Introduction

History and Terminology

Cerebral palsy (CP) is defined as a group of non-progressive, but often changing, motor impairments due to lesions of the central nervous system (CNS) in the early stages of development (Kuban & Leviton, 1994). Although the lesion itself is non-progressive, the resulting impairments, disabilities, and handicaps can be progressive. One reason for this is that a lesion has an impact on a body, and hence a CNS, that is still growing and maturing. In addition, the impairments, disabilities, and handicaps interact over time, producing further changes and impairments.

Cerebral palsy was first identified in the literature by Dr. William Little, who described it in detail in a paper presented to the London Obstetrical Society in 1861 (Schleichkom, 1987). The disability was first called Little’s disease because of his extensive descriptions and early attempts to determine the causes of what he called spastic infantile paralysis. He attributed CP mainly to perinatal events and abnormal birth processes. Sigmund Freud also described cerebral palsy in the 1890s (Newton, 1995) and did some of his early work in this field. He challenged Little’s concept that cerebral palsy usually was caused during the birth process. Freud felt that it was not always possible to determine when in the development of the fetus and neonate the insult(s) took place. He suggested that perhaps problems in fetal development were sometimes the cause of an abnormal birth process.

Early in this century, CP was treated using primarily an orthopedic approach. Surgery that was used for children with polio often was used for children with cerebral palsy. According to Dr. Winthrop Phelps, an orthopedist of the period who devoted extensive time to children with CP, such surgery had disastrous results. He believed in bracing and in organizing teams of professionals to treat children with cerebral palsy (American Academy for Cerebral Palsy and Developmental Medicine [AACPDM], 1996).

In the 1940s, new approaches for treatment emerged in the world of therapy. These approaches looked more holistically at the many impairments caused by the CNS lesion and expanded treatment beyond what physicians were already doing. New treatment ideas by the Bobaths, Margaret Rood, and others also came into being (Levitt, 1995). These approaches attempted to understand the problems in sensory and motor control and the role that development played in attaining skills, as well as the secondary orthopedic impairments caused by CP. These pioneers established clinical and theoretical treatment and management strategies for therapists. Their work was revolutionary—they firmly believed that with therapy people with CNS lesions could alter their anticipated prognosis. The beliefs of these practitioners had such a profound impact on the world of therapy that it often is taken for granted today that our treatment is beneficial. (We are well advised to look critically at the results of everything that we do, however!)
Historical Perspectives on the NDT Approach to Treatment of Children With Cerebral Palsy

Because there is such widespread misunderstanding of the NDT approach, even in the literature (Olney & Wright, 1994; Ostrosky, 1990; Sahrmann, 1983; Van Sant, 1983), it is wise to look historically at its development. Much of the criticism is based on the belief that practitioners who use the approach today still adhere to the theoretical assumptions made in the 1940s and 1950s about motor control. Whether or not therapists embrace or reject the concepts of the NDT approach to treatment of children with cerebral palsy, it is important that they completely understand the development of and changes in the approach.

Berta and Karel Bobath were a physician-therapist husband and wife team who worked in London (Schleichkorn, 1992). Beginning in the 1940s, they developed ideas for treatment that differed from orthopedic management only, and began publishing and teaching these ideas, eventually opening their own clinic. Berta Bobath was a physiotherapist who saw that children with cerebral palsy had more than simply muscle weakness and contracture. She observed abnormal development of motor milestones as well as deviant postures and movements, and she began to try to figure out how and why this was happening. She also saw abnormal tonus and believed that her treatment affected this tonus. Her husband, Dr. Karel Bobath, searched the literature to find explanations for these observations. He studied the neurophysiology of the day, including the work of Jackson, Magnus, and Sherrington (Bobath & Bobath, 1972). These scientists described the reflex as the basic unit of motor control and saw the CNS as hierarchically organized. They used this model of motor control to perform experiments and to explain motor behavior.

