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Complementary and Alternative Therapies for Cerebral Palsy

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The optimal practice of medicine includes integrating individual clinical expertise with the best available clinical evidence from systematic research. This article reviews nine treatment modalities used for children who have cerebral palsy (CP), including hyperbaric oxygen, the Adeli Suit, patterning, electrical stimulation, conductive education, equine-assisted therapy, craniosacral therapy, Feldenkrais therapy, and acupuncture. Unfortunately, these modalities have different degrees of published evidence to support or refute their effectiveness. Uncontrolled and controlled trials of hippotherapy have shown beneficial effects on body structures and functioning. Studies of acupuncture are promising, but more studies are required before specific recommendations can be made. Most studies of patterning have been negative and its use cannot be recommended. However, for the other interventions, such as hyperbaric oxygen, more evidence is required before recommendations can be made. The individual with CP and his or her family have a right to full disclosure of all possible treatment options and whatever knowledge currently is available regarding these therapies.
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Cerebral palsy (CP) is a term used for a heterogeneous group of disorders that affects the brain and leads to problems with motor abilities and other aspects of development. It is a chronic condition and, in most instances, has no cure. Rarely, a child will be diagnosed as having CP but will have a specific condition such as dopa-responsive dystonia (Segawa disease) that improves dramatically with specific treatment [Jan, 2004]. Because children with CP have multiple symptoms for which no curative treatment exists, their families seek therapies from many sources. Some look for cures, while others seek therapies that will improve the way their child functions or feels.

Complementary and alternative medicine (CAM) has been defined by the National Center for Complementary and Alternative Medicine, a division of the National Institutes of Health, as "a group of diverse medical and health care systems, practices, and products that are not presently considered to be part of conventional medicine" [National Center for Complementary and Alternative Medicine, 2005]. CAM includes 1) alternative medical systems such as traditional oriental medicine and naturopathy, 2) mind–body interventions such as prayer healing and art therapy, 3) biological-based therapies such as herbal treatments and special diets, 4) manipulative and body-based methods such as massage therapy and chiropractic manipulations, and 5) energy therapies such as electromagnetic-field therapy.

Whether a particular therapy can be classified as CAM may be difficult. For instance, the use of hyperbaric oxygen for chronic wounds [Wang et al., 2003] is not considered a complementary or alternative therapy. Hyperbaric oxygen does not readily fit into one of the five categories It is not holistic, spiritual, vitalistic, and does not have distinct views of the healer or of touching. Yet, some consider the use of hyperbaric oxygen in the treatment of CP as a CAM therapy [Hurvitz et al., 2003]. Another definition of CAM that would allow the inclusion of therapies such as hyperbaric oxygen is that complementary and alternative therapies are those treatments that have not been accepted by mainstream clinical practice [Lynoe, 1992].

In a recent survey of children based on the national Medical Expenditure Panel Survey, Yussman and colleagues [2004] found that 2.0% of children and adolescents visited a CAM provider, but only 12.3% disclosed this use to their usual source of care. If both parents used CAM, 28% of the children and youth consulted a CAM provider. In a survey of families of children with CP who attended an academic CP clinic, Hurvitz et al. [2003] found that 56% of the children and youth used one or more CAM techniques. Massage therapy (25%), aquatherapy (25%), and hippotherapy (18%) were the most commonly used techniques. Children who had more severe motor impairment were more likely to use CAM. Parental use of CAM, younger age of the child, and lack of independent ambulation were the most significant predictors of the use of CAM in this study. Many of the therapies in this study were performed by "conventional" practitioners, including physical and occupational therapists.

Any therapy, whether complementary or allopathic, should be evaluated in terms of its effects on targeted body functions and structures, activities, and participation [World Health Organization (WHO), 2001]. For example, general anesthesia is an extremely effective way to decrease spasticity in the lower extremities of children with CP. It also prevents seizures.

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However, children under general anesthesia do not function well or participate in daily activities.

