Critique of Home Constraint-Induced Movement Therapy Trial

Constraint-Induced Movement Therapy Study Prompts the Need for Further Research

Lara A. Boyd, PT, PhD*; Marion F. Walker, FCOT, PhD*

Enhancing recovery from stroke with effective rehabilitation interventions remains an elusive goal. Although intensive rehabilitation therapies such as constraint-induced movement therapy (CIMT) show promise, the intervention has not been deployed in routine clinical practice. Slow uptake of CIMT in routine clinical practice has been attributed to its large demand on professional resources and patient compliance, as well as the costs associated with delivering high doses of therapy in a relatively short time. To remediate these limitations, there have been calls for modified versions of CIMT that are less intensive, lower cost, and easier to deliver. Recent work by Barzel et al attempted to advance the understanding of modified forms of CIMT by applying this therapy in the home setting. Home CIMT includes the basic elements of CIMT including repetitive training, transfer of activities, and constraint of the nonparetic hand. However, Home CIMT attempts to accomplish each of these goals within the individual’s home setting under the supervision of a nonprofessional coach. Although study participants were involved in overall goal setting for their therapeutic program, they only interacted with professional rehabilitation practitioners (Occupational or Physical Therapists) in 5 visits: 2 initial home visits to set up the program in the first week of a 4-week program and 3 additional sessions to adjust the program during the next 3 weeks. The overall goal was 40 hours of task practice with the paretic arm for a 20-day period.

The authors are to be commended for applying a positive intervention in a real-world setting. Their methodology included an elegant geographical cluster randomization that allowed individuals who were receiving care in the chronic stage post stroke (>6 months) to be included on the basis of clinic they were visiting. This approach limited the potential contamination of protocol adherence associated with requiring therapists from the same clinic to deliver Home CIMT and standard therapy (which was the control intervention). Furthermore, the 2 groups (Home CIMT and standard care controls) were matched for the amount of time that the participants directly interacted with therapists.

Importantly, the study showed equivalent effects of the Home CIMT and standard care interventions for one of the primary measures, the Wolf Motor Function Task, and slightly better outcomes for the Home CIMT group on the Motor Activity Log—Quality of Movement (MAL-QOM). The Wolf Motor Function Task is a quantitative measure of upper extremity motor ability that uses timed and functional tasks. It has known reliability and validity as a test of arm function after stroke. In the MAL-QOM, individuals are asked to rate their QOM during functional tasks. It measures activity and participation, and is reliable and valid for use after stroke. Although the advantage of MAL-QOM for the Home CIMT group was statistically significant, this finding should be interpreted with great care. First, neither the magnitude of improvement nor the between-group difference in MAL-QOM was large enough to represent a clinically meaningful difference (Table). Second, the MAL-QOM is a self-report measure. Thus, it is possible that other factors such as knowledge of membership in a novel intervention group, motivation to participate in research, and attention from a dedicated coach (who was a friend or family member) could have played a role in the positive responses on the MAL-QOM from the Home CIMT group.

Similarly, it is hard to understand the fidelity of the intervention because the main outcome (MAL-QOM) was reported by study participants on a form and not tested or observed directly. Another interesting aspect of this trial was the role of the coach. We were surprised that the coach was not consented to the trial, despite being integral to the design of the study (and the authors’ statement that they planned to interview them). There is a likely considerable amount of data to be captured from the coach on their role in the trial, their compliance to the protocol, and what they observed and experienced during training. Consideration of whether improvement in self-reported arm movement was greater for those that worked with their coach, perhaps because they felt that there had to be a positive benefit for the individuals who were volunteering time to work with them is important. This factor may help to explain the MAL-QOL changes in the Home CIMT group.
Further, there is mention in the article that 12 individuals in the Home CIMT group failed to adhere to the protocol either because of insufficient time or because some therapists did not follow the protocol, and that on average participants engaged in 27.7 hours of home therapy rather than the 40 hours that were intended. However, the authors did not comment on the lower than intended dosage or explicitly consider how this may have impacted their findings. Given our emerging understanding of the relation between dose of therapy and functional gains, this may be a key limitation of the present work. The venue for therapy was at home for Home CIMT but the authors do not state whether the majority of sessions took place in a clinic setting for the standard care group. The geographical environment of the control group participants was not discussed in the results, which was surprising given past literature that suggests that there are benefits of treating in a home environment.

It is curious that the trial included patients who were 4 years post stroke (on average). Recently, Kwakkel et al suggested that “CIMT has greater effects on motor function only when applied in the early stages post stroke (when the restitution of neurological functions is still possible).” Kwakkel et al seem to be stating that the application of CIMT later after stroke may yield different results and include the training of adaptation strategies to improve, rather than stimulating neuroplastic change associated with recovery. This raises the question as to what mechanisms are at play in the small changes shown with Home CIMT.

Although the efforts of the authors to modify and enhance the applicability of CIMT are to be commended, it is clear that the intervention as delivered failed to exploit the full effects of forced use therapies. The results from the intervention group are modest. The small effects of the Home CIMT intervention may be a reflection of the relatively small dose of therapy, which was far less than what would normally be offered. It is also hard to know whether the home therapy was delivered as intensive or frequent as reported, this factor was largely uncontrolled. It would be helpful to understand in greater depth the training of therapists and coaches; from the article, it seemed to be minimal and there was no follow-up with coaches or therapists by the study staff to clarify any queries with protocols.

The data presented by Barzel et al suggest that it is critical that a skilled therapist, in conjunction with a highly trained nonprofessional coach, who can collaboratively guide the progression, speed, and effort of the patient deliver CIMT interventions at sufficiently high dosage. This and the economic costing of such requirements are crucial information that must inform future trials where modified forms of CIMT or other novel therapies for stroke rehabilitation are tested. It will be crucial for future trials to include objective measures of function that index recovery after stroke beyond that as perceived by the study participant. Studies with this type of design are a key to advance our understanding, and the eventual widespread implementation, of CIMT therapies.

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### References


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**Table.** MAL-QOM Data at Each Time Point, and Absolute and Percent Change Associated With the Intervention From Baseline to 4 Weeks

<table>
<thead>
<tr>
<th>Groups</th>
<th>Baseline</th>
<th>4 wk</th>
<th>3 mo</th>
<th>6 mo</th>
<th>Change Baseline to 4 wk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home CIMT</td>
<td>1.19</td>
<td>1.78</td>
<td>1.80</td>
<td>1.73</td>
<td>0.56 (66.8%)</td>
</tr>
<tr>
<td>Standard care</td>
<td>1.55</td>
<td>1.81</td>
<td>1.78</td>
<td>1.87</td>
<td>0.31 (85.6%)</td>
</tr>
</tbody>
</table>

Note that a clinically meaningful difference for MAL-QOM is 1.0. CIMT indicates constraint-induced movement therapy; and MAL-QOM, Motor Activity Log—Quality of Movement.

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