area to the mouth was difficult for Noah; the height of his hands was directly related with difficulty of keeping them together (Rebecca, personal communication, November 27, 2012). It was observed that Noah’s ability to maintain his hands clasped at the
midline increased, and his mom reported an ability to maintain his hands clasped at the level of his chest (Rebecca, personal communication, November 27, 2012)—an improvement from the starting point. Although the influence of ATNR was fluctuating, prior to changing horses the second to last Hippotherapy session, Noah performed with a decreased influence of ATNR, and thus, an increase in extremity function. Extremity function is an area Noah is continuing to improve, but at the conclusion of this study, he showed some improvements in extremity function after participating in Hippotherapy.

**Muscle Tone**

The effects of Hippotherapy on muscle tone for a child with spastic quadriplegic CP were analyzed. Before Hippotherapy was implemented, Noah presented abnormal muscle tone, as his type of CP is spastic. Beginning on the third Hippotherapy session, Noah presented a decrease in muscle tone. Throughout the study, Noah continued to demonstrate decreased muscle tone while riding the horse allowing for progress in the three other sub-groups (Kacie, personal communication, October 2012). Even though during two sessions Noah did not demonstrate decreased muscle tone (October 2, 2012 and November 6, 2012), overall Noah’s muscle tone improved because Hippotherapy relaxed Noah’s muscles during the majority of the sessions, and towards the end of the study, Noah sustained relaxed muscle tone ten minutes following Hippotherapy (October 23, 2012).

**Recommendations**

Future studies with a sample size over thirty are necessary to generalize the effects of Hippotherapy for all patients with CP (McGee & Reese, 2009; McGibbon, Andrade, Widener, & Cintas, 1998; McGibbon, Benda, Duncan, & Silkwood-Sherer, 2009; Sterba, 2007; Zadnikar & Kastrin, 2011). Because the sample involved one child, the results of this study pertained only to
Noah, the child observed. Therefore, the results could not be generalized to every child with CP. Future research studies with larger sample sizes where the type of CP is unified, are recommended to generalize the effects of Hippotherapy to a larger population than one child.

Conducting a quantitative study would be beneficial to decrease bias that arises due to qualitative data. Although qualitative data were recorded accurately in this case study, perspectives from one person to another on classifying improvements vary (Isaac & Michael, 1971). Quantitative data would decrease bias, and benefit future research studies on the effects of Hippotherapy for children with CP. To collect quantitative data, past researchers utilized GMFM measures (Casady & Nichols-Larsen, 2004; Kwon et al., 2011; Sterba, 2007), Formetric instrument systems (El-Menawy & Thabet, 2011), and GAITRite Gold Walkway Systems (McGee & Reese, 2009). It is recommended for future researchers to utilize technological instruments if available to collect quantitative data.

**Conclusion**

This research study was conducted to investigate how Hippotherapy affects a child with spastic quadriplegic cerebral palsy. The possible areas Hippotherapy could improve include head and neck control, trunk alignment, extremity function, and muscle tone (Kwon et al., 2011; Sterba, 2007; Violette & Wilmarth, 2009). Therefore, the general problem was divided and analyzed in those four sub-problems. Hippotherapy improved head and neck control, trunk alignment, extremity function, and abnormal muscle tone for Noah, the case study child. The horse relaxed Noah thus decreasing his muscle spasticity, and the horse helped properly align Noah’s trunk as suggested by previous researchers (as cited in Sterba, 2002; Bertoti, 1988; Kwon et al., 2011). The other two sub-problems (head and neck control and extremity function) Noah is still working on improving; however, by the end of this study, Noah presented improved...
functional use in his upper extremities and hands as well as improved head and neck control.

From this research study, future researchers can conduct studies to further investigate the effects of Hippotherapy and eventually generalize the results to all children with cerebral palsy.

**Definition of Terms**

**Adductor Muscle:** a muscle that moves an extremity towards the center of the body; involved with gross motor function (McGibbon, Benda, Duncan, & Silkwood-Sherer, 2009)

**APGAR scores:** the first medical test given to a newborn baby to check for normality

**Asymmetrical tonic neck reflex (ATNR):** a reflex that is supposed to diminish after being a newborn; however, with developmental delays, ATNR remains present causing motion of the head and extremities to be connected abnormally. When the head turns to one side, the extremities on the side the head is facing extend and the others flex.

**Barrel sitting:** When horses are unavailable, barrels serve as the horse in Hippotherapy; Barrel sitting is cheaper than Hippotherapy but not as effective as Hippotherapy (Kwon et al., 2011)

**Bilateral:** two sides of the body are affected (Kacie, personal communication, October 16, 2012).

**Cerebral Palsy:** brain damage resulting in loss of mobility or function; commonly referred to as CP (Stern Law Group, 2012)

**Cognitive Skills:** the ability to think; includes attention span, concentration, and speech (Kacie, personal communication; October 2, 2012)

**Diplegic Cerebral Palsy:** two ligaments are impaired; the legs are affected more often than the arms (Stern Law Group, 2012)

**Extension:** When talking about the head, extension refers to the ability to lift one’s head up to the normal upright position.
**Extensor Tone:** limits ability to use free movement (Kacie, personal communication, September 2012)

**Flexion:** flexion is the opposite of extension; when talking about the hips or thigh, flexion refers to moving the leg upward towards the sky

**Gait:** walking motion (Kacie, personal communication, September 2012)

**Gross Motor Function:** the ability to manipulate muscles that enable lying, rolling, sitting, crawling, kneeling, standing, walking, running, and jumping (Sterba, Rogers, France, & Vokes, 2002).

**Gross Motor Function Measure (GMFM):** quantitatively measures gross motor skills in five dimensions: “(A) lying and rolling; (B) sitting; (C) crawling and kneeling; (D) standing; and (E) walking, running, and jumping” (Sterba, Rogers, France, & Vokes, 2002).

**Hippotherapy:** a form of therapeutic horseback riding where a licensed physical therapist, occupational therapist, or speech pathologist is required; derived from the Greek word “hippos” meaning horse (All & Loving, 1999)

**Lower extremity:** legs

**Midline:** center of body

**Non-spastic CP:** decreased or fluctuating muscle tone (Stern Law Group, 2012)

**Posture, Balance, Mobility, and Function:** the four primary areas Hippotherapy is theorized to improve. Posture refers to proper alignment of the spine; balance refers to stabilization on the horse helping the trunk; mobility refers to improvements in gait through Hippotherapy; function refers to gross and fine motor skills and proper function of upper and lower extremities (arms and legs).

**Prone:** laying on one’s stomach
ROM: range of motion

Side-walker: assistant during Hippotherapy; walks along the right side of the horse

Spastic Cerebral Palsy: CP characterized by increased muscle tone (Stern Law Group, 2012)

Supine: laying on one’s back

Therapeutic Horseback Riding (THBR): focuses on recreational aspects of horseback riding and does not require a licensed health professional; general term to describe horseback-riding for therapy

Upper extremity: arms

Quadriplegic Cerebral Palsy: all four ligaments impaired (Stern Law Group, 2012)
References


