Support for An Optimistic Approach

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Is an optimistic approach for children with severe neurological disabilities justified? The MOVE curriculum is based on the assumption that historically we have not expected enough progress from these children, and that they will continue to learn skills as long as we continue to teach them. This author shares the conviction that an optimistic approach is justified, based on personal experience using a task-oriented approach, including the MOVE curriculum, with this population. New developments in the field of neural plasticity also have exciting implications for what we may expect for individuals with neurological disabilities.

What evidence supports a more optimistic therapeutic approach for children with severe disabilities? Objective evidence with this specific population is sparse, due in part to an under-representation in the research literature. However, the following is some information that is applicable to this question:

Studies on Skill Acquisition in This Population

Obviously the best support would be well-designed outcome studies clearly demonstrating the effects of therapeutic intervention on motor function in children with severe disabilities. Unfortunately there are very few such studies specific to this population. There is an urgent need for more research in this area. In searching the literature I focused on the question: Can children with severe disabilities learn skills if they are given appropriate intervention? (And what characteristics of intervention seem to be important in improving motor skills?) These studies examine performance changes and/or learning in children with severe disabilities, including cognitive disabilities:

Brown and coworkers studied the effect of "ability-focused" PT intervention in a population with severe physical and cognitive disabilities. Ability-focused therapy "emphasizes teaching gross motor abilities that are important to both the individual and the individual's caregivers." (Brown et al., 1998, p. 936) Three goals were individually selected for each subject, two of which were designated as treatment goals and one as a control. The researchers found that performance significantly improved in the activities selected as "treatment goals" compared to those selected as "control goals" following 18 weeks of twice-weekly therapy, as scored by independent raters observing videotape records of the subjects' performance. This study used isolated therapy intervention targeting specific motor activities (such as head control, coming to a sitting position, or protectively bearing weight on the upper extremities) as goals for each individual. Skills practiced in the therapy setting did not transfer consistently to other settings (home and recess). This is not surprising, since the skills were only practiced in the isolated therapy setting, and other school staff members were not informed what the goals were. This study shows that children with severe physical and cognitive limitations can learn motor skills when given appropriate intervention. The use of specific activities as therapy goals seems to be important for skill acquisition. (One is only left wondering how much more the children's skills could have improved if the other staff members had encouraged practice of the same skills throughout the school day!)

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Bower and McLellan in a pilot study examined the effects of a period of intense physiotherapy on children with quadriplegic cerebral palsy. (Bower & McLellan, 1992) The study used a three-week period of "conventional" physiotherapy followed by three weeks of "intensive physiotherapy" and then by another three weeks of "conventional" physiotherapy. The conventional amount of physiotherapy was the amount the child typically received, which came to an average of less than 2 hours in 3 weeks. In the intensive period the child received one hour of treatment per day (around 15 hours in 3 weeks). The study gives evidence that increased intensity of therapy can accelerate motor skill acquisition in this population. The researchers also felt that the process of precisely defining the goals of therapy might have had a positive effect on the outcome. Certain skills were noted to be maintained after the intensity of physiotherapy was decreased, namely those skills which could be easily incorporated into a child's daily activities and which seemed to be understood by the child.

The same investigators performed a similar study a few years later, which was much larger and followed a randomized, controlled design. (Bower et al., 1996) In it they compared intensive PT with conventional PT as well as comparing the use of general treatment aims with specific treatment goals, for 44 children with quadriplegic cerebral palsy. The aims were general statements such as "to improve sitting" whereas the goals were specific, measurable activities. Subjects were assigned to one of four groups: conventional amount of therapy with aims, conventional amount of therapy with goals, intensive therapy with aims, and intensive therapy with goals. The intervention period for all subjects was 2 weeks. The type of treatment approach used throughout is described as "eclectic". In summary, they found that intensive therapy had a slightly greater effect than conventional amounts of therapy, but that working toward specific, measurable goals rather than general aims was more strongly associated with increased motor skill acquisition. These studies show that children with quadriplegia have the ability to acquire motor skills, and that working on specific, measurable goals that are associated with daily functional activities may significantly improve skill acquisition.

