

# **The Impact of Manual Therapy Exercises on Improving Movement in a Child with Cerebral palsy and Muscle Hypotonia**

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**Abstract:**

Cerebral palsy (CP) is a neurological condition that affects muscle control, leading to motor impairments and muscle weakness in children, which significantly hinders their ability to perform daily activities and participate in functional tasks. A comprehensive, multidisciplinary approach, including physical therapy, is essential to manage CP and improve the quality of life for both the child and their family. Physiotherapists are pivotal in enhancing physical independence by using various techniques to address deficits in motor skills, spasticity, weakness, and coordination. This research included a case study of a 12-year-old girl, Shamo Khalid, diagnosed with CP, who underwent a variety of therapeutic interventions, including strength training and manual therapy exercises. These therapies, such as progressive resistance training, aquatic exercises, and weight training, were implemented to improve her muscle power, flexibility, and balance. Despite the challenges posed by CP, the intervention resulted in modest improvements in her motor function and overall physical abilities. The findings from the case study showed that Shamo experienced some positive changes, such as enhanced muscle strength and mobility, though the progress was relatively modest. The combination of physical therapy approaches, particularly strength training and aquatic therapy, contributed to improvements in her functional abilities, although the extent of the improvements varied. The results highlight the potential benefits of strength training and manual therapy for children with CP, while emphasizing the importance of an individualized, tailored approach to treatment to maximize outcomes. In conclusion, strength training, when integrated with other therapeutic methods, can provide significant improvements in muscle function, activity limitations, and participation in daily life for children with cerebral palsy. However, further research is necessary to determine the most effective strategies for different children with CP.

Key words : Manual Therapy Exercises Improving Movement in a Child , Cerebral palsy and Muscle Hypotonia.

**المخلص:**

شلل الدماغ (CP) هو حالة عصبية تؤثر على التحكم في العضلات، مما يؤدي إلى صعوبات حركية وضعف العضلات لدى الأطفال، مما يعيق قدرتهم على أداء الأنشطة اليومية والمشاركة في المهام الوظيفية. يتطلب التعامل مع هذه الحالة نهجًا شاملاً ومتعدد التخصصات، بما في ذلك العلاج الطبيعي، لتحسين جودة الحياة للطفل وعائلته. يلعب أخصائيو العلاج الطبيعي دورًا حيويًا في تعزيز الاستقلالية البدنية باستخدام تقنيات متنوعة لمعالجة العجز في المهارات الحركية، والتنسيق العضلي، والضعف، والتنسيق الحركي.

تضمن هذا البحث دراسة حالة لطفلة تبلغ من العمر 12 عامًا تُدعى شمو خالد، تم تشخيصها بشلل دماغي، وخضعت لعدد من التدخلات العلاجية بما في ذلك تمارين تقوية العضلات والعلاج اليدوي. تم تطبيق هذه العلاجات مثل التدريب التدريجي للمقاومة، والتمارين المائية، وتدريب الأثقال لتحسين قوة عضلاتها ومرونتها وتوازنها. على الرغم من التحديات التي يفرضها شلل الدماغ، فقد أسفرت التدخلات عن تحسينات معتدلة في وظائفها الحركية وقدراتها البدنية بشكل عام. أظهرت نتائج دراسة الحالة أن شمو شهدت بعض التغيرات الإيجابية مثل تعزيز قوة العضلات والحركة، على الرغم من أن التقدم كان محدودًا. أسهم الجمع بين تقنيات العلاج الطبيعي، وخاصة تمارين تقوية العضلات والعلاج المائي، في تحسين قدراتها الوظيفية، على الرغم من تفاوت درجة التحسن. وتبرز النتائج الفوائد المحتملة لتدريب القوة والعلاج اليدوي للأطفال المصابين بشلل الدماغ، مع التأكيد على أهمية تبني نهج فردي مخصص للعلاج لتحقيق أفضل النتائج. في الختام، يمكن أن يوفر تدريب القوة، عند دمجه مع أساليب علاجية أخرى، تحسينات كبيرة في وظائف العضلات، وتقليل القيود في الأنشطة، والمشاركة في الحياة اليومية للأطفال المصابين بشلل الدماغ. ومع ذلك، فإن هناك حاجة إلى مزيد من البحث لتحديد الاستراتيجيات الأكثر فعالية للأطفال المصابين بشلل الدماغ.

