Stroke is one of the leading causes of adult disability, with more than half of stroke survivors losing functional abilities in their more affected arm and hand (Kwakkel et al, 2004; McCarron et al, 2008; Pan et al, 2008). The consequences of upper limb dysfunction in people with stroke influence their daily activities, such as self care, feeding and dressing (Gowland et al, 1992; Whitall et al, 2000). The upper limb dysfunction due to stroke is one of the most common disorders treated by therapists using various rehabilitation approaches (Carr and Shepherd, 1998). However, because the types of hand function intervention outcomes are unclear and lack sound research, there is a need for innovative rehabilitation approaches (Fritz et al, 2005; Wolf et al, 2006). These approaches may minimize the consequences of upper limb dysfunction and enhance stroke patients’ daily functional activities (Page et al, 2002).

The Neurodevelopmental Treatment (NDT) approach includes specific techniques of inhibiting pathological tone that interfere with performing active movements. This could be achieved by using trunk rotations to normalize tone and reduce spasticity, or using weight-bearing techniques on spastic extremities to inhibit spasticity and facilitate normal movements of the lower extremities (Bobath and Bobath, 1984). The NDT approach is the most popular method of treating stroke survivors in various countries, especially in Jordan.

One approach for which the literature is rapidly expanding is Constraint-Induced Movement Therapy (CIMT) (Taub et al, 1993; van der Lee, 1999). CIMT has been evaluated on adults who had stroke resulting in upper limb dysfunction with promising outcomes (Taub et al, 1980; Taub et al, 1993; Wolf et al, 2008). The CIMT is based on the hypothesis that ‘learned non-use’ occurs when individuals fail to use their affected hand (Taub et al, 1980). In the early stages after stroke, patients begin to compensate by using the unaffected side, rather than the affected side, this delays recovery of function of the affected limb (Grotta et al, 2004).

The elements of CIMT include:

- Constraint of the unaffected hand to encourage the use of the affected hand
Home-based modified CIMT is an effective treatment approach in improving upper limb dysfunction in stroke survivors.

Home-based modified CIMT is more effective than the Neurodevelopmental Treatment (NDT) approach in improving upper limb dysfunction in stroke survivors.

**METHOD**

**Design**

This pretest-post-test randomized study was conducted over a period of 12 months. The study protocol received ethical approval from the Research Council of the Hashemite University (Jordan) before the study was conducted. All participants signed informed consents. A total of 20 participants met the inclusion criteria and were randomly numbered from one to twenty. Participants with odd numbers were allocated to CIMT group and those with even numbers were allocated to NDT group. The investigators, who were blind to the allocation of the groups, provided the evaluation tests, and were not the therapists who treated the participants.

**PARTICIPANTS**

The inclusion and exclusion criteria of the sample were adopted from previous CIMT studies (Taub et al, 1993; Alberts et al, 2004; Wolf et al, 2006). The inclusion criteria were:

- Experienced stroke more than 2 months prior to the study enrolment
- Aged greater than 40 years and less than 75 years
- Live with family caregivers at their homes
- Have no balance problem that might risk safety.

The exclusion criteria were:

- Recurrent strokes, bilateral, or brain stem stroke
- Inability to actively extend 10° at metacarpophalangeal and interphalangeal joints, and 20° at wrist (Atteya, 2004; Page et al, 2004; Wolf et al, 2006)
- Substantial use of the involved upper extremity in their life situation, as evidenced by a score 2.5 on the motor activity log (MAL) amount of use scale (Wittenberg, et al, 2003; Wolf, et al, 2006; Page, et al, 2008)
- Major cognitive deficits (score of less than 24 points on the Folstein Mini-Mental state Examination) (Folstein et al, 1975; Ploughman and Corbett, 2004; Wolf et al, 2006; Myint et al, 2008)
- Excessive spasticity and pain, as determined by clinical judgment (Taub et al, 1993; Wolf et al, 2006).

All previous CIMT studies showed promising results, but have been conducted on a relatively small scale, using a single test site. In a better quality design using multi-sites, the Extremity Constraint Induced Therapy Evaluation (EXCITE) trails have shown the efficacy of the CIMT intervention for stroke patients who were followed for 1–2 years (Wolf et al, 2006; Wolf et al, 2008). However, there were some concerns related to the CIMT training programmes. Most studies were institutional-based and carried out in developed countries. There were limited studies that looked at the applicability of CIMT in natural environments where patients spent most of their normal lives. For these reasons and other methodological limitations, the CIMT is not a part of the routine stroke rehabilitation programme; the approach is still evolving (Grotta et al, 2004).

