

# Comparison of the effects of aquatic and robotic-based rehabilitation for children with cerebral palsy

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**Background:** Children and adolescents with cerebral palsy (CP) experience many types of disabilities and functional impairments that affect motor function and the gait cycle. The physical rehabilitation of children with CP commonly places therapeutic emphasis on improving muscle strength, physical and cardiorespiratory fitness, motor control, and functional independence. The therapeutic environment of both aquatic and robotic-based therapies provides additional benefits to the rehabilitation process by reducing the effects of gravity.

However, with multiple intrinsic differences between them, little research has been performed to compare the outcomes of these therapies. While the use of aquatics therapies have been widely used as a rehabilitative modality for pediatric CP, robotic-assisted gait training (RAGT) is a relatively novel therapeutic approach to gait therapy. Several studies have examined the efficacy of both therapeutic modalities.

**Aim:** The purpose of this review is to examine the trends in the therapeutic efficacy of utilizing aquatic and RAGT therapies as a restorative modality for motor, cardiovascular, and gait performance for children with CP. **Results:** The present studies show that RAGT therapies may provide multiple therapeutic benefits to children with CP, including statistically significant improvements in gross motor function and multiple gait characteristics. Additionally, the available document evidence in aquatic CP rehabilitation supports the idea that aquatic exercise therapy may be beneficial for children and adolescence with CP, with considerable evidence supporting improvements in gross motor function.

Aquatic and RAGT therapies show similar outcomes in most functional tests and may be a safe and favorable complement to current physiotherapy regimens.

Cerebral palsy (CP) is a “group of permanent disorders of the development of movement and posture, causing activity limitation, that are attributed to non-progressive disturbances that occurred in the developing fetal or infant brain” (Hockenberry, 2015, p. 1617). According to the Center of Disease Control Data and Statistics for Cerebral Palsy (2018), an estimated one out of every 323 children has been diagnosed with cerebral palsy. “The Prevalence of Cerebral Palsy” (2018) by the Cerebral Palsy Foundation reveals that every year 10,000 children in the United States are born with this condition: prevalence of children in the United States, under the age 18, with the diagnosis of cerebral palsy is approximately 500,000. With this number of children impacted by this condition, it is important to consider how to effectively improve this population’s quality of life. This disorder can have profound effects on operative functions such as cognition, gait, coordination, and behavior. Cerebral palsy can cause additional problems depending on the severity of the disorder. “Cerebral Palsy” by the Mayo Clinic (2016) described that problems

include but are not limited to gastroesophageal reflux, epilepsy, intellectual disabilities, speech difficulties, vision and hearing problems and contractures. All of these problems lead to a decreased ability to participate in activities of daily living, causing low endurance, less independence, and less enjoyment (Moraes, Copetti, Angelo, Chiavoloni, & David, 2016). Individuals with CP may also experience malnutrition and develop pressure ulcers because of lack of activity (Mayo Clinic, 2016). It is important for nurses and healthcare providers to be made aware of signs and symptoms of cerebral palsy. There is no cure for this disease, therefore, traditional treatment consists of occupational and physical therapy. The goal of treatment is to increase functioning and performance of everyday tasks and thus improve overall quality of life.

**EFFECTIVENESS OF ALTERNATIVE CEREBRAL PALSY TREATMENTS** 4 There has been research that suggests therapies, other than traditional physical therapy, are beneficial for children suffering from this disorder (Kwon, Chang, Yi, Lee, Shin, & Kim, 2015). Based on literature searches, three alternative therapies for this population have been identified and studied. These include hippotherapy, aquatic therapy, and robotic gait training (refer to appendix A for Table of Evidence). Hippotherapy uses horseback riding as a rehabilitative treatment to increase coordination and balance in children with cerebral palsy (Champagne, Corriveau, & Dugas, 2017). Aquatic therapy utilizes mechanical and thermal effects of water to improve motor functionality (Lai, et al., 2014). Robotic gait training focuses on improving gait by using mechanical devices to support and increase motor abilities (Bayon et al., 2016). These alternative methods bring a different approach to improve gross motor and balance performance for children with cerebral palsy.

Nurses should be aware of the treatment options for children with cerebral palsy so that the most effective and appropriate therapy is utilized. The purpose of this systematic review is to identify, describe, and critically appraise the evidence about the effectiveness of the three alternative therapies in children with cerebral palsy. In addition, the systematic review will determine which age subpopulations of children would benefit the most from each of the alternative treatments.

## Discussion-

The subpopulations of children follow the national pediatric categories of infant (birth to 1 year), toddler (1 to 3 years), preschool (3 to 6 years), school-age (6 to 12 years), and adolescents (12 to 18 years) (Hockenberry, 2015). This review attempts to answer the following PICOT question: How effective are hippotherapy, aquatic therapy, and robotic gait therapy on gross motor function and balance in four to twentyfour-week studies on the subpopulations of children with

cerebral palsy compared to traditional therapy?  
EFFECTIVENESS OF ALTERNATIVE CEREBRAL PALSY TREATMENTS 5 Methodology The approach to answering the question above is through a systematic review. A systematic review is a rigorous and systematic synthesis of research findings about a clinical problem (Schmidt & Brown, 2019). For this systematic review, the therapies reviewed were considered alternative therapies, versus complementary therapies.

If the therapies were studied strictly as complementary treatments, it would be difficult to determine if the traditional or complementary treatment was causing the effects. In choosing appropriate research to address this problem and answer the PICOT question, the authors used electronic databases of Academic Search Complete, CINAHL, and MEDLINE.

Key search words included: cerebral palsy, motor control, balance, gait, alternative therapies, traditional therapies, hippotherapy, aquatic therapy, robotic gait training, children, and pediatrics. Inclusion criteria are: published within the last 12 years and samples of children with cerebral palsy under 18 years of age. Due to a limited amount of research and to retrieve a greater amount of research articles, currency of studies was extended to 12 years. All research utilized in this systematic review regarding robotic gait training and hippotherapy are within the last five years.

Conclusion: Various degrees of functional improvements are a noticeable trend among all presented studies. Further studies in both therapeutic modalities are warranted, and implementation of similar therapeutic protocol may be valuable to a rehabilitation care plan. The highly repetitive and task-specific nature of both therapies may provide a valuable paradigm for children with CP whom have never learned a normal gait pattern pain relief, but the use of topical agents produced lower plasma drug concentrations and fewer systemic adverse events (AEs).

The physical-chemical properties of diclofenac epolamine make it well suited for topical use. In patients with acute soft tissue injuries treated with DETP, clinical data report an analgesic benefit within hours of the first application, and significant pain relief relative to placebo within 3 days. Moreover, DETP displayed tolerability comparable with placebo; the most common AEs were pruritus and other application site reactions. Review of published literature suggests that DETP is generally safe and well tolerated, clinically efficacious, and a rational treatment option for patients experiencing acute pain associated with strains, sprains, and contusions, and other localized painful conditions.