Before a practitioner uses or recommends any therapy, whether complementary or allopathic, evidence on its effectiveness, safety, costs, and utility should be published. The "gold standard" for evaluating such studies is the randomized, controlled, blinded trial [Guyatt et al., 1993, 1994]. Randomizing subjects, having a comparison group, and insuring that evaluators are blinded to group status minimize bias. For example, families or children may have better outcomes just because they are receiving something in the experimental group (placebo effect) or because they are receiving attention in either the control or experimental group (Hawthorne effect [Verstappen et al., 2004]). Even the use of this type of study does not eliminate bias [Kramer and Shapiro, 1984]. For example, Pizzo et al. [1983] used a controlled trial to evaluate antibiotic prophylaxis in children with cancer. They found that patients with excellent adherence (compliance) did the best in their study, whether they were receiving antibiotics or placebos. Thus, a higher level of adherence by itself is associated with better outcomes (adherence effect).

The following review of selected complementary and alternative therapies is not meant to be exhaustive either in topic or scope, but highlights those therapies that are currently most controversial. Table 1 summarizes the findings.

HYPERBARIC OXYGEN

Proponents of hyperbaric oxygen, the delivery of 100% oxygen under pressure, have argued that "dormant areas" can be found surrounding injured areas in the brains of children with CP. High levels of oxygen in the brain reactivate or "wake up" the cells of this dormant area. It is also believed that hyperbaric oxygen therapy reduces swelling in the brain by constricting blood vessels, and "provides an ideal internal environment for the growth of new brain tissue" [Chico Hyperbaric Center 1999]. Pressures of 1.5 to 1.75 atmospheres (the equivalent of 25 feet below sea level) typically are used. Each treatment lasts 1 hour and one or two treatments are prescribed each day, 5 or 6 days per week. It is common to administer 40 treatments in the first phase of treatment. Potential adverse effects include problems with the ear, including pain, perforation, and bleeding, pneumothorax, myopia, fire or explosions, and oxygen-induced convulsions.

In an unblinded study by Montgomery et al. [1999], 25 children with CP received 20 treatments at 1.75 atmospheres for 60 minutes each. They reported improved gross motor and fine motor functioning and reduced spasticity (based on a combination of objective motor scales and parent observation.). In a study published only as an abstract, Packard [2000] evaluated 26 children with CP ages 15 months to 5 years. They were randomized to immediate therapy with hyperbaric oxygen or a 6-month delay in treatment. The children had 40 1-hour sessions at l.5 atmospheres; 45% had ear problems requiring intervention. Improvements in parental reports of attention, language, and play were reported on the Pediatric Evaluation of Disability Inventory (PEDI). However, no objective differences were noted by observers who viewed videotapes and were blinded to group membership.

Any therapy, whether complementary or allopathic, should be evaluated in terms of its effects on targeted body functions and structures, activities, and participation.

A blinded, randomized, controlled clinical trial of 111 children was conducted in Quebec [Collet et al., 2001; Hardy et al., 2002]. The children in the treatment group received 40 treatments of hyperbaric oxygen at 1.75 atmospheres while the children in the control group received air at a pressure of 1.3 atmospheres. Interestingly, both groups showed significant functional improvements in gross motor abilities, cognition, communication, and memory. However; no additional benefits were found from the oxygen, since no differences were found between the two groups. In this study, 27 of 49 children (55%) in the hyperbaric oxygen group and 15 of 52 children (29%) in the slightly pressurized air group had ear problems. Some have argued that these findings demonstrate the value of elevated oxygen, even at minimal levels [Marois and Vanasse, 2003]. Others have argued that it demonstrates a "powerful clinical trials effect" [Rosenbaum, 2003], i.e., highly motivated parents spent many hours with their children in an intensive setting, knowing that developmental outcomes would be evaluated (a combination of Hawthorne and adherence effects).

Many proponents of HBOT argue that it is effective for all children who have cerebral palsy. However, because CP is so heterogeneous, e.g., involving different parts of the brain with different etiologies and pathophysiologies, it would be surprising to have one therapy be beneficial for everyone with CP.

A formal evaluation of published research on the use of hyperbaric oxygen commissioned by the Agency for Healthcare Research and Quality concluded that "There is insufficient evidence to determine whether the use of HBOT improves functional outcomes in children with CP" [McDonagh et al., 2003].

