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# **Integrative Treatment for Children with Cerebral Palsy**

Rebecca Palter

## **Introduction**

Cerebral palsy is the manifestation of an injury to the areas of the brain that control voluntary movement. Cerebral palsy is the most prevalent motor disorder in children [9]. Specifically, it occurs in 1.5 to 4 out of 100 births [1]. One of the most difficult aspects of treatment is that, depending on the areas that are damaged, the disorder can manifest in very diverse ways [2]. The purpose of this paper is to establish guidelines to create the optimal treatment for a child with cerebral palsy in terms of motor improvement and practicality.

Cerebral palsy can be caused by abnormal brain development or damage to the developing brain while the child is in utero, at birth, or during the first year of the child's life [1]. Cerebral palsy is caused by damage to the brain, rather than to the muscles or nerve fibers [3]. The causal damage is thought to exist in the basal ganglia, brainstem, cerebellum, and/or cortispinal tracts [2]. These areas are responsible for more basic functions as opposed to the forebrain, which is the center of human reasoning. This does not mean that other parts of the brain will not be affected by the damaging event that causes cerebral palsy (CP). There has been no clear correlation between the area of damage and the way in which it manifests [2].

## **What is Cerebral Palsy?**

The main characteristic of CP is a difficulty to maintain balance and posture. CP is characterized by two dimensions of the disorder: the time at which the disorder is caused and the way in which the motor difficulties manifest [1]. Congenital CP occurs before the child is born or within a short time after its birth, while acquired CP is caused by damage that is incurred at least 28 days after birth. Acquired CP is usually associated with some type of head injury or an infection.

There are several different categories of CP that are determined by the symptoms that are experienced. The first is spastic CP, characterized by increased muscle tone or muscle tightness. Within spastic paralysis, there are three classes to define what area of the body is affected: spastic diplegia (legs), spastic hemiplegia (half of the body), and quadriplegia (all four limbs). This is the most common type of CP. The second category is dyskinetic CP. People affected by this category of the disorder have difficulty controlling their extremities. The third category is ataxic CP, characterized by a difficulty with balance and coordination. Some people have a combination of two types of CP, with the most common being spastic-dyskinetic CP.

The extent of developmental damage caused by the disorder is judged by using the differences between three ages: birth age, gestational age, and developmental age. The birth age of a child is how long it has been since that child was born. The gestational age of a child takes the date that they were due to be born into account. The child's developmental age is based on an assessment of the child's reflexes, responses to the environment, and other motor and cognitive abilities. The goal of treatment is to decrease the difference between the developmental age and birth or gestational ages. The developmental age can be compared to either the birth or gestational ages to

document a change. The earlier this difference is detected, the earlier treatment can begin, allowing for better lifetime improvement to happen for the effected individual.

CP is often paired with other developmental disorders, such as autism or epilepsy. In 60 percent of cases, an 8-year-old child with CP has co-morbidity with another disorder [1]. The high levels of co-morbidity reflect the complexity of this disorder. Although there are landmark symptoms, such as difficulty with movement and balance, there are other complexities depending on the specific area of the brain where the damage has occurred. There are also high incidence rates of psychological distress that occurs with CP. Roughly 40 percent of children scored above an abnormal boundary on a test of psychological disturbance [4]. For instance, a child with CP may be frustrated by their inability to walk like their classmates, but their psychological disturbance would stem from the fact that they feel like a burden to their family. These difficulties that extend beyond the realm of motor skills should be taken into account when treating the child [4].

Because CP is caused by the brain damage incurred by an event or illness, the damage is not progressive. The area that is initially damaged is the only area that will be directly damaged by the disorder [1]. This means that the effects of the disorder will remain the same throughout an individual's lifetime. However, the implications could be different. CP only affects the motor centers of the brain and therefore has no effect of life expectancy [9]. It is the causes of CP that can limit the life expectancy of a child [1]. Some of the leading causes of shortened life expectancy are anoxia (limit of oxygen), trauma, or infection [2]. All of these causes do not have isolated damage. When these events occur, they can lead to damage in other areas. If the damage occurs to areas that control functions that maintain life, it can be a threat to that individual's life.