The purpose of this study was to test the following two hypotheses:

- Massed practice of the affected hand to facilitate learning of movement and function,
- Use of intensive techniques to train the affected hand (Taub et al, 1993; Uswatte et al, 2005).
Two trained occupational therapists participated in educating and training stroke survivors as well as caregivers for the CIMT at home. The training programme included:

- Orientation about the CIMT approach
- The importance of caregivers’ commitment to the success of training activities
- Detailed information about training activities to be carried out at home during the intervention period and the follow-up of 4 months training post intervention.

This training was varied from one patient to another; it took about 3–4 sessions. Two other therapists (one occupational therapist and one physical therapist) worked with the NDT group using the NDT approach. Their duties involved home visits once a week to homes of stroke survivors, as well as follow-up phone calls.

During the two-month period, treatment of stroke survivors in the modified home-based CIMT group consisted of two main elements:

- Restricting the movement of the unaffected hand using a resting hand splint for two hours per day
- Intensive training of the affected arm two hours per day while restraining the unaffected hand, seven days a week, for two months.

The training was based on self-induced voluntary movements used in bilateral hand activities using principles of motor learning and shaping. All training activities were carried out at the participants’ homes. Most of the training activities were similar to those performed by the participants in their daily lives. Training activities focused on patients’ activities of daily living (ADLs) (e.g. eating, dressing, personal hygiene, bathing, brushing, combing, shaving); instrumental activities of daily living (IADLs) (e.g. dusting, laundry, mopping the floor, preparing meals, dishwashing); and leisure activities (e.g. playing cards, chess, crafts, gardening). The amount of training was noted in a diary by patients’ families.

In the NDT group, the training consisted of weight bearing and facilitation of arm movement based on conventional NDT procedures, which is the common treatment for stroke survivors in Jordan. The NDT treatment was conducted by trained occupational and physical therapists at Al-Basheer Hospital, out-patient rehabilitation department. The amount of treatment was two hours per day during the weekdays, and a home programme of two hours per day during the weekend, for two months. The total amount of training therapy was the same for both groups.

Changes in functional performance were evaluated using different clinical evaluations, which were administered at the onset, at two months, and at six months after the first assessment (Figure 1).

Three assessment tools were used in this study:

- The Wolf Motor Function Test (WMFT) was used as a primary outcome measure. The WMFT assesses changes in arm motor function on 15 functional tasks that progress in complexity from using an individual joint, to use of total arm. Quality of movement scoring was assessed using a 6-point Functional Ability Scale, with scores ranging from 0 (not attempted) to 5 (normal movement) (Morris et al., 2001; Wolf et al., 2002)

- The Motor Activity Log (MAL) is a semi-structured interview that measures ‘how often’ and ‘how well’ patients use their affected arm in 30 functional tasks that are related to activities of daily living, on a scale of 0–5 in 0.5 increments (Uswatte et al., 2005)

- The Fugl-Meyer (FM) assessment assesses changes in arm motor impairment using a three point ordinal scale. The FM measures joint motion (24 points), pain score (24 points), sensation (12 points), and motor function (66 points) (Page et al., 2001). Both MAL and FM assessment tools were used as secondary outcome measures.

All assessment tools’ validity and reliability have been ascertained in different stroke populations (Sanford et al., 1993; Morris et al., 2001; Uswatte et al., 2005; Wolf et al., 2002).
STATISTICAL ANALYSIS

All data analysis was computed with the Statistical Package for Social Sciences (SPSS) version 16.0. To test the first hypothesis of this study, paired t-tests were used to analyze within group differences. Mean scores and standard deviation (± SD) for baseline, post intervention and four months after intervention were calculated on the primary and secondary outcome measures and its subscales. The analysis of covariance (ANCOVA) was used to analyze differences between groups, with the baseline score as a covariate to test the second hypothesis of this study.

RESULTS

Ten participants with single unilateral stroke were included in the CIMT group and 10 served as the NDT group. Two participants dropped out of the NDT group at an early stage, resulting in eight participants completing the NDT intervention. There were no reasons given by the two participants who decided to withdraw from the study.