ADELI SUIT

The Adeli suit originally was developed for Russian cosmonauts to counteract the adverse effects of zero gravity, including muscle atrophy and osteopenia. The suit had rings placed on it to allow elastic cords to be attached across joints. The suit modified for children consists of a vest, shorts, headpiece, and knee pads. A wide belt with rings is worn at the hips. The belt is connected to shoes and kneepads, and a headpiece can be provided for patients with poor head control. It allows controlled exercise against resistance, similar to the use of weights [McPherson, 2002], as well as changes to posture. For example, if a child has lordosis, cords can be placed to increase extension of the hips and flexion of the lower abdomen. The suit works as an elastic frame surrounding the body, with the elastic cords creating tension, theoretically developing the muscles in the legs and arms. It is also felt that deep pressure at the joints improves the sensory and proprioceptive information at that joint, enhances the vestibular system, and improves coordination.

Treatments are administered from 0.5 to 2 hours a day, 5–6 days a week for 4 weeks under the direct supervision of a physical therapist. Other types of therapy, including stretching and functional activities, are included as part of the intervention. Until recently, the suit and program were only available in Europe [EuroMed, 2004]; now they are available in the United States as well [Euro-Peds, 2004]. No published evidence from a controlled trial is available in English to

Table 1. Summary of Selected Complementary and Alternative Treatments for Cerebral Palsy

Therapy	Theory/Benefits	Adverse Effects	Evidence	Comments
Hyperbaric oxygen	Awakens dormant brain tissue surrounding the original injury	Ear trauma, pneumothorax, fire and explosions	Uncontrolled studies show improvements in the treated children. Controlled study showed improvement in treated and controls	More evidence is required before recommendations can be made; e.g., what is the role of increased pressure without supplemental oxygen?
Adeli suit	Resistance across muscles can improve strength, posture, and coordination	Discomfort from suit; expense for intensive therapy and for travel to centers that prescribe the suit	No conclusive evidence either in support of or against the use of the Adeli suit	
Patterning	Passively repeating steps in normal development can overcome brain injuries	Time, energy, and expenses required for treatment	Results of uncontrolled studies are inconsistent; controlled trials show no benefits	Cannot be recommended
Electrical stimulation				More evidence is required before recommendations can be made
Threshold electrical stimulation	Increased blood flow from electrical current will lead to stronger muscles	Expense for unit; generally safe	Some uncontrolled trials show subjective improvements; controlled trials are inconclusive	
Functional neuromuscular stimulation	Increased muscle contraction will improve strength and function	Expense; infection from needles; discomfort	Evidence somewhat more positive than for threshold stimulation but still inconclusive	
Conductive education	Problems with motor skills are problems of learning; new abilities are created out of teaching	None known	Uncontrolled trials show benefit; controlled trials are mixed	Conductive education is implemented in many different ways making generalizations from a single program difficult
Hippotherapy	Riding a horse can improve muscle tone, head and trunk control, mobility in the pelvis, and equilibrium	Trauma from a fall; allergies	Uncontrolled and controlled trials show beneficial effects on body structures and functioning	Horseback riding also increases social participation
Craniosacral therapy	Therapy is used to remove impediments to the flow of cerebrospinal fluid within the cranium and spinal cord	None known	No studies showing efficacy in CP; some question the basis of the intervention	
Feldenkrais	Change of position and directed attention can relax muscles, improve movement, posture, and functioning	None known	No studies showing efficacy in CP; studies in other conditions are equivocal	
Acupuncture	Acupuncture can help to restore the normal flow of Qi, or energy	Forgotten needles, pain, bruising, and infection	Uncontrolled studies show improvements in several areas; two controlled trials also showed improvements	Appears promising, but more studies are required before specific recommendations can be made

support or reject the use of the suit. Thus, no conclusive evidence either in support of or against the use of the Adeli suit is available.

A similar approach using a tight-fitting Lycra suit has been investigated [Blair et al., 1995; Gracies et al., 2000; Rennie et al., 2000; Nicholson et al., 2001]. Although positive effects were identified in independence, gait, and upper extremity function, most children and families rejected the orthosis because of discomfort, problems with respiration, and incontinence.