The Bobaths believed that spasticity, or hypertonus, was a release phenomenon, as explained by the neurophysiologists they studied, but they viewed this hypertonus as a release of inhibition of whole patterns of movements or postures, not just a release of inhibition of individual muscle activity. They explained changes in a child's postural activity, changes in the resistance to movement, and greater ease in movement as changes in postural tone.

The Bobaths became widely known for this new concept that the tone and the outcome of movement in children with cerebral palsy could be changed for the better. They also wrote a descriptive text on the different types of CP (Bobath & Bobath, 1975). Their work offered hope that the outcome of children developing with cerebral palsy was not immutable, that there was the possibility of changing the way they moved. They never claimed that they could cure or eliminate the disability, however (Scrutton, 1991). Later in their careers, the Bobaths recognized that what they ultimately wished to change were functional skills.

As noted above, the Bobaths based their explanations of clinical procedures and outcomes on the neurophysiology of the day—that what they were changing was muscle tone, and that they were influencing primitive and mature reflexes. Dr. Bobath also discussed the influence of normal reciprocal inhibition—the normal relationship of muscle activity around a joint as a body segment grades movement. He and Mrs. Bobath addressed the lack of variety of movement synergies that children with cerebral palsy develop. As newer explanations of motor control emerged the original neurophysiological explanations on which the Bobaths based treatment became outdated (Shumway-Cook & Woollacott, 1995). However, because their clinical observations were innovative and astute, the newer theories of motor control, motor learning, and motor development often fit in quite well with their treatment plans.
It is likely that many aspects of reflexive and voluntary control are involved in the tone Mrs. Bobath discussed. Her technique of facilitation and inhibition through handling the child provides organized, graded sensory input (proprioceptive, tactile, visual, auditory, vestibular). Therefore, she may have influenced postural control and coordination through an ability to bias muscle groups to increase or decrease their firing. She helped children who needed more cocontraction to hold postures to perform more effectively. She also helped children who sustained holding postures too much to move with more graded control. She helped children initiate movement more effectively. She paid careful attention to the alignment of the body while asking a child to hold a posture or move a body segment, which probably biased the child to initiate movement more efficiently and often with more effective muscle synergies. All this she called "changing tone" because the neurophysiology of the day did not yet have more precise words.

Therapists who use the NDT approach today find that many of the explanations for the selection of treatment techniques can be very different from those originally offered by Dr. Bobath's theories, in part because we have revised our understanding of how the impairments of cerebral palsy affect a child's function. There are often new or revised neurophysiological theories that explain clinical findings in different therapeutic approaches drastic alteration of clinical applications. Therefore, it is not surprising that the NDT approach to treatment has been, and continues to be, revised.

Many of Mrs. Bobath's teachings still apply today—careful observation and evaluation; use of handling to facilitate desired movement and to obtain correct alignment for initiation of muscle activity, with gradual withdrawal of this handling as the child takes over; treatment in functional situations; and involvement of the family in treatment. The Bobaths' treatment strategy of guiding children to move in more efficient and functional ways fits quite well with today's theories of motor control and motor learning.

The Bobaths called their approach Neuro-Developmental Treatment, and it is still known by that name today. Those familiar with today's NDT often find it an excellent approach for sound clinical observation and reasoning. Its attention to individualized goals and treatment strategies is both challenging and rewarding, and its attention to function as outcome is sound rationale for treatment.

Current Neuro-Developmental Approach to Treatment of Children With Cerebral Palsy

The Bobaths' treatment philosophy is an excellent problem-solving format for understanding the needs of children with cerebral palsy. The current neuro-developmental treatment (NDT) approach has been revised and expanded to reflect more current theories of motor control (Styer-Acevedo, 1994). Currently the NDT approach encompasses several important concepts.

1. The child is evaluated as a unique individual who lives in a particular family with unique needs. The child's current and future living situations are considered when planning treatment goals. The goal of treatment is an increase in functional skills.

