



# A PEDIATRIC *Perspective*

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## **Hyperbaric oxygen, electrical stimulation and Conductive Education: Do alternative treatments for cerebral palsy work?**

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News stories, Internet searches or family and friends sometimes encourage parents to seek additional information or referrals for "alternative treatments" for their children. But evaluating the merits of such treatments can be difficult.

Hyperbaric oxygen, electrical stimulation and Conductive Education are all alternative methods that proponents credit with achieving remarkable results for children who have CP. Is there scientific evidence that these methods really work, or are reported successes largely anecdotal?

### **Hyperbaric oxygen**

Centers that use Hyperbaric oxygen (HBO) chambers to treat a multitude of conditions have sprung up across the country. For certain acute conditions, studies have indicated that legitimate success can be achieved with HBO therapy.

Findings in a study by Siddiqui et al (Plast Reconstr Surg 1997) suggest that the pressurized administration of 100 percent oxygen does improve the ability of the body's tissues to utilize oxygen in the hours following treatment. FDA approved uses of HBO include treatment of crush injuries, carbon monoxide poisoning, healing of problematic wounds, anemia, gas embolism and others.

The goal of HBO treatment in patients with brain injuries is to intensify the delivery of oxygen to the brain to benefit the injured tissues. It is believed that there is a zone of potentially reversible injury – the penumbra. This applies only to acute injuries, however. And while studies have shown an increased rate of survival with the use of HBO for acute injury, no changes in outcomes have been reported.

As for brain injury related to chronic conditions, such as cerebral palsy, there is no area of tissue similar to the penumbra. HBO treatment for such conditions is still considered experimental and, until recently, published reports have been anecdotal, citing a variety of beneficial effects.

However, in September 2000, the findings of the first-ever randomized, placebo controlled, double blind, multicenter study of HBO treatment for cerebral palsy were reported. The Health Ministry in Quebec provided support for the investigation.

Under pressure from patients and their families to fund HBO treatment for children with cerebral palsy, the Health Ministry opted to first conduct an investigative trial. The results, reported at the

2000 annual meeting of the American Academy of Cerebral Palsy and Developmental Medicine, offer the first definitive evidence that HBO treatment in children with cerebral palsy is largely ineffective.

The Canadian study included 111 children. No participant was on any type of medication and all physical therapy was discontinued for the duration of the study. Each child received 40 treatments – five days a week, for eight weeks.

The experimental group received 100 percent oxygen at 1.7 ATA (atmospheres). This resulted in a partial pressure of oxygen of 1200 in the blood and delivered to the tissues. The control group received room air at 1.3 ATA, resulting in a partial pressure of oxygen at 150. Evaluations of both functional and developmental skills, as well as a neuropsychological exam, were performed to develop a pre-trial baseline, at the end of treatment, and three months post-study.

Outcomes showed some improvements in functioning for both the placebo and treatment groups. However, no significant treatment effect was seen.

It should also be noted that contraindications for HBO treatment do exist (see table 1), and complications include ear squeeze, sinus squeeze and a small chance of seizures. HBO also appears to cause transient changes in visual refraction.

Table 1

### **Contraindications for use of HBO treatment include:**

Pneumothorax  
 Some chemotherapeutic agents  
 Sinus disease  
 Difficulty equalizing pressure of the ears  
 COPD  
 RAD

### **Electrical stimulation**

In theory, electrical stimulation results in decreased spasticity and improvement of gross motor skills.

Certain types of electrical stimulation have been used with cerebral palsy patients for decades. These include Neuromuscular Electrical Stimulation (NMES) or Functional Electrical Stimulation (FES). Both involve stimulation that produces a muscle contraction with the goal of strengthening and training the muscles.

Not long ago, rehabilitation medicine frowned on the notion that strengthening spastic muscles could have positive effects. It was believed that strengthening these muscles would not only result in stronger muscles, but greater spasticity. Today, we know that strengthening any muscle to improve volitional control makes sense — even if the muscle is spastic. The spasticity remains, but the individual's ability to control that muscle improves.

Consider the successful use of FES or NMES to strengthen ankle dorsiflexor or hip extensor muscles prior to selective dorsal rhizotomy surgery (the cutting of nerve rootlets near the spinal

cord to decrease muscle spasticity). Much of post-rhizotomy rehabilitation involves muscle strengthening, and optimizing a child's strength prior to surgery can assist with rehabilitation afterward.

## Threshold Electrical Stimulation

As the name suggests, Threshold Electrical Stimulation (TES) involves low-intensity stimulation at the sensory threshold – below the level of causing muscle contraction. Electrodes are placed in the direction of blood flow and muscle fibers, creating an electrical stream in the body while the patient sleeps.