PATTERNING (DOMAN DELACATO METHOD)

In the 1950s and 1960s, Temple Fay, C. H. Delacato, and Glenn Doman noted that normal development progresses in an established sequence, e.g., crawling, then cruising, and then walking. They argued that failure to properly complete any stage of neurological development adversely affected all subsequent stages. They hypothesized that the development of a child who had a neurological injury could be improved by making him or her undergo normal sequences in a frequent, repetitious fash-

ion. They developed different ways of passively putting children with brain injuries through normal motions, a procedure called patterning. For example, in a child with a midbrain injury, "[o]ne adult turned the head, while the adult on the side toward which the head was turned flexed the arm and extended the leg. The adult on the opposite side extended the arm and flexed the leg. When the head was turned the other way, the position of the limbs was reversed." [The Institute for Human Potential, 2003] This procedure was repeated many times during the day. According to Doman, "[w]e had found that if these patterns were applied rigorously; on a specific schedule, and done with a religious zeal, brain-injured kids improved" [The Institute for Human Potential, 2003].

In a study of 45 children with severe mental retardation who were divided into three groups, Sparrow and Zigler [1978] found that all improved during the course of the study, but no dramatic differences were found in the children who had received patterning. In a study of 66 children and adolescents with mental retardation who lived in residential facilities, Neman et al. [1975] found subjects receiving patterning improved more than subjects in the other groups in visual perception, program-related measures of mobility, and language ability. MacKay [1987] and Bridgman et al. [1987] found either no or only short-lived improvements in children treated with patterning.

Parents who used patterning with their child often spent many hours a day, utilizing tremendous energy doing the patterning [AAP, 1982]. Siblings often did not receive usual attention, expenses were high, and parents felt guilty if the child did not progress. The American Academy of Pediatrics concluded that "patterning treatment continues to offer no special merit, [and] that the claims of its advocates remain unproved. . ." [Ziring et al., 1999].

Patterning sometimes is confused with neurodevelopmental treatment (NDT or the Bobath method of physical therapy). The Bobaths believed that children with CP had abnormal posture against gravity and abnormal inhibition of primitive reflexes. Initially, they placed children in specific postures to inhibit their reflexes and had the child follow the normal sequence of motor development. Since their original work, the emphasis of this technique has shifted more to participatory, functional activities in everyday settings. A recent review of NDT by Butler and Darrah [2001] found that, although many studies have shown improvements with NDT, except for maternal responsiveness, the most credible studies were unable to document a difference between children treated with NDT and those treated with other interventions.