**الكلمات المفتاحية:** تمارين العلاج اليدوي، تحسين الحركة لدى الأطفال، شلل الدماغ، نقص التوتر العضلي.

## Introduction :

Cerebral palsy (CP) is a significant neurological condition caused by brain damage that occurs during early development. This disorder disrupts the normal progression of motor skills, muscle tone, and coordination, which are essential for everyday functioning. In addition to motor impairments, children with CP often experience mental and speech disorders, which can further complicate their overall development. The clinical presentation of CP is multifaceted, often involving motor and sensory dysfunctions, intellectual disabilities, and difficulties with cognitive functions. In more severe cases, children may also experience epileptic symptoms. The onset of cerebral palsy typically occurs either during the prenatal period or at birth, resulting in incomplete or abnormal development of the brain (Paleg et al.,2018).

The most noticeable symptom of CP is the disturbance in motor functions. Children with CP may suffer from paralysis, paresis (partial paralysis), hyperkinesia (excessive movement), and ataxia (lack of coordination). These motor issues are often accompanied by additional problems, such as speech disorders, cognitive delays, and sensory impairments like difficulties in vision and hearing. The specific nature and severity of these symptoms depend largely on the location and extent of the brain injury. One of the most common forms of cerebral palsy is spastic CP, which affects the muscle tone, causing stiffness and difficulty in movement. This form can manifest in various ways, such as monoplegia, which affects only one limb, or spastic hemiplegia, which impacts one arm and one leg on the opposite side of the brain injury. Double spastic paraplegia affects both legs, while spastic quadriplegia involves all four limbs.

Apart from the spastic form, CP can also present in hypotonic or atonic forms, especially in younger children. In these cases, the child's muscles may be weak and lack tone, and over time, this can develop into spasm, athetosis (involuntary movements), or dystonia (muscle contractions causing abnormal postures). Additionally, brain injury in the extrapyramidal system, which controls involuntary movements, can result in a hyperkinetic form of CP. It is also not uncommon for children to experience a mixed form of cerebral palsy, where both pyramidal (spastic) and extrapyramidal (non-spastic) symptoms are present due to widespread brain involvement (Günel et al.,2014).

Cerebral palsy frequently leads to severe disability, making it one of the most challenging conditions to manage. Early diagnosis and intervention are crucial for improving the long-term outcomes of children with CP. The condition is difficult to diagnose in infants under six months of age, except in extreme cases. However, early signs of CP, such as developmental delays and abnormal muscle tone, typically begin to appear in the first few months of life. Infants who are at risk of developing cerebral palsy, such as those with a history of premature birth, low birth weight, or oxygen deprivation at birth, should be closely monitored by pediatric neurologists. Regular developmental assessments and clinical examinations, including evaluations of muscle strength, reflexes, and sensory function, are essential for identifying CP early and initiating treatment as soon as possible (Franki et al.,2020)

The goal of this study is to assess the role and effectiveness of manual therapy exercises as part of a physical therapy and rehabilitation program for children with cerebral palsy, focusing on early childhood. Manual therapy, combined with other therapeutic approaches such as conductive education, has the potential to significantly improve motor skills, muscle tone, and overall function in children with CP. Beginning therapy early in life is essential to maximizing the child's developmental potential and minimizing the long-term impact of the disorder. Early and continuous rehabilitation can help these children achieve greater independence, reduce the severity of their symptoms, and improve their overall quality of life

## Literature Review:

Diplegic cerebral palsy primarily affects the upper limbs in children, significantly restricting their ability to engage in daily activities. This condition is characterized by muscle stiffness, impaired sensation, and reduced strength, all of which contribute to a decline in upper limb function and quality. Children with diplegic CP often display abnormal patterns of grasping, weakness, spasticity, incomplete finger movement, and sensory disturbances.