For practical reasons, participants were selected purposively and recruited from a rehabilitation outpatient clinic at Al-Basheer Hospital (a large governmental hospital in the capital) (Table 1). At the beginning of the intervention, stroke survivors were 3–17 months (M = 9.2, SD = 5.79) post onset of stroke for the CIMT group, and 2.6 – 15.3 months (M = 9.6, SD = 4) onset of stroke for the NDT group. The participants were matched for age (M = 54.8, SD = 10.9) in the CIMT group, and (M = 60.6, SD = 4.9) in the NDT group (Table 1).

No significant differences between both groups were found at the baseline assessment according to age, time since stroke, and all outcome measures used in this study (Table 2).

The CIMT group showed a statistically significant improvement of their upper limb dysfunction in all functional ability measures.

Primary outcome measure

Differences between the groups in the WMFT performance time showed a non-significant trend of improvement in favour of the CIMT group at the initial post-treatment, F (1, 15) = 1.48, P = 0.24, and at the four months follow-up, F (1, 15) = 3.0, P = 0.10. There was a significant difference in the WMFT functional ability score between the groups, in favour of the CIMT at the initial post-treatment, F (1, 15) = 12.68, P = 0.003. However, at the four months follow-up, a non-significant improvement in favour of the CIMT group, according to the functional ability score was found, F (1, 15) = 4.37, P = 0.054. Stroke survivors in the CIMT group significantly improved on both subscales. The CIMT group significantly improved their performance time in the initial post-treatment, t (9) = 2.46, P < 0.05, and at the four months follow-up, t (9) = 5.82, P < 0.001. Similarly, the CIMT group significantly improved their functional ability (WMFT) at the initial post-treatment, t (9) = -6.27, P < 0.001, and at the four months follow-up, t (9) = -6.52, P < 0.001. No significant improvement was noticed for those in the NDT group (Table 3).

Secondary outcome measures

A non-significant improvement in favour of the CIMT group was noticed between the groups, according to both MAL amount of use, and quality of movement scales, at the initial post-treatment and at the four months follow-up assessment. The CIMT group sig-
significantly improved their MAL amount of use at the initial post-treatment time, $t(9) = -3.63$, $P < 0.05$, and at four months post treatment, $t(9) = -6.59$, $P < 0.001$. A significant improvement was noticed at the initial post-treatment time for the NDT group on the MAL amount of use scale, $t(7) = -2.93$, $P < 0.05$. However, this improvement was not significant at the four month follow-up.

On the MAL quality of movement scale, the CIMT group significantly improved at both the initial post-treatment period and at the four month follow-up ($P < 0.05$). The NDT group did not show any significant improvement according to the FM assessment ($Table 5$).

**DISCUSSION**

Results of this study are consistent with other studies in terms of the improvement of upper limb function after CIMT therapy in stroke survivors (Taub et al, 1993; Wittenberg, 2003; Wolf et al, 2006; Wolf et al, 2008). A key difference between this study and previously conducted ones was the conducting of the therapy at stroke survivors’ homes, by their own families, with therapists’ support. This is unlike previous CIMT studies, where the intervention was deliv-

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**TABLE 3.** The Wolf Motor Function Test (WMFT) assessment results

<table>
<thead>
<tr>
<th></th>
<th>CIMT ($N = 10$)</th>
<th>NDT Group ($N = 8$)</th>
<th>Between-group Differences, mean differences ANCOVA P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean + SD</td>
<td>Within group differences, mean change (95% CI)</td>
<td>Mean + SD</td>
</tr>
<tr>
<td>WMFT– performance time (seconds)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Baseline</td>
<td>16.7 (0 %)</td>
<td>12.37 (0 %)</td>
<td>0.242</td>
</tr>
<tr>
<td>- Post-treatment (2 months)</td>
<td>10.25 (-39 %)*</td>
<td>12.24 (-1 %)</td>
<td>0.104</td>
</tr>
<tr>
<td>- Four months follow-up</td>
<td>7.86 (-53 %)**</td>
<td>16.52 (34 %)</td>
<td>0.054</td>
</tr>
<tr>
<td>WMFT– functional ability (max = 5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Baseline</td>
<td>2.96 ± 0.43</td>
<td>3.3 ± 0.44</td>
<td>0.01 (-0.29 to 0.32)</td>
</tr>
<tr>
<td>- Post-treatment (2 months)</td>
<td>3.62 + 0.49</td>
<td>3.29 + 0.60</td>
<td>0.003</td>
</tr>
<tr>
<td>- Four months follow-up</td>
<td>3.82 + 0.44</td>
<td>3.43 + 0.67</td>
<td>0.054</td>
</tr>
</tbody>
</table>