2. The therapist uses the knowledge of normal development to understand the many and varied ways that children develop skills. This knowledge is applied to children with cerebral palsy to understand why the child cannot perform
certain skills. Normal development no longer is used as a measure of success of treatment or even as the desired outcome of treatment. Children with CP will not follow the normal developmental milestones.

Normal developmental scales can be used to determine whether a problem exists. These scales never were intended for use as a measure of treatment success. Therapists must be wary of any research that claims that therapy is ineffective because children with CP fail to make gains on scales of normal development.

3. Because we are treating a movement disorder, treatment is an active process. Movement skills require the integration of many body systems. Therefore, treatment identifies the problems the child has with movement and how those problems affect function. The systems that affect movement must be treated simultaneously because each system's problems usually impact one or more of the other body systems. These systems include the neuromuscular system, sensory and perceptual systems, musculoskeletal system, and respiratory system. Treatment involves the decreasing input of the therapist, both physical and verbal, so the child will take over movement and learn how to initiate movement.

4. Treatment is a team approach. No one professional or family member is trained or licensed to manage all of the possible impairments, functional limitations, and disabilities associated with children with CP. Effective management involves communication among all concerned with the child.

Research and Terminology

Today there is a growing need and desire to understand more fully the long-term outcomes of any type of medical, educational, and social treatment of people with disabilities. The health care system in the United States is rapidly changing and will continue to undergo many revisions. Those who treat people with disabilities are aware of the tremendous task of making a difference in their clients' function through treatment. American health care and culture look for fast results and quick cures. Clinicians who work with people with disabilities know that there are no fast results and for many disabilities, there are no cures. Treatment, however, can make a difference in the lives of many people who have disabilities.

Several national and international organizations are working to set up systems of common understanding, terminology, and measurement of outcomes of treatment of people with disabilities. The purpose is to have a more unified language in describing disabilities and a method of research into the outcomes of treatment. The World Health Organization (WHO) and the National Center for Medical Rehabilitation Research (NCMRR) are two of these organizations that are working to define terms used to describe the problems encountered by people with disabilities.

These terms are now common in peer-reviewed literature. They also fit in well with organized clinical documentation (Stamer, 1995) and the NDT approach when describing children with cerebral palsy. This text will use these terms, in order to be current with and conform to rehabilitation research and classification. The following definitions are from the National Institutes of Health's Research Plan for the NCMRR (U.S. Dept. of Health and Human Services, 1993):

Pathophysiology: Interruption of, or interference with, normal developmental processes or structures.
Impairment: A loss or abnormality at the organ or organ system level of the body.

Functional Limitation: Restriction or lack of ability to perform an action in the manner of, or within the range consistent with, the purpose of an organ or organ system.

Disability: Limitation in performing tasks, activities, and roles to levels expected within physical and social contexts.

Societal Limitation: Restrictions attributable to social policy or barriers (structural or attitudinal) that limit fulfillment of roles or deny access to services and opportunities associated with full participation in society.

Other terms defined by the NCMRR:

Function: The performance of an action for which a person or thing is especially fitted or used.

Habilitation: An initial learning of skills that enables an individual to function in society.

Rehabilitation: Restoring or bringing to a condition of health or useful and constructive activity, usually involving learning new ways to do functions that were lost.

The NCMRR (U.S. Department of Health and Human Services, 1993) goes on to give examples of some of the terms as they apply to cerebral palsy:

Pathophysiology: Abnormal development or perinatal injury to the central nervous system.

Impairment: Excess muscle contraction, excess reflex activity, poor control of balance and posture.

Functional Limitation: Slow and inefficient movements. Difficulties with activities of daily living such as eating, dressing, and hygiene.

Disability: Lacking independence in mobility. Not independent with family or peers. Requires assistance for school and recreational activities.

Societal Limitation: Examples include lack of full integration in school activities, lack of health insurer coverage for payment of powered wheelchair.

This text will use these terms as it describes in detail the development and characteristics of the different types of cerebral palsy. By using these terms we have a common language with others in the rehabilitation field worldwide.