### **Current Therapies and Treatments**

Because there are a variety of ways that CP can manifest, there are many different treatments. Therapy ranges from types of physical therapy to injecting Botox into the rigid muscles to cause them to relax [2]. The goal of most treatments is to decrease the pain of the subject, as well as increase voluntary motor control. Depending on the type of CP, this control could mean a decreased tightness of limbs, increased balance, or an increased level of fine-motor control. Treatments are often combined with other medications to manage the additional effects of the brain damage [3].

Most of the research on therapies for CP focuses on the motor aspect of the disorder, which is the easiest to observe and measure in all patients. The two main areas of treatment that are currently being compared in the field are occupational therapy and constraint-induced therapy. Other experimental treatments are often paired with one of these treatments to test the effectiveness of the experimental treatment. Although both of these treatments have similar goals, they have specific ways of being implemented with CP patients.

#### *Occupational Therapy*

When providing occupational therapy the therapist provides the family with options of possible treatment, and then they work together to decide on the best possible treatment for the individual [5]. The therapist then records measurable

differences and reports them to both the family and the referring doctor in order to make the patient's progress known [5]. A specific area of occupational therapy that is becoming increasingly popular is occupational home therapy programs, or OTHPs [5]. This design allows patients to work in their own homes, thereby reducing the need for patients to go to a clinic or to have a clinic setting that is similar enough to the environment that the patient will consistently be in [5]. This change in the therapy setting can result in decreased anxiety for the patient and increased parental involvement. In addition, the activities involved in the therapy can be more tailored to the child's specific needs.

In current studies involving, OTHPs a 5-step process is used: create a collaborative relationship with the parents, set mutual goals, choose activities that will be effective at attaining those goals, provide the parents with updates on how the child is progressing, and evaluate the outcomes [5]. A study compared children who received OTHPs with children who did not receive OTHPs [5]. This study found no adverse effects with the children who were in OTHP programs, and children in the shorter programs elected to continue onto a longer program when offered it [5]. Based on the results of the study, the researchers have several pieces of advice to offer to pediatricians when working with families of CP children. They recommend that the approach to treatment should involve collaboration, be goal-oriented and use evidence to document progress. They believe that individualized measures should be used rather than normative tests [5]. By creating individualized scales, it is easier to chart a patient's improvement. The study also recommended that the activities be chosen by family and that the family is given support in implementing them [5]. It is argued that if the family choose the activities that they want their child to do, they will be more likely to implement the activities [5]. The researchers argue that this type of occupational therapy may not have been as effective as possible in the past because the new suggestions that the therapists have made have not been followed or because the baseline assessment excludes too many candidates from the treatment [5]. With the new suggestions on how to implement treatment researchers hope to generalize OTHPs to a larger group.

### *Constraint-Induced Therapy*

The second main area of therapy for individuals with CP is constraint-induced therapy. The goal of this therapy is to increase use of a limb that cannot be controlled because of injury to the brain, spinal cord, or nerves extending from the spinal cord. The therapy relies on the phenomenon that has been observed in stroke patients called spontaneous recovery [6]. In this occurrence, the patient regains some amount of their original movement after the stroke. This has yet to be completely explained but it is thought to be due to neuroplasticity [6]. Neuroplasticity is the concept that our brains can be changed, which is observable in everyday life. If someone learns a new skill they are training their brain to perform a series of tasks that it had not previously performed. It is only recently that this idea has been applied to regenerating motor abilities that have been created and then lost.

In order to apply the results of previous studies, we must combine the finding with the theory of learned nonuse. Learned nonuse is a theoretical model for why spontaneous recovery may not occur as often as possible. After a stroke, a patient often

discovers that they have lost use of one of their limbs. After failed attempts to use that limb, they may become frustrated and resort to using one limb [6]. As the individual ceases to use a limb, the region of the cortex used to control that area of the body shrinks [6]. Ultimately the individual appears to lose complete control of the limb [6]. Constraint-induced therapy was used to combat this pattern of learned nonuse in stroke patients. After this treatment, individuals in the treatment group showed a significant increase in motor abilities [6]. Since the initial study, many more studies have been published, all of which show improvement in subjects and many of which show long-term positive effects [6].

