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NEUROPHYSIOLOGY 2021: Edit efficacy of constraint-induced movement therapy in cerebral palsy children with asymmetric hand impairment-Chulalongkorn University, Thailand

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Introduction:
Constraint-induced movement therapy (CIMT), also known as forced use movement therapy, is a therapeutic approach to rehabilitation of movement after stroke. It has purportedly been demonstrated to improve motor function in patients following cerebro-vascular accident (CVA). The intensity and schedule of delivery of CIMT is different from that of traditional physical rehabilitation approaches. Constraint-induced movement therapy entails a family of rehabilitation techniques with an underlying goal of inducing individuals with stroke to markedly increase the use of a more-affected upper extremity (UE) for many hours a day over a period of 2 to 3 weeks. The principal therapy involves constraining movements of the less-affected arm with a sling for 90 % of waking hours for the duration of therapy, while intensively training use of the more-affected arm.

Constraint-induced movement therapy has been employed for patients with chronic and sub-acute CVA, chronic traumatic brain injury, incomplete spinal cord injury, cerebral palsy, fractured hip, phantom limb pain, as well as musicians with focal hand dystonia. Although the improvement in motor function produced by CIMT in chronic stroke patients has been postulated to be associated with a shift in laterality of motor cortical activation toward the undamaged hemisphere, the exact mechanisms supporting rehabilitation-induced motor recovery are unclear.

In a randomized study (n = 66), van der Lee et al (1999) reported a small improvement in motor impairment in patients with chronic hemiparesis treated with CIMT. In another randomized study (n = 20), Dromerick et al (2000) found that CIMT resulted in a marked improvement in motor impairment.

Pierce et al (2004) examined the effectiveness of a program of traditional outpatient neurological rehabilitation that included home forced use. In total, 17 patients with chronic stroke and 1 patient with sub-acute stroke (mean time post-stroke = 27.6 months) completed an individualized program consisting of seven 2-hour treatment sessions composed of 1 hour of occupational therapy and 1 hour of physical therapy. Therapy sessions were completed over a 2- to 3-week period and included instruction on the use of a restraining mitt at home during functional activities. The authors stated that the

preliminary results suggested that the forced-use component of CIMT may be effective when applied within a traditional outpatient rehabilitation program.

In an observer-blinded randomized control trial (n = 69), Suputtitada et al (2004) reported that CIMT of unaffected upper extremities has an advantage over conservative treatment for chronic stroke patients. The CIMT group received 6 hours of daily affected-upper-extremity training and restrained unaffected upper extremities for 5 days per week, totally 2 weeks. The control group received bimanual-upper-extremity training by conservative neuro-developmental technique without restrained unaffected upper extremities for 2 weeks. These authors concluded that CIMT may be an effective technique of improving motor activity and exhibiting learned non-use.

In a single-blinded randomized controlled trial, Page et al (2004) determined the effectiveness of a modified CIMT protocol for patients with chronic stroke. A total of 17 patients who experienced stroke more than 1 year before study entry and who had upper-limb hemiparesis and learned non-use enrolled in this study. Seven patients participated in structured therapy sessions emphasizing more affected arm use in valued activities, 3 times a week for 10 weeks. Their less affected arms were also restrained 5 days/week for 5 hours (modified CIMT). Four patients received regular therapy with similar contact time to modified CIMT. Six patients received no therapy (control). These investigators concluded that modified CIMT may be an effective method of improving function and use of the more affected arms of chronic stroke patients.

The findings of Suputtitada et al (2004) and Page et al (2004) are in agreement with the observations of Van Peppen et al (2004) and Yen et al (2005). Van Peppen and colleagues noted that there is strong evidence for therapies that are focused on functional training of the upper limb such as CIMT in improving functional outcomes after stroke; while Yen and associates reported that modified CIMT is useful in improving the function of the affected upper extremity in stroke patients (n = 30). Subjects in the modified CIMT group received a 2-week course of modified CIMT that entailed massed training of the affected arm without any physical restriction of the intact one.

Stein (2004) stated that younger stroke patients appear to have a greater ability to recover from stroke and are likely to benefit substantially from treatments that facilitate plasticity-mediated recovery. The use of new exercise treatments, such as CIMT, robot-aided rehabilitation, and partial body weight supported treadmill training are being studied intensively, and are likely to

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ultimately be incorporated into standard post-stroke rehabilitation.

Moreover, in a randomized controlled pilot study (n = 10), Page et al (2005) compared the effectiveness of modified CIMT to traditional rehabilitation in acute stroke patients exhibiting upper limb hemiparesis (less than 14 days post-stroke). Five patients were administered modified CIMT, consisting of structured therapy emphasizing more affected arm use in valued activities 3 days/week for 10 weeks and less affected arm restraint 5 days/week for 5 hours. Five other patients received half sessions of traditional motor rehabilitation for the affected arm, which included affected limb manual dexterity exercises and stretching, as well as compensatory strategies with the unaffected limb. The traditional rehabilitation regimens occurred 3 days/week for 10 weeks. These researchers concluded that modified CIMT is a promising regimen for improving more affected limb use and function in acute CVA. However, larger confirmatory studies need to be performed.

The Veterans Health Administration's clinical practice guideline for the management of stroke rehabilitation (2003) noted that the use of CIMT should be considered for a select group of patients, i.e., those with 20 degrees of wrist extension and 10 degrees of finger extension, who have no sensory and cognitive deficits.

Guidelines from the British Intercollegiate Stroke Working Party state that “[c]onstraint-induced therapy to increase the use of the affected arm should be considered in patients with at least 10 degrees of active wrist and finger extension, who are more than a year post-stroke and who can walk independently without an aid.”

Ottawa Panel Guidelines (2006) state that "there is sufficient evidence to recommend the use of CIMT during the acute, subacute, or chronic phases of rehabilitation for improving dexterity, motor function, and functional status in stroke patients capable of some active finger and wrist extension."