* $P < 0.05$ ** $P < 0.001$

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**TABLE 4.** The Motor Activity Log (MAL) assessment results

<table>
<thead>
<tr>
<th></th>
<th>CIMT ($N = 10$)</th>
<th>NDT Group ($N = 8$)</th>
<th>Between-group Differences, mean differences ANCOVA P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean + SD</td>
<td>Within group differences, mean change (95% CI)</td>
<td>Mean + SD</td>
</tr>
<tr>
<td>MAL– Amount of Use (Max = 5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Baseline</td>
<td>1.61 ± 0.88</td>
<td>1.79 ± 0.6</td>
<td>0.199</td>
</tr>
<tr>
<td>- Post-treatment (2 months)</td>
<td>2.97 ± 1.2</td>
<td>2.46 ± 0.937</td>
<td>0.128</td>
</tr>
<tr>
<td>- Four months follow-up</td>
<td>3.44 ± 1.15</td>
<td>2.73 ± 0.30</td>
<td>0.0115</td>
</tr>
<tr>
<td>MAL– Quality of Movement (Max = 5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Baseline</td>
<td>1.54 ± 0.78</td>
<td>1.66 ± 0.72</td>
<td>0.130</td>
</tr>
<tr>
<td>- Post-treatment (2 months)</td>
<td>2.78 ± 1.07</td>
<td>2.2 ± 0.62</td>
<td>0.115</td>
</tr>
<tr>
<td>- Four months follow-up</td>
<td>3.14 ± 1.13</td>
<td>2.467 ± 1.18</td>
<td>0.130</td>
</tr>
</tbody>
</table>

* $P < 0.05$ ** $P < 0.001$
Another difference was related to the modification of the intervention time and duration, of two hours per day for two months. In all previous CIMT studies, the intervention time and duration were 90% of waking hours, for two weeks (Myint et al, 2008; Dahl et al, 2008); six hours per day for three weeks (Lin et al, 2007; Wu et al, 2007a) and five hours per day for 10 weeks (Atteya, 2004; Page et al, 2008). Only in two studies was the training time modified to two hours (Dromerick et al, 2000) and a mean restraint time of 2.7 hours (Ploughman and Corbett, 2004), because of muscle fatigue. However, in these previous studies, the intervention duration was for two weeks and was conducted in rehabilitation facilities.

It has been suggested that the intensity of training is an important factors in CIMT intervention (Taub et al, 1993; Alberts et al, 2004; Page et al, 2005; Wu et al, 2007b). However, the modification of the intensity in this study indicated that other factors might play a positive role in improving upper limb function in the CIMT group. The possible explanation for this can only be speculated. The commitment of family caregivers to carry out the intervention, with the support of the therapists through home visits and follow-up phone calls, might have positively influenced the outcomes of this study. Another possible explanation is that the home environment might create a natural healing atmosphere. In institutional or clinical-based studies, transferring the treatment effect to the life situation might not be possible, while in the current study, the home-based environment allowed a positive transfer of skills and improved functional abilities by the CIMT group as measured by WMFT. This secure home environment might also be behind survivors and their caregivers’ motivation to participate actively in the CIMT intervention, and complete the programme with positive outcomes.

In terms of changes in upper limb function, stroke survivors in the CIMT group displayed considerably larger improvement in the functional use of their affected arms, measured by MAL, when compared to the NDT group. These greater improvements of MAL scores in the CIMT group were consistent with previous findings (Miltner et al, 1999; Page et al, 2002; Page et al, 2005; Bonifer et al, 2005; Wu et al, 2007b). The great improvement in MAL scores suggested that stroke survivors in the CIMT group were more willing to engage their affected upper extremity and produced enhanced quality of movement (Page et al, 2002; Page et al, 2005; Wu et al, 2007a; Myint et al, 2008). The changes of MAL among CIMT stroke survivors were accompanied by marked motor recovery changes on FM scale. The changes of MAL were also