Because so many of these studies showed positive results in individuals who had difficulties with motor control, the therapy was applied to children with CP. Applying this treatment to children optimizes the high amount of neuroplasticity seen in young children, as opposed to adults [7]. In the brain, there are two types of tissue: gray matter and white matter. Gray matter contains the cell bodies of the cells that send neural signals and white matter consists of the connections between those cell bodies [10]. As we grow older, the amount of gray matter decreases and the amount of white matter increases, which is thought to be caused by a process called synaptic pruning [7]. Synaptic pruning is the strengthening of connections that are used most often, and the loss of connections that are unused or redundant [7]. By using this technique with children, the therapy optimizes a time in a child's life when not all of the connections between cells have been solidified. If connections are increased through therapy, a child may be able to utilize areas of the brain that have not been damaged for tasks that would have otherwise been assigned to the injured areas. As stated earlier, damage usually occurs to the mid- and lower-brain areas rather than the cortical areas [2]. Because of this, much of the cortex may not be damaged and therefore new connections could be made there to navigate around the damaged areas in the lower structures.

In children with CP, CI treatment is particularly used on hemiplegic individuals, or individuals that have restricted motion only on half of their body. A study assigned children to wear a removable cast on their less affected arm for three weeks [8]. The children in the treatment group showed significant improvements in the amount and quality of use of their more affected arm [8]. Benefits of the therapy were observed for six months after the permanent removal of the cast [8]. While these results seem promising for children with CP, limitations have been identified.

First, this study only contained only children with spastic hemiplegia CP. Even within those children, it did not take into consideration other difficulties that the child might have been experiencing in addition to reduced motor control. Second, this type of therapy does not make movement "normal", nor does it restore the quality of movement to the level it was before the injury [6]. Although there is an improvement from the observed motor baseline, there is still a deficit. The final issue with CI therapy is that the level of improvement and the retention of that improvement depend greatly on the initial injury [6]. Children who begin the therapy with a higher level of function improve a larger amount and are able to retain that improvement for a longer period of time. Furthermore, higher functioning children show a reduction in affect of roughly twenty percent after one year.

### *Comparison*

Each of these therapies has both strengths and weaknesses. One of the main weaknesses is the aspect of psychological difficulties. Both therapies only address the motor aspect of the disorder, but previous research has found that this is not the main area that causes psychological distress [4]. Even if the motor abilities of the patient increased, the psychological distress would not necessarily decrease. The treatments also ignore the associated problems that can come with CP, such as mental retardation or difficulties with vision. Lastly, the studies analyzing constraint-induced therapy and occupational therapy only require the patient to be in treatment for a short period of time, usually three to eight weeks. Most likely a child would spend some amount of their time in therapy throughout their entire life, and therefore this is not the best way to test the success of a treatment.

### **Proposal**

In order to optimize the best parts of the treatments that have been discussed, a longitudinal study should be created in which the patient is viewed holistically, rather than as a collection of motor symptoms. The best treatment to use in order to facilitate the greatest increase would be an occupational therapy program that utilizes a family structure and includes additional support systems for the child's psychological needs.

In order for the child to have any amount of improvement, there needs to be a solid support system. This usually consists of family members, but this does not always have to be the case. As long as there are individuals who will help implement the treatment on a regular basis and communicate with therapists and doctors the child will be able to gain more improvements. The best type of therapy for any child to initially engage in is occupational therapy. Occupational therapy works for children with a wider range of symptoms than constrain-induced therapy and it helps the child both improve their motor abilities and have increased autonomy. The ideal setting in which the treatment would take place would be the primary residence of the patient. One main goal of occupational therapy is to teach the patient how to move around their environment and accomplish tasks in ways that take into consideration their disabilities. If the therapist is able to view the home environment, they may be able to create new ways for the child to accomplish goals that are specific to their environment.

One area where all studies of therapies have fallen short is the timeline in which they study the effects of therapy. Most types of therapy that address a chronic impairment should continue for the patient's entire life. Many of the studies examined how the patient's improvements lasted after the treatment ended; however, this is not realistic because the treatments would likely never end completely. Another aspect of the treatment that should be changed to take into account lifelong treatment is that the treatment plan should not be static. As a person improves and ages they will likely have different goals that will be hindered by different aspects of their disorder. The therapy plan will have to change to help the patient accomplish their new goals and work on different areas of improvement.

Because of the high instance of co-morbidity with both psychological disorders and other medical problems, it is important that the treatment for CP not only be limited to occupational therapy. The patient may need to take medication or see specialists for other issues. A key aspect of addressing different treatments is that the treatment

providers must remain in communication with one another. This is another area where the family support structure is very important. It is crucial that each treatment change be well documented in order to convey needs to other parts of the care team. Because of the complexity of the disorder, it must be examined on multiple dimensions.

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