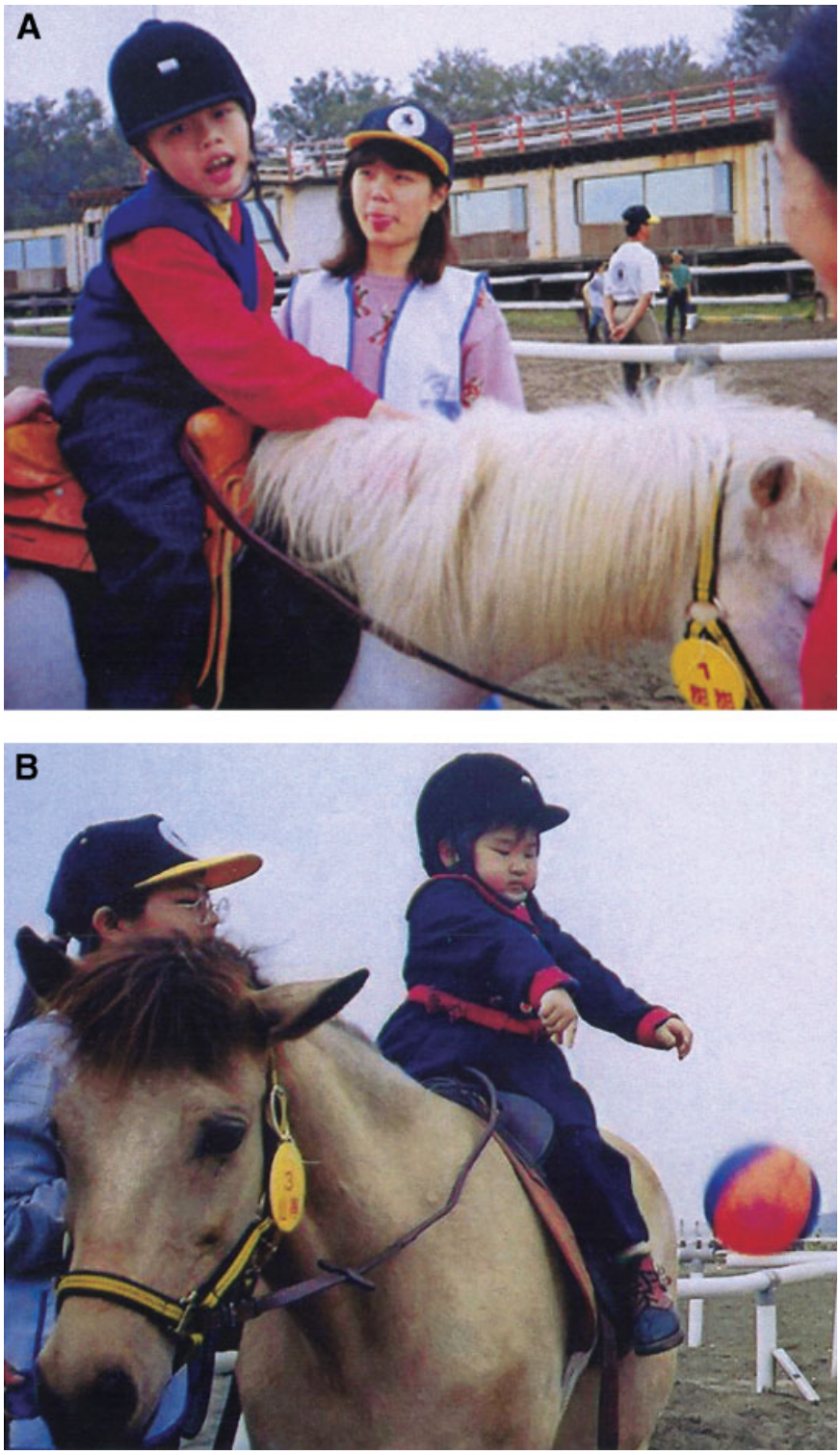

Fig. 1. Two children enjoying equine assisted therapy. Photos are courtesy of Rong-Ju Cherng, National Cheng Kung University, Taiwan. [Color figure can be viewed in the online issue, which is available at www.interscience.wiley.com.]

THERAPEUTIC ELECTRICAL STIMULATION

Several types of electrical stimulation have been used to treat children who have CP [Kerr et al., 2004]. In neuromuscular electrical stimulation, electrical current actually elicits muscle contrac-

tion. It may be applied superficially on top of the skin or percutaneously through the skin. If a muscle is stimulated when it should be contracting during a functional activity, e.g., during ambulation, the stimulation is called functional electrical stimulation. In threshold electrical stimulation (TES), the current does not cause visible contraction of the muscle and there are no known negative side effects [Dali et al., 2002]. The theory underlying of TES is that the stimulation increases the blood flow to the muscle, which increases its bulk. TES usually is applied at home while the child sleeps [Pape et al., 1993].

Three controlled trials of TES have been published. In one study [Sommerfelt et al., 2001], 12 children completed a 24-month crossover study. No significant effect of TES on motor or ambulatory function was found on the blinded evaluation, but the parents of 11 of the 12 children stated that TES had a significant effect. In the second study, Dali et al. [2002] evaluated 57 children with CP. No significant differences were found between TES and placebo treatment on tests of motor function, range of motion, degree of spasticity, and muscle growth. In the third study, Steinbok et al. [1997] evaluated 44 children who had recently had surgical dorsal rhizotomy for management of spasticity. Half were assigned to TES for a year. They found that the mean change in the gross motor function measure (GMFM) score at 1 year was 5.5% in the TES group compared with 1.9% in the comparison group. Some uncontrolled trials of TES show subjective improvements; controlled trials, however, are inconclusive.

In a recent review of 12 studies examining neuromuscular electrical stimulation, 10 described improvements in function and/or strength [Kerr et al., 2004]. A case report [Pierce et al., 2004] and uncontrolled study [Johnston et al., 2004] published after this review support the utility of the higher current neuromuscular electrical stimulation. Thus, the evidence supporting neuromuscular electrical stimulation is somewhat more positive than for TES but remains inconclusive.