<table>
<thead>
<tr>
<th>TABLE 5. The Fugl-Meyer (FM) assessment results</th>
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<tbody>
<tr>
<td><strong>CIMT (N = 10)</strong></td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td><strong>Mean + SD</strong></td>
</tr>
<tr>
<td><strong>FM – Joint motion (max = 24)</strong></td>
</tr>
<tr>
<td>- Baseline</td>
</tr>
<tr>
<td>- Post-treatment (2 months)</td>
</tr>
<tr>
<td>- Four months follow-up</td>
</tr>
<tr>
<td><strong>FM – Pain score (max = 24)</strong></td>
</tr>
<tr>
<td>- Baseline</td>
</tr>
<tr>
<td>- Post-treatment (2 months)</td>
</tr>
<tr>
<td>- Four months follow-up</td>
</tr>
<tr>
<td><strong>FM – Sensation (max = 12)</strong></td>
</tr>
<tr>
<td>- Baseline</td>
</tr>
<tr>
<td>- Post-treatment (2 months)</td>
</tr>
<tr>
<td>- Four months follow-up</td>
</tr>
<tr>
<td><strong>FM – Motor function (max = 66)</strong></td>
</tr>
<tr>
<td>- Baseline</td>
</tr>
<tr>
<td>- Post-treatment (2 months)</td>
</tr>
<tr>
<td>- Four months follow-up</td>
</tr>
</tbody>
</table>

* P < 0.05, ** P < 0.001
accompanied by marked motor function changes in WMFT.

The WMFT outcomes in this study are consistent with previous studies showing that CIMT is effective in improving upper limb motor function, as assessed by clinical rating scales (Alberts et al. 2004; Atteya, 2004; Dahl et al., 2008). The improvements achieved at post intervention were sustained at a 4-month follow-up period, which is consistent with previous studies (Page et al., 2001; Ploughman and Corbett, 2004).

The positive changes in the use and motor function in the affected arms after intervention in this home-based study suggest that CIMT leads to improvement of the hemiplegic upper limb. This result supports the first hypothesis of this study. Stroke survivors in the CIMT group showed better improvement in their upper limb dysfunction than those in the NDT group. The authors’ hypothesis that home-based modified CIMT would be more effective than NDT was not however supported. Results of this study are encouraging, and may lead to home-based CIMT being accepted as an approach for improving the motor performance of stroke survivors, after further investigations.

LIMITATIONS

This home-based study revealed positive effects of modified CIMT for stroke survivors with upper limb dysfunction. However, the findings of this study must be interpreted with caution for the following reasons:

- Purposive sampling was used
- The small sample size in the current study (18 participants) (also raising concerns about the generalizability of the study
- The use of some subjective measures such as a self report measure (MAL), and the observer-initiated measures (FM). These measures have psychomotor limitations in a heterogeneous population such as stroke survivors (Page et al., 2005).

To strengthen the evidence of the CIMT approach and validate the applicability of CIMT in stroke survivors across different cultures and environments, additional studies are needed to understand better:

- Whether the CIMT would be carried out by family caregivers at patients’ own homes with the help of therapists
- Whether culturally modified CIMT would be implemented in community environments with limited resources.

Further studies using kinematic measures during functional ADLs movements and upper limb bimanual activities are needed. As in other CIMT studies the follow-up intervention period was relatively short. If a longer follow-up assessment beyond 4 months was included, the relative improvement of upper extremity function in the two groups could be better compared.

CONCLUSION

This study has confirmed the feasibility of an approach for delivering CIMT at home with family involvement. Further studies with larger samples are needed to test the superiority of home-based modified CIMT from current standard care.

Conflict of interest: none

Acknowledgments: The researchers would like to thank all stroke survivors and their caregivers who participated in this study. Their efforts, enthusiasm, as well as their patience, played an important role in the success of this study. The funding of this research from the Hashemite University and the cooperation of the staff of the rehabilitation centre at Al-Hasheer hospital made this study possible. The efforts of data collectors are highly appreciated.


analysis. Stroke 35: 2529–36

KEY POINTS

- Upper limb dysfunction in stroke survivors was improved by CIMT intervention, which was conducted by family caregivers, with the support of therapists.
- The improvement in arm and hand function was maintained at four months follow-up.
- Home-based CIMT intervention produced similar outcomes to previous, more costly, clinical-based studies.
- This CIMT study presented, for the first time, modifications of intensity of two hours per day, seven days per week, over two months, with positive outcomes.

COMMENTARIES

It is always exciting to see studies generated by clinical researchers in countries in which rehabilitation and the rehabilitation professions are not well established. Providing high quality care with limited resources, and little recognition, can be a battle. Doing research within this kind of environment is often a challenge, and I congratulate the authors of this study for their innovation and persistence.

