ORIGINAL ARTICLE

A 1-Year Follow-Up After Shortened Constraint-Induced Movement Therapy With and Without Mitt Poststroke

Christina Brogårdh, RPT, PhD, Jan Lexell, MD, PhD

ABSTRACT. Brogårdh C, Lexell J. A 1-year follow-up after shortened constraint-induced movement therapy with and without mitt poststroke. Arch Phys Med Rehabil 2010;91:460-4.

Objective: To explore the long-term benefits of shortened constraint-induced movement therapy (CIMT) in the subacute phase poststroke.

Design: A 1-year follow-up after shortened CIMT (3h training/d for 2wk) where the participants had been randomized to a mitt group or a nonmitt group.

Setting: A university hospital rehabilitation department.

Participants: Poststroke patients (N=20, 15 men, 5 women; mean age 58.8y; on average 14.8mo poststroke) with mild to moderate impairments of hand function.

Interventions: Not applicable.

Main Outcome Measures: The Sollerman hand function test, the modified Motor Assessment Scale, and the Motor Activity Log test. Assessments were made by blinded observers.

Results: One year after shortened CIMT, participants within both the mitt group and the nonmitt group showed statistically significant improvements in arm and hand motor performance and on self-reported motor ability compared with before and after treatment. No significant differences between the groups were found in any measure at any time.

Conclusions: Shortened CIMT seems to be beneficial up to 1 year after training, but the restraint may not enhance upper motor function. To determine which components of CIMT are most effective, larger randomized studies are needed.

Key Words: Follow-up studies; Rehabilitation; Stroke; Upper extremity.

CONSTRAINT-INDUCED MOVEMENT therapy is a promising rehabilitation intervention poststroke to improve upper-extremity function and self-reported use of the more affected hand in daily activities.[1,2] The traditional therapy consists of repetitive task-oriented training of the more affected hand, including shaping exercises where movements are approached in steps of progressively increasing difficulties, 6 to 7 hours a day for 2 weeks. Simultaneously, the less affected hand is restrained with a sling or a mitt 90% of waking hours.[1] Most studies of CIMT have been performed in chronic stroke patients,[1-13] but in recent years also in the subacute[12,14-18] and acute phase poststroke.[19-22] In the early poststroke phase, modified forms of CIMT,[15-17,19,20] with shorter daily therapy but sometimes for several weeks, have been used most frequently.

Improvements in arm and hand function have been found, after both traditional CIMT and modified forms of CIMT. There is, however, uncertainty about how the training should be administered and which component in the concept—the restraint, the mode, or the intensity of hand training—is most important. In some studies,[3,20,23] the restraint has been described as a useful and important component to improve upper-extremity function, whereas others[11,17,18,24] have found the restraint to be of minor importance for the outcome.

The short-term benefit of mitt use after shortened CIMT (ie, 3h of training per day for 2wk) in the subacute phase poststroke was evaluated by Brogårdh et al.[17] Large improvements in arm and hand function were found, both in the mitt group and the nonmitt group after treatment as well as after 3 months, but no significant differences between the groups were observed. Thus, the restraint did not seem to enhance improvements in arm and hand function in the short-term perspective.

Because there is a need to explore the long-term benefits of CIMT and the importance of the different components of the therapy, the aim of this study was to investigate the arm and hand function and self-reported use of the more affected hand 1 year after participation in the shortened CIMT program with and without using a mitt.

METHODS

This was a 1-year follow-up study of a single-blind randomized controlled trial evaluating the effectiveness of mitt use during shortened CIMT in patients with subacute stroke (1-3mo poststroke). The study was carried out at the Department of Rehabilitation Medicine, Lund University Hospital, Sweden. Detailed information about the trial, shortened CIMT intervention, and mitt use has been reported previously.[17]

Participants

All subjects who had participated in the randomized controlled trial were invited for a 12-month follow-up. Of the 24 possible participants, 4 dropped out (1 in the mitt group and 3 in the nonmitt group) because 3 had had a restroke and 1 declined to participate. The remaining 20 subjects (15 men, 5 women; mean age 58.8y; on average 14.8mo poststroke) gave their informed consent to participate. In table 1, the character-

List of Abbreviations

AOU	amount of use
CIMT	constraint-induced movement therapy
MAL	Motor Activity Log
MAL AOU	Motor Activity Log–amount of use
MAL QOM	Motor Activity Log–quality of movements
MAS	Motor Assessment Scale
QOM	quality of movements

From the Department of Rehabilitation Medicine, Lund University Hospital, Lund (Brogårdh, Lexell); the Division of Rehabilitation Medicine, Department of Clinical Sciences, Lund University, Lund (Brogårdh, Lexell); and the Department of Health Sciences, Luleå University of Technology, Luleå, (Lexell), Sweden.

Supported by the Norrbacka-Eugenia foundation (grant no. 808/08).

No commercial party having a direct financial interest in the results of the research supporting this article has or will confer a benefit on the authors or on any organization with which the authors are associated.

Reprint requests to Christina Brogårdh, RPT, PhD, Dept of Rehabilitation Medicine, Lund University Hospital, SE-221 85 Lund, Sweden, e-mail: *christina.brogardh@skane.se*.

0003-9993/10/9103-00486$36.00/0
doi:10.1016/j.apmr.2009.11.009

Table 1: Participant Characteristics at 1-Year Follow-Up in the Mitt and Nonmitt Groups

Characteristics	Mitt Group (n=11)	Nonmitt Group (n=9)
Age (y)	59.2±6.4	58.2±11.9
Time poststroke (mo)	14.7±0.6	15.0±0.6
Sex (men/women)	9/2	6/3
Dominant hand affected	7	6

NOTE. Values are mean ± SD or n.

istics of the participants in the mitt group (n=11) and nonmitt group (n=9) at the 12-month follow-up are presented. The research protocol was approved by the Medical Ethics Committee of Lund University, Sweden, Dnr LU 386-00.