Pediatric rehabilitation for cerebral palsy requires a comprehensive, multidisciplinary treatment (MDT) approach to foster both functional and psychological independence in affected children. This approach also aims to improve the quality of life (QoL) for both the child and their family. Physiotherapists, as movement specialists, play a crucial role in this MDT. The primary objective of physiotherapy is to help children with cerebral palsy achieve optimal physical independence and community participation by minimizing the impact of their physical impairments. Additionally, physiotherapy seeks to enhance the overall quality of life for both the child and their family, who are integral to the rehabilitation process (Weber et al.,2014).

Physiotherapists utilize a variety of therapeutic techniques to improve the functional abilities of children with motor impairments. These interventions focus on enhancing gross motor skills, functional mobility of the trunk and extremities, and

activities such as positioning, sitting, transitioning from sitting to standing, walking (with or without assistive devices and orthoses), as well as wheelchair use and transfers.

Children with cerebral palsy often experience motor impairments in the trunk and extremities, which hinder their participation in physical activities and negatively affect their cardiopulmonary fitness, stability, muscle strength, and agility. To address these challenges, several therapeutic models have been implemented in recent years, many of which are considered best practice and have become established treatment protocols. However, more well-controlled, randomized trials are necessary to assess the effectiveness of these approaches and determine the most appropriate role for new technologies in the rehabilitation of children with cerebral palsy (Franki et al.,2020).

Physical therapy for patients with cerebral palsy focuses on reducing spasticity and maintaining joint mobility, as spasticity is a primary symptom that limits functional mobility, flexibility, and stability. Traditionally, muscle strength training was avoided in children with cerebral palsy because it was believed that such exercises could worsen spasticity and further restrict the range of motion.

However, recent studies have shown that muscle strengthening has become an effective therapeutic intervention for improving strength and function in individuals with cerebral palsy. While strength training is often used as a standalone treatment, it is also increasingly combined with other interventions, such as motor learning and aerobic training, to enhance outcomes.

Strength training for children with cerebral palsy was once discouraged due to concerns about exacerbating spasticity. Despite this, uncontrolled studies suggest that strength training can increase lower limb muscle power without exacerbating stiffness. While some studies provide evidence supporting the benefits of strength training in improving muscle power, it is important to note that the quality of these studies has sometimes been lower, which may lead to overestimation of the effects (Günel,2009).

Emerging research highlights that strength training can significantly improve muscle power and physical activity levels in children with cerebral palsy. In particular, strength training enhances muscle power, flexibility, posture, and balance. It also promotes better performance in daily activities, such as walking and jogging. Although strength training for CP was once believed to contribute to muscle tightness (spasticity), current evidence shows that it has beneficial effects. Resistance training, cycling, weight lifting, and aquatic exercise have all been found to improve both body structure and function in individuals with cerebral palsy.

It is important to recognize that each child with cerebral palsy requires a personalized approach. Strength training can offer various benefits, including improvements in balance, flexibility, muscle strength, and posture. Additionally, strength training helps to strengthen weak antagonist muscles and reduce spasticity in agonist muscles, providing functional benefits and improving overall mobility. As a result, strength training has become a widely used and effective technique to enhance the physical abilities of children with cerebral palsy (Sewell et al.,2014).

### **Types of Strengthening Exercises:**

#### **1. Aqua-based Training:**

Water-based exercises offer numerous benefits for muscle development. The unique properties of water, such as reduced gravity and joint load, create an ideal environment for children and adolescents with cerebral palsy. The buoyancy of water decreases the demands on body control and makes weight-bearing activities easier. Aquatic exercises also provide better joint protection compared to land-based exercises. Studies have shown that performing motor tasks in water not only builds confidence but also requires less resistance to complete challenging activities than on land.

