Occupational Therapy and Motor Control

Occupational therapists are interested in goal-directed motor behavior for the performance of daily life tasks. These tasks range from rolling over in bed to fabricating a splint or driving a car. Successful, goal-directed motor behavior is characterized by the coordinated action of many muscle groups and an interaction between the performer and the environment. The successful performer must control movement parameters such as force, velocity, acceleration, and stiffness; orient to spatial constraints such as size, shape, and position; and coordinate the timing of the contraction of various muscle groups to move body parts. Even so simple a task as picking up a cup is immensely complicated.

Knowledge about these and other aspects of motor control has increased dramatically in the past few years. As Bourbonnais and Vanden Noven indicate in their paper, the scientists contributing to this knowledge base include a growing group of physical and occupational therapists. Some of these scientists have contributed to this special issue on motor control. Seven of the nine authors have backgrounds in rehabilitation, five in occupational therapy, and two in physical therapy. The other two authors have backgrounds in physical education and are closely associated with therapists. My goals in designing this issue were to bring clinicians up-to-date on current research and to help them become better informed consumers of the scientific literature germane to rehabilitation. The authors included in this issue are well qualified to help clinicians accomplish those goals.

Control of the trunk is crucial for functional limb manipulation in the upper or lower extremities. Therefore, the first paper, by Lee, addresses the mechanisms of postural control. A central theme of this paper, the performance of activities of daily living, is presented in the context of control systems theory, which may be new to some therapists. Control systems theory relates movement of any part of the body to the entire system, which continually adapts to changing conditions. To understand the system, all of the inputs, processes, and outputs must be defined. Furthermore, apparently isolated movements must be considered in their entirety, including distant postural adjustments, such as those made in the lower extremities when a hand is being raised. This frame of reference requires a reorientation away from a reductionist treatment philosophy and away from some traditional tabletop modalities. In practical terms, it negates the outdated dichotomy between occupational therapy as providing above-the-waist and physical therapy as providing below-the-waist treatment. Few practitioners today believe in that division of labor, but many institutions still favor it, many third-party payers are still guided by it, and many physicians who prescribe therapy still believe in it.

As Lee points out, the trunk provides a proximal base from which the limbs can be moved. She discusses the idea that sensory input is important for motor output—a familiar idea to therapists (Stockmeyer, 1967)—but mentions the limitations to this notion as well. She also suggests assessment tools and treatment ideas based on control systems theory. The author, a behavioral neuroscientist with a doctorate in physical education, teaches at a school of physical therapy and does research on limb manipulation and posture.

Upper extremity limb manipulation and hand function are classic concerns of occupational therapists. The ability to grasp and manipulate an object is a primary daily life skill. In her paper, Spaulding updates our grasp of the biomechanics of prehension. The author, an occupational therapist, teaches at a school of occupational therapy and is studying for her doctorate in biomechanics.

Most people appear to be bilaterally symmetrical, with the two halves of the body being mirror images of each other. However, appearances can be deceiving. The two sides are

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not quite identical, and the preferred and nonpreferred sides have different movement characteristics. These differences can be important during the development of motor skill, the remediation of motor deficits, or skill substitution from one side to the other. Larkin reviews the literature on asymmetries in movement and suggests that some relevance to the clinic exists. The author, a physical educator with a doctorate in motor learning, teaches in a school of human movement studies and does research on movement problems in children.

People who have had cerebrovascular accidents are often referred for rehabilitation because of weakness, incoordination, and the resulting loss of independence in activities of daily living. Bourbonnais and Vanden Noven discuss some problems of upper extremity motor disorder in these patients, accomplishing the difficult task of dissociating the problems of weakness and spasticity. The physiology of motor units is discussed in depth because pathological changes in motor units play an important role in muscle weakness. To design treatment activities appropriate for remediating movement problems, the occupational therapist must understand the substrates of the disorders. Bourbonnais, an occupational therapist with a doctorate in the neural sciences, teaches and does research at a school of occupational therapy. Vanden Noven, a physical therapist with a doctorate in neurophysiology, does research at a school of medicine.

As Rood taught us many years ago (Stockmeyer, 1967) and Lee reminds us in this issue, sensory input is important for motor output. Within the rehabilitation community much discussion has centered on the role of vestibular input. Two papers, written by Keshner and me, review the recent research on vestibular function and discuss the involvement of this sensory system in the control of posture, eye movements, and spatial orientation. Both Keshner, a physical therapist, and I, an occupational therapist, hold doctorates in motor learning and do research on vestibular mechanisms in motor control at schools of medicine.

Occasionally, a scientist who has been disabled can use her personal experience to teach others. This gift to the community deserves special appreciation. Farber’s Case Report is such a gift to us. Generously forgoing her personal privacy, she describes her own vestibular disorder with its associated motor and functional problems. Her insightful paper is a blend of objectivity and lucid, firsthand experience. The author, an occupational therapist with a doctorate in physiology, teaches and does research at a school of occupational therapy.

I hope that many of the ideas in this special issue are thought provoking and worthy of continued exploration. The Issue Is column in this journal provides a forum for such discussion. In this month’s column, Burgess discusses why we should gain a better understanding of motor control, including our past and future involvement in this area. She challenges the educators to take us into the future. The author, an occupational therapist who has been an educator, is studying for her doctorate in biological psychology and is in clinical practice.

Many people helped bring this issue to fruition. I thank the members of the editorial board who reviewed most papers. Some papers were also reviewed by the following outside readers: Bernard Cohen, MD, Susan Goldberg, MA, OTR, and Deborah Moore, MA, OTR. I thank them for their efforts.

References