Effect of constraint-induced movement therapy on persons-reported outcomes of health status after stroke : a systematic review and meta-analysis

Title: Effect of Constraint Induced Movement Therapy on Persons Reported Outcomes of Health Status after Stroke: A Systematic Review and Meta-analysis

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Abstract

Background: Constraint induced movement therapy (CIMT) is used for the rehabilitation of motor function after stroke. **Aim:** The aim of this review was to investigate its effect on persons reported outcomes of health status (PROsHS) compared with conventional therapy. **Materials/ Method:** The study was a systematic review and meta-analysis registered in PROSPERO (CRD42019142279)**.** Five databases: PubMED, PEDro, OTSeeker, CENTRAL and Web of Science were searched. Randomized controlled trials were included if they assessed PROsHS. Mean scores of PROsHS, sample size and dose of CIMT and control groups interventions were extracted. The result was analyzed using qualitative and quantitative syntheses. **Result:** Nine studies (n=558) were included in the review. From the result, CIMT significantly improved PROsHS post-intervention. However, post-intervention, there was no statistically significant difference between groups for the upper limb (MD= 6.67, 95% CI= -2.09 to 15.44, p=0.14) and the lower limb (MD= -1.86, 95% CI= -16.29 to 12.57, p=0.80). Similarly, there was no statistically significant percentage of variation across studies, upper limb (I^2=0%, p=0.92) and lower limb (I^2=0%, p=0.86). For the lower limb at follow-up, there was no statistically significant difference between groups (MD= 0.97, 95% CI= -13.59 to 15.53, p=0.90). When upper and lower limbs studies were pooled, there was no statistically significant difference between groups post-intervention (MD= 0.22, 95% CI= -0.15 to 0.58, p=0.24) and at follow-up (MD= 0.03, 95% CI= -0.43 to 0.49, p=0.90). **Conclusion:** Constraint induced movement therapy improves PROsHS after stroke. However, it is not superior to conventional therapy based on the current literature.

Key words: Patient reported outcomes of health status; quality of life; activities of daily living; stroke; constraint induced movement therapy; international classification of functioning, disability and health.

Introduction

Stroke can affect motor, sensory and cognitive functions of the brain [1-2]. When motor function is impaired after stroke, the patient may be unable to use their limbs and carry out activities of daily living [3]. Constraint induced movement therapy (CIMT) has been used for several decades for the rehabilitation of motor function after stroke. It is based on the learned non-use phenomenon, a theory that assumes that, after stroke, the survivors learn not to use the limb as a result of pain, fatigue or failure after an attempt [4-5]. However, when the unaffected limb is restrained and the affected limb is used to practice tasks repetitively, the functions of the affected limb improve [6-7].

The technique (CIMT) has been shown to improve motor function and other outcomes after stroke [7-10]. When motor function improves, independence in performing activities of daily living also improves; and following this, persons reported outcomes of health status (PROsHS) may be enhanced. This is because ability to perform activities of daily living significantly predicted PROsHS following CIMT [11-12]. In addition, achieving good PROsHS is one of the main goals of rehabilitation [13]. The aim of this study was to carry out a systematic review and meta-analysis on the effect of CIMT on PROsHS (primary outcome) and motor function, real world arm use and other functional outcomes (secondary outcomes). Therefore, the review sets to answer the following questions: 1) What are the effects of upper and lower limbs CIMT on PROsHS and other secondary outcomes after stroke? 2) What are the effects of upper and lower limbs CIMT compared to the control on PROsHS and other secondary outcomes after stroke? 3) What are the combined effects of upper and lower limbs CIMT compared to the control on PROsHS and other secondary outcomes after stroke?

Materials and Methods

The study design was a systematic review and meta-analysis which was registered in PROSPERO with registration number, CRD42019142279. The review was carried out in accordance with the guideline of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [14].

Eligibility criteria and information sources

PubMED, PEDro, CENTRAL, OT Seeker and Web of Science and the lists of the included studies and related systematic reviews were searched from their earliest dates to 21st October 2019. The search strategies used are shown in the appendix. One of the authors (TVC) carried out the literature search and it was confirmed by another author (AA). Duplicate studies were removed using Endnote software by one of the authors (TVC). Studies were selected if they were randomized controlled trials (RCTs) comparing upper or lower limb CIMT with traditional therapy involving stroke patients who were 18 years and above. The studies must also have assessed PROsHS as an outcome.

Selection of eligible studies and extraction of data

Two of the authors AA and NUM assessed the studies for eligibility by reading the titles and the abstracts independently using Rayyan software [15]. However, if there was no adequate information to consider a study for inclusion, they read the full text. Discrepancies were managed through consensus or by contacting another author (UUZ). The data on the study design, sample size, stage of stroke, participants' mean age, interventions for both experimental and control groups including intensity and duration, outcomes assessed (mean scores and standard deviation), the outcome measures used and the study findings were extracted by AA.

Assessment of Methodological Quality of the Included Studies

The quality assessment was carried out by AA and NUM independently and consensus was achieved following discussions between the authors and resolution of any disputes by another author (UUZ). The assessment was carried out using PEDro scale which has good psychometric properties [16]. The scale has 11 items with the first assessing internal validity (which is rated as yes or no) and the remaining items assessing external validity (which are rated from zero to ten). When the total score ranges from zero to three, four to five and six to ten, the quality is said to be low or moderate or high respectively [17-19].