Abu Tariah et al have presented a pragmatic trial of constraint induced movement therapy (CIMT) that was designed to approximate other studies of CIMT, but with one important difference. In this study, the CIMT at home group participated in training under the guidance of trained family carers. While the involvement of carers in rehabilitation is recognised as representing good clinical practice in many guidelines (Intercollegiate Working Party for Stroke, 2004; National Stroke Foundation, 2010), carers as trainees has received much less attention. In countries where the number of available rehabilitation staff is limited, and where the family unit means that carers are available, it makes sense to consider how carers may be helpers. Poor access to transport and large geographical separation between patients and rehabilitation centres may also be good
reasons to look at the option of training car-
erers to do rehabilitation.

Conclusions
Although the study was probably too small
to definitively answer the proposed ques-
tions, an important contribution of the
study is that the authors have shown that
it is feasible for carers to deliver a CIMT
intervention following a small amount of
training. The highly functional focus of the
intervention also made delivering it within
a home setting highly appropriate. I’m am
sure that we will continue to see further
good quality research that addresses some
of the barriers to providing great rehabili-
tation care in challenging settings.

stroke management 2010. National Stroke Foundation,
Melbourne, Australia

National Clinical Guidelines for Stroke (2nd Edn). Royal College of
Physicians, London

“The authors have shown that it is feasible for car-
erers to deliver a CIMT intervention.”

Julie Bernhardt
Director,
AVERT Early Intervention Research Program,
Australian Research Council Future Fellow,
National Stroke Research Institute (part of
Florey Neuroscience Institutes)
Melbourne, Australia
j.bernhardt@unimelb.edu.au

“A recent study indicated that only 4–20% of car-
egivers were involved in establishing the client’s
rehabilitation goals.”

Conclusions
Certainly, a home based CIMT protocol is feasible. This study yielded promising results that,
I believe, will be strengthened with future studies containing larger, random sam-
pel sizes, as suggested by the authors. I agree
with the need for future studies to define
the optimal parameters of home based CIMT
with the use of caregivers and therapists, as
well as implementation of culturally modified
CIMT in institutional and community settings.
This study was a promising initiative toward ‘real-world’ application of CIMT.

induced therapy on precision grip: A preliminary study.
Neurorehabilitation Neural Repair 18(4): 250–8

Improving patient and carer communication, multidiscipli-
inary team working and goal-setting in stroke rehabilita-

Taub E, Harger M, Grier HC, Hodos W (1980) Some ana-
amical observations following chronic dorsal rhizotomy in

Taub E, Miller NE, Novack TA et al (1993) Technique to
improve chronic motor deficit after stroke. Arch Phys Med
Rehabil 74(4): 347–54

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28(24): 1557–61

Wittenberg GF, Chen R, Ishii K et al (2003) Constraint-
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maps and cerebral activation. Neurorehabilitation Neural
Repair 17(1): 48–57

trial: Attributes of the Wolf Motor Function Test in patients
with subacute stroke. Neurorehabilitation Neural Repair
19(3): 1183–94

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Occupational Therapy Department
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Current research on constraint
induced movement therapy
(CIMT) provides us with an evid-
ced based treatment method to use
in the rehabilitation of the upper extrem-
ity after a stroke. The signature protocol,
as performed in the EXCITE trial (Wolf
et al, 2006), justified the need to spend
longer, more intensive amounts of time
with patients who have hemiplegia. CIMT
administered in this way was shown to elicit
positive outcomes (Taub, 1980, Taub, 1993,
Wittenberg, 2003, Alberts, 2004). Certainly,
the EXCITE trial proved that intensity of
training is important, and can be used to
justify increases in therapy time allotted
to patients who have suffered a stroke.
However, the clinical applicability of this
protocol is limited. Currently, the expense
of 2 weeks of therapy for 6 hours a day pro-
hibits widespread use. Also, patient compli-
ance becomes difficult given the intensity
of this programme.

This article
This study examined a modified form of
CIMT and compared its results to the com-
monly used techniques of NDT. The CIMT
was administered at home and consisted of
a distributed method of administration. This
method is a more feasible way to administer
a CIMT protocol and it would be easy to
replicate in therapeutic settings or future
research studies. In contrast, the protocol
used for NDT in this study was not as clearly
defined. This could explain the lack of
significant findings between home-based
CIMT and NDT. However, standardizing a
specific protocol for NDT is very difficult,
due to the variability of techniques.

Family and home
Stroke has been labeled as a ‘family disease’
(Visser-Meily, 2006). As such, rehabilitation
should take on a family-centred approach.
A recent study indicated that only 4–20%