Constraint-Induced Movement Therapy for Upper Extremities in People With Stroke

Davide Corbetta, PT, BSc; Valeria Sirtori, PT, BSc; Greta Castellini, PT, MSc; Lorenzo Moja, MD, MSc, PhD; Roberto Gatti, PT, MSc

Despite preserved or recovered movement ability after stroke, often people do not fully realize this ability in their everyday activities. Constraint-induced movement therapy (CIMT) is an approach to stroke rehabilitation that involves the forced use of the affected arm by restraining the less affected arm combined to several hours of exercise. Modified forms of CIMT exist, reducing the training during the period of restraint, or concentrating only on the use of restraint.

Objective
We assessed the efficacy of CIMT and its modified forms for arm management in people with hemiparesis after stroke.

Methods
In January 2015, we searched multiple databases, ongoing trials registers and reference lists of relevant papers. We included randomized controlled trials comparing CIMT or its modified forms with other rehabilitative techniques, or none. Primary outcome was disability; secondary outcomes were arm motor function, perceived arm motor function, motor impairment, quality of life, and dexterity. Reviewers extracted data and assessed risk of bias of included randomized controlled trials.

Main Results
Forty-two randomized controlled trials (1453 participants) are included in the review. The trials included participants who had some residual motor power of the paretic arm, the potential for further motor recovery and with limited pain or spasticity, but tended to use the arm little, if at all. Eleven trials (344 participants) assessed disability immediately after the intervention, indicating a nonsignificant standard mean difference 0.24 (95% confidence interval, −0.05 to 0.52). Three of these studies (125 participants) explored disability after a few months of follow-up and found no significant difference, standard mean difference −0.21 (95% confidence interval, −0.57 to 0.16). For the most frequently reported outcome, arm motor function, 28 studies (858 participants) showed a significant standard mean difference 0.34 (95% confidence interval, 0.12–0.55) in favor of CIMT (P=0.004). Sixteen studies (372 participants) assessed arm motor impairment, indicating a significant standard mean difference 0.82 (95% confidence interval, 0.31–1.34) in favor of CIMT (P=0.0017; Figure).

Conclusions
CIMT is a multifaceted intervention where restriction of the less affected arm is accompanied by increased exercise tailored to the person’s capacity. We found that CIMT was associated with limited improvements in motor impairment and motor function, but that these benefits did not convincingly reduce disability. Information about the long-term effects of CIMT is scarce. CIMT trials do not make it clear which people might most benefit from this treatment. Researchers involved in future studies should analyze the correlation between participant characteristics and outcome improvements to identify responders to CIMT. In this way, clinicians would have the possibility to detect the patients to which propose a tailored program of CIMT.

Disclosures
None.

References
<table>
<thead>
<tr>
<th>Outcome</th>
<th>No. of trials (participants)</th>
<th>Effect size [95% Confidence intervals]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disability postintervention</td>
<td>11(344)</td>
<td>SMD 0.24 [-0.05, 0.52]</td>
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<tr>
<td>Heterogeneity: $I^2 = 37%$</td>
<td></td>
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<tr>
<td>Test for overall effect: $Z = 1.64$ ($P = 0.10$)</td>
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<tr>
<td>Disability 3 to 6-month follow-up</td>
<td>3(125)</td>
<td>SMD -0.21 [-0.57, 0.16]</td>
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<tr>
<td>Heterogeneity: $I^2 = 0%$</td>
<td></td>
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<tr>
<td>Test for overall effect: $Z = 1.12$ ($P = 0.26$)</td>
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<tr>
<td>Arm Motor Function</td>
<td>28(858)</td>
<td>SMD 0.34 [0.12, 0.55]</td>
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<tr>
<td>Heterogeneity: $I^2 = 47%$</td>
<td></td>
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<tr>
<td>Test for overall effect: $Z = 3.08$ ($P = 0.002$)</td>
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<tr>
<td>Arm Motor Impairment</td>
<td>16 (372)</td>
<td>SMD 0.82 [0.31, 1.34]</td>
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<tr>
<td>Heterogeneity: $I^2 = 77%$</td>
<td></td>
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<tr>
<td>Test for overall effect: $Z = 3.14$ ($P = 0.002$)</td>
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Figure. Effect of constraint-induced movement therapy and its modified forms (constraint) versus other rehabilitative techniques or none (control). SMD indicates standardized mean difference.
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Stroke. 2016;47:e205-e206; originally published online June 7, 2016;
doi: 10.1161/STROKEAHA.116.013281
Stroke is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
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Print ISSN: 0039-2499. Online ISSN: 1524-4628

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World Wide Web at:
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