Description of the Shortened Constraint-Induced Movement Therapy

In summary, all participants were 1 to 3 months poststroke and had mild to moderate impairments of hand function (ie, had ability to extend the wrist of the more affected hand at least 10°, to extend 2 fingers at least 10°, and to abduct the thumb at least 10°), had only minimal balance problems, (ie, were able to walk 20m within 40s), and had no gross language deficits, severe cognitive impairments, or neglect. Exclusion criteria for participating were deformity of the more affected arm because of previous injury, epilepsy, and botulinum toxin injections for spasticity. The participants were consecutively randomized to a mitt group or a nonmitt group (control group). They received approximately 3 hours of focused hand training a day for the more affected arm for 2 weeks. Those randomized to the mitt group wore a mitt on the less affected hand 80% to 90% of waking hours during the 2 weeks, which was registered in a log book. The exercises consisted of task practice, fine motor training, muscle strength training, muscle stretching, swimming pool training, and general activity training. Tasks were approached in small steps of progressively increasing difficulty including verbal feedback (ie, similar to shaping exercises).[17] The exercises in the shortened CIMT program were similar to the traditional CIMT program, but the amount of training was reduced to 3 hours a day instead of 6 hours a day. Shorter daily constraint-induced movement therapy with 3 hours of training a day for 2 weeks has been described earlier by Sterr et al.[6]

Assessments and Outcome Measures

The 12-month follow-up was undertaken at the Department of Rehabilitation Medicine, Lund University Hospital. All participants were assessed by independent and blinded assessors (licensed occupational therapist, physiotherapist). The assessments lasted about 2 and one half hours for each participant. The Sollerman hand function test[25] and the modified MAS[26-28] were used to examine the arm and hand function. The MAL[29,30] was used to reflect self-reported daily hand use (AOU) and QOM. These measures were used previously to evaluate the short-term benefit of shortened CIMT.[17]

The Sollerman hand function test[25] consists of 20 subtests reflecting daily hand activities; the type of grasp, quality of movement, and speed of performance is assessed on a 0- to 4-point scale. The instrument has been shown to be reliable poststroke.[31] The modified MAS, tested for validity and reliability,[26-28] consists of 15 tasks from gross arm to fine finger movements on a 0- to 5-point scale; only the items for upper extremity were used, and both arms were tested. The MAL is a 30-item questionnaire, tested for validity and reliability,[29,30,32] and scores how often (AOU) and how well (QOM) the affected hand is used for 30 daily activities on a 0- to 5-point scale.

Statistical Analyses

All data were tested for normality using the GraphPad Instat program.[a] To detect significant differences within the 2 groups, the Wilcoxon signed-rank test was used for the Sollerman hand function test and the MAS and MAL tests, respectively. In clinical practice as well as in research, the total sum scores of the Sollerman hand function test and the MAS test are often used. These represent a clinically relevant overall measure of arm and hand function, albeit nonlinear, and were therefore analyzed with a nonparametric test.

To detect significant differences between the 2 groups (mitt vs nonmitt), the Mann-Whitney U test was used for the Sollerman hand function test and for the MAS and the MAL, respectively. The data were analyzed using SPSS version 16.0 software for Windows.[b] Differences between distributions (rejection of the null hypothesis) were considered significant when P less than .05.

RESULTS

Changes in Arm and Hand Function and Self-Reported Daily Hand Use

In table 2, data for the Sollerman hand function test, the modified MAS, and the MAL tests on all test occasions are presented for the mitt and nonmitt group, respectively. In table 3, the results of the statistical analyses are presented. Twelve months after shortened CIMT, the participants in the mitt group had significantly improved their arm and hand function and self-reported daily hand use and quality of movement in comparison with before and after treatment. In comparison with 3-month follow-up, further statistically significant improvements were found only in the hand function score as measured by the Sollerman hand function test and self-reported quality of movement score

Table 2: Data for All Outcome Measures on All Test Occasions in the Mitt and Nonmitt Groups

	Mitt Group (n=11)	Nonmitt Group (n= 9)
Sollerman score		
Before sCIMT	40.0 (30-59)	52.0 (39-54)
After sCIMT	60.0 (44-72)	62.0 (55-69)
After 3mo	67.0 (52-73)	64.0 (61-75)
After 12mo	71.0 (62-78)	77.0 (69-78)
MAS score		
Before sCIMT	24.0 (22-26)	23.0 (21-24)
After sCIMT	26.0 (24-29)	28.0 (24-29)
After 3mo	29.0 (26-29)	29.0 (25-29)
After 12mo	29.0 (27-29)	29.0 (27-30)
MAL AOU score		
Before sCIMT	2.3 (1.8-2.6)	3.0 (2.2-3.3)
After sCIMT	3.0 (2.6-3.7)	3.0 (2.6-3.6)
After 3mo	3.5 (3.0-4.3)	3.4 (2.9-4.0)
After 12mo	3.8 (3.3-4.3)	3.8 (3.1-4.6)
MAL QOM score		
Before sCIMT	2.0 (1.6-2.5)	2.6 (2.0-3.0)
After sCIMT	2.7 (2.6-3.5)	3.0 (2.7-3.5)
After 3mo	3.1 (2.7-3.9)	3.4 (3.1-3.6)
After 12mo	3.6 (3.2-4.1)	3.8 (2.9-4.1)

NOTE. Values are median (interquartile range).
Abbreviations: sCIMT, shortened CIMT; Sollerman, Sollerman hand function test.