Water activities are often more enjoyable and stimulating for children, potentially increasing motivation and engagement. For children with higher levels of gross motor function (GMFCS) and severe movement impairments, aquatic training can be especially beneficial, as it can overcome the limitations that children face when engaging in physical activities on land. In short, water-based exercises can provide lifelong advantages for individuals with cerebral palsy, improving both physical fitness and motor function.

However, there is a lack of comprehensive aquatic training programs specifically for children with cerebral palsy, and the full impact of these therapies remains under-researched. Despite this, studies have demonstrated that aquatic training can improve flexibility, respiratory function, muscle power, and gross motor function in children with CP(Günel et al.,2014).

## 2. **Isokinetic Training:**

3. Isokinetic training is a form of resistance exercise where muscle contractions occur at a consistent speed, facilitated by mechanical devices like the Cybex II. This type of training adjusts the resistance based on the force applied, meaning the resistance increases as the speed of the movement increases. The device ensures that the maximum effort exerted during the movement is met with maximum resistance. Isokinetic resistance training has been shown to be an effective and safe method for improving both strength and power in individuals with cerebral palsy, particularly in reciprocal movement patterns. Studies using the Cybex II, the equipment used in this study, have demonstrated the reliability of this training method. Despite some concerns about the potential risks of resistance training for individuals with cerebral palsy, such as increased muscle tone at rest, abnormal posture, and limited range of motion, research indicates that rigorous resistance training can enhance strength in CP patients. However, there is a lack of studies investigating the specific effects of systematic resistance training on movement function in individuals with cerebral palsy. It is also worth noting that repeated attempts at exercises without resistance have been shown to improve muscle activation efficiency, as evidenced by electromyography recordings. Though these studies have been conducted on individuals without CP, the observed improvements in nerve-muscle performance highlight the need for further research in this area for children with cerebral palsy. In conclusion, while both aquatic training and isokinetic exercises have demonstrated potential benefits for children with cerebral palsy, more research is needed to fully understand their impact on movement function and muscle development in this population (Nikolovska et al.,2023).

## 4. **Progressive Resistance Exercise (PRE):**

Progressive resistance exercise (PRE) is a well-established strength training method that involves gradually increasing the intensity of exercises. This approach leads to greater gains in strength compared to regular growth and development. The main principles of PRE include providing sufficient resistance so that the individual can complete only a small number of repetitions (typically 8-12) before experiencing fatigue. As strength improves, the resistance is gradually increased, and the training program continues for a sufficient duration to yield long-term benefits.

Systematic reviews have shown that strength training in children with cerebral palsy can enhance muscle power without causing issues such as increased stiffness or restricted range of motion. However, a recent analysis concluded that strength training might not be effective in children with cerebral palsy in terms of improving certain functions, such as walking. Despite these findings, controlled studies suggest that incorporating strengthening exercises into a regular daily exercise routine can effectively increase strength levels.

In daily activities, a minimum level of muscle strength is required, often referred to as the lowest threshold. While strength training can increase strength above this threshold, there may be limited benefits for further improving movement development once the strength reaches the maximum threshold. Therefore, if the goal is solely to improve mobility, strength training alone may not be sufficient. Other factors, such as balance and coordination, may play a more significant role in enhancing mobility than muscle strength alone.

Functional PRE has been shown to improve muscle strength in children with cerebral palsy. It can also be integrated into more intense rehabilitation programs or used as a targeted treatment following temporary muscle weakness, which may occur before or after interventions such as Botulinum Toxin A injections or surgical procedures (Miller ,2020).

## 5. **Aerobic Exercises**

Children with cerebral palsy often experience deficits in both endurance and strength. The extent of the impact on strength can vary between studies, and this variability may be due to differences in intervention methods, including intensity, frequency, and duration. Bicycle riding is a commonly used rehabilitation tool in physiotherapy to improve muscle strength and cardiovascular health. It is recommended as a suitable exercise for individuals with cerebral palsy to help maintain overall fitness. Stationary cycling, in particular, provides resistance training for the lower extremities and can improve muscle strength. Although more research is needed to fully assess the benefits of stationary cycling for children with cerebral palsy, preliminary findings suggest that it has the potential to enhance both strength and cardiovascular fitness, all while requiring minimal balance and motor control.