CONDUCTIVE EDUCATION

Conductive Education (CE) was started in the 1940s in Hungary by Andreas Petö to help children who had motor dysfunction to participate and function in society [Darrah et al., 2004]. One of its ideals was to avoid learned helplessness by having students identify new achievable goals. In this program, the "conductor" acted as teacher and therapist. Interventions included promoting independent functioning using repetition and verbalization by the child. The use of adaptive equipment such as splints, walkers, and wheelchairs in the classroom was discouraged.

Initial results of uncontrolled trials from Hungary were encouraging, although children had been selected for participation in CE by their potential for developmental independence [Rosenbaum, 2003] and, therefore, were higher functioning with highly motivated families. Several uncontrolled trials in other studies also showed promising findings [Darrah et al., 2004]. In a study of early intervention programs in New Zealand, Liberty [2004] found that children enrolled in programs that were based on the principles of CE acquired skills (based on a list of 100) more rapidly than children enrolled in community-based programs. In another controlled trial, CE showed no advantage over interventions of equivalent intensity [Reddihough et al., 1998]. In a review of the literature Darrah et al., [2004] concluded that the current published evidence could not provide conclusive evidence either in support of or against CE. Thus, the claim that "Conductive Education is a major breakthrough in the well-being of children and adults with motor disorders and their families" [Foundation for Conductive Education, 2005] cannot be supported.

EQUINE-ASSISTED THERAPY (HIPPOTHERAPY)

Therapeutic horseback riding has been used with children who have disabilities since the 1950s when it was used primarily for children who had polio. Recently, it has become increasingly popular with children who have CP. Theoretically, riding astride a horse can improve posture, balance, and overall function by mobilizing the pelvis, lumbar spine, and hip joints, decreasing muscle tone, improving head and trunk postural control, and developing equilibrium reactions in the trunk [Sterba et al., 2002].

A number of studies without comparison groups [Bertoti, 1988; MacPhail et al., 1998; McGibbon et al., 1998; Sterba et al., 2002; Winchester et al., 2002; Casady and Nichols-Larsen, 2004] have shown beneficial effects from horseback riding in children with CP. For example, Sterba et al. [2002] had 17 children ride for 1 hour per week for 18 weeks. Improvements were noted in specific aspects of the GMFM score, specifically in walking, running, and jumping, as well as the total GMFM score.

In a crossover study, Cherng et al. [2004] found significant improvements in the same subscore of the GMFM (walking, running, and jumping), as well as the total GMFM score, and the improvements lasted at least 16 weeks. In another controlled trial, Benda et al. [2003] evaluated 15 children with spastic CP. They were randomized to 8 minutes of hippotherapy or 8 minutes astride a stationary barrel. Remote surface electromyography (EMG) was used to measure muscle activity of the trunk and upper legs during sitting, standing, and walking tasks before and after each intervention. They found significant improvement in symmetry of muscle activity in muscle groups that had the most asymmetry prior to hippotherapy. No significant change was noted after sitting astride a barrel.

Both uncontrolled and controlled trials have shown positive effects from hippotherapy. In addition, riding on a horse is fun and increases the social participation of the child with CP.

Thus, both uncontrolled and controlled trials have shown positive effects from hippotherapy. In addition, riding on a horse is fun and increases the social participation in a community activity of the child with CP, a concept supported by the WHO's view of health (Fig. 1). Other activities, such as adapted skiing and hydrotherapy, have not been studied as extensively as horseback riding, but also should be engaging, enjoyable, and increase participation in recreational activities [Rosenbaum, 2003].

CRANIOSACRAL THERAPY

Craniosacral therapy is based on the theory that a cranial rhythm exists and is linked with movements in the sacrum through mechanical forces transmitted through the dura of the spinal cord. Therapy is used to remove impediments to the flow of cerebrospinal fluid within the cranium and spinal cord. A

nervous system that is free of impingement would allow more normal function [Boon, 2004]. Using light touch, the practitioner can feel the rate, amplitude, symmetry, and quality of the rhythm. Light corrective pressure is applied to various points along the craniosacral axis to reestablish a normal, symmetrical pattern of impulses throughout the system. This would allow more efficient functioning of the entire nervous system throughout the body.