Initially introduced by Dr. Karen Pape of the Magee Clinic in Canada, TES therapy (formerly known as Therapeutic Electrical Stimulation) has been used for more than a decade. Treatment is generally administered for a minimum of five hours, at least six nights a week. Treatment lasts two to three years.

The theory behind TES is that it:

- increases blood flow
- causes the secretion of trophic (nutritive) hormones
- provides increased sensory input in the absence of cortical inhibition

The perceived advantages of TES are that it is simple to administer, pain-free and occurs during the otherwise “wasted” time of sleep. It targets non-spastic muscles that promote motion opposite of the spastic muscles. TES has been used to treat multiple conditions including cerebral palsy, spina bifida, brachial plexus injury, spinal cord injury, arthrogyposis and others. But does it work?

Case reports have noted improvements in strength, spasticity, continence and motor skills. Pape's own 1993 study followed five patients receiving TES. Functional gains were noted during treatment, with regression when treatment was stopped. Outcomes were based on functional testing and patient report. The study, however, was not randomized, and patient awareness of treatment can skew results.

Nevertheless, a prospective study of TES by Steinbok et al (Devel Med Child Neurol, 1997) did show significant improvement in patients who had previously had a selective dorsal rhizotomy. The randomized, placebo controlled, double-blinded study followed 44 patients. While there was no change in spasticity, range of motion or strength, TES resulted in statistically significant improvements in gross motor function. These results suggest that TES may have positive benefits for certain populations of patients and further study is warranted.

## Conductive Education

Among the most controversial treatments for cerebral palsy is Conductive Education (CE). Dr. Peto András developed the method in the mid 1940s. Today, the Peto Institute for Conductive Education of the Motor Disabled in Hungary, serves more than 300 residential patients and 1,000 outpatients annually. Other CE centers have opened in England, New Zealand, Australia and the United States.

The educational approach is based on the theory that “proper functioning is achieved as a result of a purposeful, planned learning process, in the framework of a carefully and gradually constructed, continuously upgraded program,” as noted on the Institute's Web site. “Complex development of the personality,” says the method's proponents, is the key to enabling individuals with motor disabilities to become active members of society.

Students participate in all day, every day sessions facilitated by a trained “conductor.” Rather than receiving multidisciplinary care, provided by a variety of specialists, children receive “transdisciplinary” care with one conductor providing for all of the child’s educational and therapeutic needs.

The programs are highly structured with goal-directed tasks, sequenced activities, frequent use of rhyme and songs, and emphasis on skills for independence. The belief is that through repetition of tasks, the brain will find alternate pathways to send messages to the muscle groups to create the desired movement. Assistive technology, including wheelchairs, standers, walkers, etc., are not used. Rather, children use simple devices such as ladder back chairs to aid with therapeutic goals.

But is there evidence that Conductive Education produces the significant improvements its proponents claim?

First, it’s important to note that only a small percentage of children with cerebral palsy meet the criteria for Conductive Education admission. Bairstow et al (Devel Med Child Neurol, 1991) found that CE programs exclude children who have:

- significant cognitive impairment
- fixed contractures
- poorly controlled epilepsy
- visual problems
- medical problems
- severity of motor problems

It follows, then, that most children admitted to a CE program with cerebral palsy are likely to have mild spastic diplegia, a group of patients who tend to do better with therapy than others.

Two separate studies (Jour. Pediatric Child Health, 1995) explored the effectiveness of Conductive Education. Cantanese et al assessed 17 children after six months in a CE program. A control group, receiving a similar level of early childhood services in a non-CE setting, was also studied.

The study concluded that both groups improved. The CE group had greater improvement in gross motor skills, with parent reports of greater improvements in toileting skills. The control group improved more in cognition, with parent report of greater improvement in social interaction and play.

Coleman et al assessed 11 children after six months of CE. Nine children were in the control group. As in the Cantanese study, both groups showed improvements. But no statistically significant differences between the groups were found. A review of the literature by Spivack (Infants and Young Children, 1995) found that most other studies of CE reported in publications had no control groups, or control groups that were not matched.

The necessity of having a control group makes the study of Conductive Education particularly difficult. Most children with cerebral palsy simply do not receive a full day of therapy and education every day — something that is particularly demanding on the children and their families. However, the studies conducted by Cantanese and Coleman indicate that when children receive a similar amount of standard therapy and treatment comparable to those offered by CE programs, outcomes are similar. Further study of the impact of high levels of standard therapy compared with CE is warranted.