Treadmill training with partial body weight support (TTPBWS) is becoming increasingly popular as a rehabilitation method for children with cerebral palsy. Most studies on TTPBWS consist of small, non-randomized trials or case reports, often lacking control groups. Two recent reviews have shown that TTPBWS can be both safe and effective in improving walking speed, with one study suggesting it may also enhance gross motor abilities. However, there is insufficient evidence to conclusively

determine its effectiveness, and further randomized trials are needed to explore its efficacy, optimal dosage, and other critical factors. These studies have called for more rigorous trials to evaluate the impact of TTPBWS on children with cerebral palsy.

Additionally, treadmill training has been shown to positively influence gait characteristics and can lead to improvements in gross motor skills. Several studies investigating the effects of treadmill training on gross motor function have reported significant improvements in various dimensions, particularly in walking, running, and jumping, as measured by the Gross Motor Function Measure (GMFM) (Bampouli et al.,2022).

## **5. Weight Training**

Strength training can be beneficial for children of all ages when conducted properly. However, it is essential not to exceed the maximum load before physical growth is fully complete, to prevent potential harm to the musculoskeletal system. Key safety considerations include gradually increasing the resistance, especially for weaker children, to prevent lifting weights without adequate supervision. Additionally, children should not perform exercises targeting the same muscle groups on consecutive days to allow proper recovery. If a strength training program leads to persistent pain or increased muscle stiffness, adjustments to the protocol should be made to prevent further issues(Günel,2011).

## **6. Sports and Recreation**

Incorporating activities that children with cerebral palsy already enjoy can be an effective way to enhance their strength and endurance. Childhood and adolescence are crucial stages for children with impairments to develop self-confidence, along with attitudes and behaviors that will positively influence their adulthood. Participation in play, recreation, and sports is vital for overall development, serving as an essential part of childhood and adolescence. Regular physical activity during these formative years provides both physiological and psychological benefits, including increased muscle density, improved fat-free muscle mass in adulthood, better weight management, a reduced risk of high blood pressure, and a decreased sense of depression and social isolation (Günel,2011).

## **7. Electrical Stimulation**

Electrical stimulation is an effective tool for alleviating muscular weakness associated with cerebral palsy in children. It aims to improve muscle strength and motor performance through various methods. Transcutaneous Electrical Nerve Stimulation (TENS) is a portable, non-invasive technique that can be used at home by parents or caregivers. Another approach, Neuromuscular Electrical Stimulation (NMES), involves administering a transcutaneous electrical current to induce muscle contraction. This method is believed to enhance muscle strength by increasing the cross-sectional area of the muscle and recruiting type II muscle fibers.

Functional Electrical Stimulation (FES) is a variation where electrical stimulation is applied to specific muscles during tasks or activities to encourage contraction. While there is some evidence supporting the use of NMES in children with cerebral palsy, many studies have limitations such as the use of concurrent therapies, differences in application methods, and challenges in measuring functional outcomes. Despite these challenges, NMES has shown promise in improving quadriceps muscle strength in ambulatory diplegic children with cerebral palsy who may struggle with traditional resistive strength training. Electrical stimulation can be particularly beneficial for children and adolescents with cerebral palsy to increase muscle power, improve functional abilities, and strengthen muscles following orthopedic treatments (Ha et al.,2022).

## **8. Plyometric Exercises**

Functional exercise training plays a significant role in improving the physical fitness, activity intensity, and overall quality of life for ambulatory children by integrating aerobic, anaerobic, and strength training capabilities. One study highlighted that incorporating plyometric exercises into the physical therapy programs of children with unilateral cerebral palsy led to notable improvements in muscular strength and walking performance. Plyometric exercises are a form of resistive strength training where a muscle first contracts eccentrically (lengthens) and then quickly contracts concentrically (shortens). These exercises generate high-velocity dynamic movements and high-impact forces on muscles and bones, which can significantly enhance muscle power and endurance.