No peer-reviewed articles on the use of craniosacral therapy in individuals with CP were found. However, several articles questioning the basis of craniosacral therapy have been published. Green et al. [1999] reviewed published articles and found insufficient evidence to support the premise of craniosacral therapy. Norton [1996] had six examiners who were osteopathic physicians with extensive training and experience in cranial osteopathy examine nine healthy volunteers. He found that, when pairs of examiners documented the cranial and sacral rhythms of a subject simultaneously, their findings did not agree. He concluded that, although the findings of this study supported predictions of the tissue pressure model for cranial rhythm, they did not support the concept of craniosacral interaction. In a more recent review of published studies, Hartman and Norton [2002] concluded that little scientific basis for any aspect of cranial osteopathy (including craniosacral therapy) existed. They noted that the only publication purporting to show diagnostic reliability with sufficient detail to permit evaluation was flawed and stood alone against five reports that showed interobserver reliabilities of essentially zero. They also concluded that there was no scientific evidence of treatment efficacy. No published studies are available on the use of craniosacral therapy in CP. Available studies in the peer-reviewed litearature question its foundations.

FELDENKRAIS METHOD

The Feldenkrais Method is an intervention using gentle change of position and directed attention to relax muscles to improve movement, posture, and functioning. It is designed to increase range of motion and to improve flexibility and coordination [Feldenkrais Educational Foundation of North America, 2004].

No studies of the use of this method in individuals with CP were identified. The method has been studied in uncontrolled trials in individuals with conditions such as fibromyalgia Kendall et al., [2001] found no sustained benefit from the intervention compared to a traditional hydrotherapy program. Malmgren-Olsson et al. [2001] studied 78 patients with nonspecific musculoskeletal disorders and enrolled them into Body Awareness Therapy, Feldenkrais, and conventional individual treatment. They found few significant differences among the groups but suggested that the Body Awareness Therapy and Feldenkrais might be more effective than conventional treatment. In an uncontrolled study of individuals who had chronic pain, Feldenkrais intervention was effective in reducing the affective dimension of pain but not the sensory or evaluative dimensions nor state anxiety. [Smith et al., 2001]. In a randomized controlled trial, 48 undergraduates were allocated into Feldenkrais, relaxation, or control groups. Hamstring length was assessed using a modified active knee extension test. No significant differences among the groups were found [James et al., 1998]. Ives [2003] has argued that positive outcomes in pain and other measures of well being following Feldenkrais interventions can be ascribed to self-regulation. Thus, no studies showing the efficacy of Feldenkrais in CP have been published and studies in other conditions report equivocal results.

Fig. 2. School-aged girl receiving acupuncture and the device used to supply the electrical current. Photo courtesy of Professor Virginia Wong, Division of Neurodevelopmental Paediatrics, Department of Paediatrics and Adolescent Medicine, The University of Hong Kong, Queen Mary Hospital. [Color figure can be viewed in the online issue, which is available at www.interscience.wiley.com.]

ACUPUNCTURE

Acupuncture, which falls in the realm of classic complementary and alternative medicine, is based on a complex theoretical framework [Kaptchuk, 2002]. According to traditional Chinese medicine, health is achieved by maintaining an uninterrupted flow of Qi, or energy, along 14 meridians. Disease is caused by stagnation of the flow of Qi and by an imbalance between yin and yang. Acupuncture can help reestablish the normal flow of Qi, thus restoring internal balance and health. In acupuncture, fine needles are inserted into precisely defined, specific points on the body to correct disruptions in harmony(Fig. 2). Electrical current may be applied through the needles [Svedberg et al., 2003]. Sessions typically last for 15 to 20 minutes and are administered several times a week. For example, Svedberg et al. [2001] used acupuncture to warm cold extremities in children with CP and employed sessions lasting 20 minutes given twice per week over 4 weeks.