An interesting study with eight children with severe cerebral palsy was conducted by Kramer and colleagues who investigated the training of head control in two different positions using a specialized biofeedback device. (Kramer et al., 1992) They found that training was effective in both sitting and semi-prone positions, and that improvement lasted at least until their 16-week post-training measurement in a no-feedback test condition. Training sessions were 30 minutes long, five per week for five weeks. This study demonstrates retention of a skill, and the ability of children with severe CP to improve head control through practice. It is also very interesting that these researchers used the "semi-prone" position for training head control, as the MOVE curriculum advocates a forward-leaning supported sitting or standing position to begin practicing this skill.

In one of the first outcome studies with the MOVE curriculum, Barnes showed that significant improvement in functional mobility skills was possible with appropriate instruction. (Barnes, 1999) The study used a multiple-baseline across subjects design with five elementary-aged students with severe multiple disabilities. A multiple-baseline design means that intervention was started at different times for the different children, which acts as a control. One child would start the intervention, and when an upward trend was observed, the next subject would begin the intervention phase. The independent variable in this study was implementation of the MOVE curriculum for each of the five children in their school setting. All students demonstrated progress in functional mobility skills during intervention or maintenance phases of the study as compared to baseline measurements. Repeated measures were taken of operationally defined behaviors (such as number of reciprocal steps, or seconds in standing) throughout all three phases (baseline, intervention, and maintenance), and the results were plotted for visual analysis. This study demonstrates the ability of students with severe multiple disabilities to learn functional motor skills using the MOVE curriculum.

All of the studies mentioned above describe some form of skill acquisition in children with severe disabilities (severe cerebral palsy or severe cognitive limitations or both). To summarize some relevant conclusions from these studies:

1. Children with severe, multiple disabilities can learn skills (if appropriate instruction is given).
2. Learned skills can be retained if they are related to daily functional activities.
3. The choice of specific, meaningful activities as goals is important in enhancing skill acquisition.

Unfortunately, the research still does not provide clear answers about the relative efficacy of different therapeutic approaches, nor quantitative data on how long it takes for children with severe disabilities to learn a new motor skill. The rate of learning is definitely much slower in this population than for non-disabled children.

In planning intervention strategies with this population it is necessary to focus on our understanding of *function*. If we understand function to include all of the motor tasks people need to accomplish in their typical environments, rather than strictly focusing on traditional "ADL" tasks, we will have a broader understanding of how functional goals relate to this population. For example, play is a very important functional activity for children. We would expect different age groups to require different functional skills. Rolling is an appropriate form of mobility for a 10-month-old, but it is less appropriate for a 15-year-old. The questions we ask and the goals and strategies we develop need to reflect an emphasis on the child's ability to function in his or her environment. Instead of asking, "How can I help this child to achieve the next developmental milestone?" we need to ask, "How can I help this child to gain the skills he or she needs in order to function more effectively in his or her environment and to become more independent?" This is not just a semantic distinction. Our focus guides how we evaluate a child and the goals we set. Several of the studies mentioned above indicate the importance of working toward specific activities as therapy goals for this population. (Brown et al., 1998; Bower et al., 1996) In addition, the MOVE curriculum places great emphasis on goal selection, "The selection of activities to be addressed is probably the single most important aspect of achieving independence." (Bidabe, 1999, p. 11)

Neural Plasticity

Recently there has been increasing interest in plasticity in the central nervous system. Some new research findings challenge the traditional view of the brain as a static structure with a fixed number of neurons and a very limited ability to adapt following injury. For example, the discovery that the adult hippocampus continues to produce new neurons (Eriksson et al., 1998) requires us to change our earlier ideas about the brain. There is also convincing evidence of significant potential for reorganization in the adult cerebral cortex. (Ramachandran, 1993) We will mention one relevant study here to illustrate how these new findings support an optimistic approach.