While previous research has largely overlooked plyometric exercise as a method for optimizing muscle strength in children with cerebral palsy, recent studies have demonstrated its efficacy in improving muscle strength in both adults and pre-pubertal children. Furthermore, plyometric training has been found to be a safe and effective approach to improving motor abilities and muscle strength in young children with cerebral palsy (Franki et al.,2012).

## 9. Upper Extremity Strengthening and Arm Ergometer

Muscle strengthening is a vital treatment strategy for individuals with cerebral palsy to enhance their strength and functional abilities. It can be used independently or alongside other interventions, such as electrical stimulation, botulinum toxin A (BoNTA), aerobic training, or motor training. Upper extremity weakness is a significant concern in children with cerebral palsy, as it directly affects their ability to perform daily activities. Evidence suggests that muscle weakness in the upper limbs impairs functional capacity, which can limit the child's independence.

To prevent muscle contractures and functional impairments, continuous upper extremity exercise is crucial for individuals with cerebral palsy. Given that insufficient muscle strength is a key factor influencing motor function in these children, improving muscle strength becomes a fundamental component of their rehabilitation. Although there is limited research on enhancing upper extremity function in cerebral palsy through intensive physical exercise, strengthening the upper limbs through repetitive training is recognized as an effective rehabilitation treatment.

Ergometers, which are devices used for both upper and lower extremity training, have been widely used in the rehabilitation of cerebral palsy patients. The cycle ergometer, a stationary device allowing cyclic rotations in passive, active, and endurance modes, is an excellent option for promoting safe, adaptive exercise tailored to the specific impairments of this population. Cycling, whether on a moving or stationary bicycle or using an ergometer, is commonly included in rehabilitation programs for children with cerebral palsy. It aids in developing muscle strength in the lower legs, which is particularly beneficial for children who use wheelchairs, and also helps in preventing joint contractures ((Paley et al.,2018).

### Case Study:

#### Patient Background

*Shamoua Khalid* is a 12-year-old girl diagnosed with spastic cerebral palsy and muscle hypotonia. She presents with reduced muscle tone, limited range of motion, and difficulty performing basic movements such as walking, sitting, and standing. Shamoua has been receiving therapy for several years, including physiotherapy and occupational therapy, focusing on improving her motor abilities. However, despite these efforts, Shamoua continues to struggle with functional limitations, which significantly impact her quality of life.

Shamoua's family sought additional treatment options to enhance her mobility and overall strength. After consulting with her rehabilitation team, it was decided to incorporate manual therapy exercises into her therapy regimen to further improve her functional capabilities. The goal of this case study is to assess the effectiveness of manual therapy exercises in increasing Shamoua's movement abilities, specifically focusing on her muscle strength, joint mobility, and coordination.

#### Intervention: Manual Therapy Exercises

Manual therapy refers to a range of hands-on techniques applied by a skilled therapist to treat musculoskeletal dysfunctions, alleviate pain, and improve movement. The manual therapy exercises designed for Shamoua focused on increasing muscle tone, improving range of motion, and enhancing joint mobility. These exercises included a combination of soft tissue mobilization, joint manipulation, stretching, and strengthening exercises.

#### Treatment Plan and Methodology

The treatment plan for Shamoua was designed to address her specific needs, with particular emphasis on increasing strength and reducing the effects of muscle hypotonia. The manual therapy regimen incorporated the following approaches:

1. **Soft Tissue Mobilization:** The therapist used techniques such as myofascial release and deep tissue massage to reduce muscle stiffness and improve blood circulation in the affected areas. These techniques helped release tension in the muscles and allowed for a greater range of motion.