Acupuncture has been used to treat children with CP for more than 20 years [Sanner and Sundequist, 1981; Shi et al., 1992]. Most studies published in English, however, have been recent and uncontrolled, often involving case series. Benefits attributed to acupuncture have included warmer extremities [Svedberg et al., 2001], decrease in painful spasms [Sanner and Sundequist, 1981], and improvement in the use of arms or legs, more restful sleep, improvements in mood and in bowel function [Duncan et al., 2004].

In an intent-to-treat study of 10 children who had drooling, Wong et al. [2001] provided acupuncture to the tongue over 30 sessions. Blinded observers found statistically significant improvements in drooling in those children undergoing active treatment. Sun et al. [2004] conducted a randomized trial of acupuncture of the tongue in 33 children with CP. They argued that, because the tongue is close to the brainstem and cerebellum, stimulating acupoints in the tongue could affect the neural pathways and improve motor function. The mean GMFM score in the treated group increased from 78.9 to 83.0. These improvements were statistically significant in the treatment compared to the control group. Three subscores improved on the PEDI in the treated group but not in the control group. Thus, uncontrolled studies have shown improvements in several areas; two controlled trials also showed improvements.

CONCLUSIONS

The optimal practice of medicine includes integrating individual clinical expertise with the best available clinical evidence from systematic research. The care of patients should be based, to the greatest extent possible, on evidence. This means that sound evidence exists that 1) the therapy recommended is effective in reducing morbidity, 2) the benefits outweigh the risks, 3) the cost of the treatment is reasonable compared to its expected benefits, and 4) the recommended therapy is practical, acceptable, and feasible.

These guidelines apply to therapy whether conventional or complementary. In fact, Fontanarosa and Lundberg [1998] have argued that, "There is no alternative medicine. There is only scientifically proven, evidence-based medicine supported by solid data or unproven medicine, for which scientific evidence is lacking. Whether a therapeutic practice is "Eastern" or "Western," is unconventional or mainstream, or involves mind–body techniques or molecular genetics is largely irrelevant except for historical purposes and cultural interest."

Sometimes, advocates of complementary and alternative medicine adopt a counterculture that is adversarial or even hostile to traditional medicine. Despite that, it is important to integrate complementary and alternative medicine with conventional medicine. The individual with CP and his or her family have a right to full disclosure of all possible treatment options. Failure to inform them of alternatives encourages them to use these therapies without informing the physician or therapist. Ethically, families have the right to use alternative medicine therapies for their children as a matter of autonomy; but they also have the duty not to harm their children [Clark, 2000]. Table 2 lists some sites relevant to CAM that provide the reader with balanced information.

Table 2. Additional Internet Sites for Some Complementary and Alternative Therapies

National Center for Complimentary and Alternative Medicine
http://nccam.nih.gov/
Acupuncture
http://nccam.nih.gov/health/acupuncture/index.htm
Alternative Medicine Foundation
http://www.amfoundation.org
Alternative Medicine Foundation's HerbMed Database
http://www.herbmed.org
National Institutes of Health Office of Dietary Supplements
http://www.ods.od.nih.gov

In addition, practitioners of traditional medicine need to be more inclusive in the counseling regarding treatment options for the treatment of individuals who have CP. Specifically, like practitioners of many schools of CAM, they need to allow families to become more active participants in the healing process, encourage peer support, encourage the relationship between them and the family/patient, encourage the unity between mind, body, and spirit, and promote a more positive view of life with CP—-health as a positive state within the continuum of illness (being healthy while being ill) [Goldstein, 1999].

The nine modalities reviewed here have different degrees of evidence to support or refute their effectiveness. For example, equine-assisted therapy has several studies of various degrees of soundness that support its use, whereas the Adeli suit does not. For the child who has CP, horseback riding has the other advantage of increasing participation in social activities available to individuals who are otherwise healthy. However, even with equine-assisted therapy, unanswered questions remain. For instance, it is not clear which subgroups of children with CP would benefit the most, what "dose" or frequency of intervention is optimal, what are considered medical therapies to be covered by health insurance, and how costs compare with benefits.

Other new treatments for children with CP are becoming available. Each one, whether allopathic or CAM, should be subject to the same rigorous guidelines before they are adopted by enthusiastic supporters. Finally, the Golden Rule should continue to be, "first do no harm." ■

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