Liepert et al. examined the effects of intensive constraint-induced movement therapy on the cortical representation of an upper extremity muscle. (Liepert et al., 2000) The study included 13 patients with a mean duration of 4.9 years of hemiparesis from stroke. Testing was performed before and after 12 days of intensive (6 hours per day) constraint-induced therapy. Using transcranial magnetic stimulation the researchers found that the cortical representation of a muscle in the hand increased dramatically, and motor performance was correspondingly improved after the course of therapy. Follow-up testing six months after treatment showed that the motor performance remained at a high level, and the cortical representation of the muscle in both hemispheres became almost equal. This exciting study shows that long after the traditional "window of opportunity" would be expected to end, dramatic functional improvement can be induced by an intensive, active therapeutic regimen, corresponding with plastic changes in the cerebral cortex itself. Importantly, the authors hypothesize that the intensive constraint-induced therapy helped the subjects overcome a certain degree of "learned non-use" of the paretic upper extremity. Many other studies are now under way to investigate the possibilities of constraint-induced movement therapy for stroke.

Although the study mentioned above examined subjects with hemiparesis due to stroke, it is plausible that similar effects could take place in children with disabilities that are due to lesions in similar CNS regions. A recent study of constraint-induced movement therapy with children with hemiparesis due to cerebral palsy showed very promising results after 21 days of intensive training. (Taub et al., 2004) Neural plasticity is one possible mechanism underlying functional improvement following therapeutic intervention, especially if intensive, active practice of movement skills is used. Studies of neural plasticity related to practice support an optimistic approach to intervention.

Task-oriented Approaches for Other Populations

Task-oriented therapy approaches have been applied and studied in patients with stroke, multiple sclerosis, Parkinson's disease, and cerebral palsy. Even though these studies do not specifically examine the population discussed in this book, they provide support for implementing such an approach for children with severe disabilities. The study mentioned above (Liepert et al., 2000) relating to constraint-induced movement therapy for chronic stroke patients is one such study, in that lasting functional gains were reported following intensive task-oriented practice.

Smith used a task-oriented exercise program employing a treadmill with handrail support, again with individuals with chronic hemiparesis (>6 months). (Smith et al., 1999) The researchers found that hamstring strength was increased while spastic reflexes in the affected hamstrings were decreased following 12 weeks of low-intensity treadmill exercise 3 times per week. In the discussion section the authors state that these improvements also correlated with improved mobility and functional activity, although these findings were not discussed in detail. In another study by some of the same researchers, (Macko et al., 1997) treadmill aerobic exercise was found to substantially reduce energy expenditure and cardiovascular demands of walking in older patients with chronic stroke.

Swinnen demonstrated improvements in speed, consistency of the trajectories, and limb synchronization with Parkinson's Disease patients using a task-oriented approach. (Swinnen et al., 2000) These results show that these patients can learn to improve motor skills, although they did not reach the level of performance of the control subjects. Task-oriented practice of the task was shown to be effective in improving performance in this population.

Lord compared a facilitation approach and a task-oriented approach for improving walking in patients with multiple sclerosis. (Lord et al., 1998) They provided 15 treatments over a 5-7 week period, and found that both approaches were associated with improved mobility, without any significant differences in the effectiveness of the two approaches.

Judy Carmick published a very interesting case report of a combination of neuromuscular electrical stimulation (NMES) with a task-oriented model of motor learning for a child with cerebral palsy. (Carmick, 1993) She found that in two older school children with hemiplegic CP this combination of interventions resulted in a significant improvement in locomotor efficiency. Efficiency of gait was measured with the Physiological Cost Index. A younger child also included in the study showed much more rapid improvement in the symmetry of locomotion.

In summary, task-oriented therapy approaches have been found to be effective in a number of different patient groups with neurological impairments. This supports the suggestion that children with severe disabilities may be able to make significant gains in functional motor ability when they participate in an active, task-oriented therapy program.

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