2. **Joint Mobilization and Manipulation:** The therapist utilized joint manipulation techniques to enhance joint mobility and reduce any stiffness caused by abnormal muscle tone. This also aimed to improve Shamoua's ability to perform functional movements such as sitting, standing, and walking.
3. **Stretching Exercises:** Gentle stretching exercises were incorporated to improve flexibility and prevent muscle contractures, which are common in children with cerebral palsy. Stretching helped increase the range of motion in Shamoua's affected joints, promoting better overall movement.
4. **Strengthening Exercises:** The therapist designed specific exercises to target weak muscles and improve overall strength. These exercises focused on the lower extremities, as this was where Shamoua experienced the most weakness. The goal was to improve her balance, posture, and functional mobility.
5. **Functional Movement Training:** The therapist incorporated functional training exercises to improve Shamoua's ability to perform everyday tasks. This included walking, sitting to standing transitions, and weight-bearing exercises to enhance stability and mobility.

## Results

Over the course of six months, Shamoua attended manual therapy sessions twice a week. The results showed modest improvements in her mobility, muscle tone, and strength. While the improvements were not dramatic, they were enough to enhance her quality of life. Key findings from the intervention include:

1. **Improved Muscle Tone:** There was a noticeable improvement in Shamoua's muscle tone, particularly in her lower limbs. The muscle hypotonia, which had previously resulted in weakness and lack of coordination, was slightly improved. This allowed her to better control her movements, especially in her lower extremities.
2. **Increased Range of Motion:** Shamoua experienced an improvement in joint mobility, particularly in her hips, knees, and ankles. She showed greater flexibility and was able to achieve a more functional range of motion, which allowed her to perform basic tasks such as sitting, standing, and walking with less effort.
3. **Enhanced Strength:** Although the improvements in muscle strength were modest, there was a noticeable increase in the strength of her lower limbs. Shamoua became more independent in her daily activities and was able to perform certain tasks, such as walking with support and standing, with less assistance.
4. **Improved Functional Mobility:** Shamoua's ability to transition from sitting to standing and walk with minimal assistance showed slight improvement. She also demonstrated increased stability while standing, which contributed to her overall independence.
5. **Psychological and Emotional Impact:** The improvements in mobility and strength positively affected Shamoua's psychological well-being. She appeared more confident and enthusiastic about engaging in physical activities. Her parents reported that she became more active and expressed a greater interest in participating in recreational activities.

## Challenges and Limitations

While Shamoua's therapy regimen led to some improvements, the progress was not as substantial as anticipated. This could be attributed to several factors, including:

- **Severity of the Condition:** Shamoua's cerebral palsy is quite severe, and her muscle hypotonia significantly impacts her ability to perform daily activities. While manual therapy exercises improved her condition, the severity of her disability limited the extent of progress.
- **Consistency and Adherence:** Although Shamoua attended her sessions regularly, the effectiveness of the therapy would have been greater with more frequent sessions and consistent at-home exercises.
- **External Factors:** Shamoua's psychological state and external factors, such as her family's support system and access to other therapies, played a role in the outcomes of the therapy. Family engagement and additional support could enhance the benefits of the intervention.



## Conclusion

The case of Shamoua Khalid demonstrates that manual therapy exercises can lead to modest improvements in mobility, muscle strength, and overall function in children with cerebral palsy and muscle hypotonia. While the results were not drastic, they provided Shamoua with increased independence in her daily activities and enhanced her quality of life. Manual therapy, when integrated with other therapeutic interventions, has the potential to contribute positively to the rehabilitation of children with cerebral palsy.

Further research is needed to explore the long-term effects of manual therapy on children with cerebral palsy, particularly those with severe muscle hypotonia. Additionally, a more intensive and individualized approach may be necessary to achieve more significant improvements in movement and strength. Despite the challenges, this case highlights the importance of a comprehensive and multidisciplinary treatment plan in managing cerebral palsy and improving the quality of life for affected children.

Muscle weakness is a prevalent issue among children with cerebral palsy, significantly impacting their motor performance and ability to perform daily activities. The development of muscle strength plays a crucial role in enhancing functional abilities and overall movement. Various strength therapies, such as isokinetic training, progressive resistance training, aerobic exercise, weight training, upper limb strengthening, aquatic training, sports and recreation, and electrotherapy, offer effective approaches to address these challenges. Strengthening exercises for children with cerebral palsy can lead to improvements in body posture, functional performance, activity limitations, and overall participation in daily life.

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