Qualitative and Quantitative Syntheses of the Results

The qualitative synthesis involved summarizing the characteristics and methodological quality of the included studies. The quantitative synthesis involved meta-analysis of the mean and standard deviation of the scores on the outcomes of interest and the study sample size (for both the experimental and the control groups) post-intervention and at follow-up. Where studies used the same outcome measures to measure PROsHS and the secondary outcomes, a fixed effect model analysis was used. In contrast, when they used different outcome measures to measure PROsHS and the secondary outcomes, random effect model analysis was used. Percentage of variation across the studies due to heterogeneity not chance (I^2) was considered significant when I^2 value is between 50% and 90% at p <0.05. Sensitivity analysis was also carried out based on the stages of stroke.

Result

Study selection

The search provided 267 studies, in which only nine studies were finally included in the review. See figure 1 for the study flowchart.

Characteristics of the Included Studies

Nine RCTs (n=558) comprising of 345 men and 215 women were included in the study. The sample sizes ranged between 21 and 222 participants, though only two studies reported how the sample sizes were calculated [20-21]. The range of time since stroke was 9.7 days to eight years. Time since stroke is an important indicator of recovery after stroke; and the earlier, the better the outcome [22].

All the studies included participants with mild to moderate disability, a score of three to five on Brunnstrom stages of recovery [20, 22-24]; or 20° of active wrist extension and 10° of metacarpophalangeal and interphalangeal joints extension [21, 25-26]; or a score of ≥15 on motor arm sub-scale of upper limb Fugl-Meyer [27]; or upper limb paresis with minimal distal control [28]. All the studies included participants who had no significant cognitive impairment. Five studies used a score ≥ 24 points on Mini Mental state Examination (MMSE) [20, 22-23, 25, 27]. Two studies used a score of > 20 or 23 points on MMSE respectively [21, 28]. One study used a score of ≥ 63 on modified MMSE [24]. One study used a score of ≤1 on the consciousness and communication items of NIHSS and the ability to perform two steps command and a score of <8 on the Short Blessed memory, Orientation and Concentration scale [21].

Participants with ischaemic stroke were 271 in number; and those with haemorrhagic stroke were 54. This information was provided by only four studies (n=325) [20-22, 25]. Ischaemic stroke usually has better outcome compared to the haemorrhagic type [29].

Only seven studies with n=306 provided details on the side of the lesion, 147 right and 159 left side lesions [20-24, 27-28]. Similarly, only four studies with n= 364 provided information on the number of cases involving the dominant limb which was 154 [21, 25-26, 28]. Usually, patients

with left sided lesion have difficulty in language comprehension and expression [30]; whereas, those with right side lesion have neglect [31]. Both problems with language comprehension and expression and neglect can make recovery difficult. In addition, although those with dominant limb stroke tend to have less impairment in motor function [32]; however, there is no significant difference in terms of PROsHS between patients with dominant and non-dominant limbs stroke [33].

There were reports of adverse events in two studies [21, 25]. In the first study, 35 participants (21 in the control and 14 in the CIMT group) experienced serious adverse events [25]; while in the second study, the participants experienced increased shoulder pain with no difference across groups [21]. Adverse events can limit the use of a particular intervention. See table 1 for the details of the characteristics of the included studies.

Methodological quality/ Risks of bias of the Included RCTs in the Study

All the included studies have high methodological quality, as they have scores on PEDro scale ranging from six to eight points. See table 2 for the details of the methodological quality of the included studies.

Quantitative Synthesis

For the quantitative synthesis, nine studies were used as they provided sufficient information or data that enabled meta-analysis to be carried out [20-28]. Five studies were used for the meta-analysis of PROsHS scores [20-24, 26]. The remaining four studies were not used because three of them did not provide sufficient information for meta-analysis to be performed [25, 28]; and one study did not assess pre-intervention score for PROsHS [21]. Eight studies were used for the meta-analysis of motor function scores [20-28]. The remaining one study did not assess motor

function [22]. Six studies were used for the meta-analysis of perceived arm function [23-28]. The remaining three studies did not assess perceived arm or limb function [20-22]. Four studies were used for the meta-analysis of activities of daily living [23-24, 26-27]. The remaining five studies did not assess activities of daily living [20-22, 25, 28].

Persons Reported Outcomes of Health Status (PROsHS)

For the upper limb, only two studies assessed PROsHS post-intervention [23-24]. The result showed that there was no statistically significant difference between groups post-intervention (MD= 6.67, 95% CI= -2.09 to 15.44, p=0.14). In addition, there was no statistically significant percentage of variation across studies (I^2=0%, p=0.92). See figure 2a for more details. However, there was no sufficient information to carry out sensitivity analysis on the upper limb PROsHS post-intervention either based on time since stroke or dose of CIMT.

For the lower limb, the result showed that there was no statistically significant difference between groups post-intervention (MD= -1.86, 95% CI= -16.29 to 12.57, p=0.80). In addition, there was no statistically significant percentage of variation across studies (I^2=0%, p=0.86). See figure 2b for more details. At follow-up, there was no statistically significant difference between groups (MD= 0.97, 95% CI= -13.59 to 15.53, p=0.90); but statistically significant percentage of variation across studies (I^2=63%, p=0.10) at follow-up. See figure 2c for more details. However, there was no sufficient information to carry out sensitivity analysis on the lower limb PROsHS post-intervention and at follow-up.

When upper and lower limbs studies were pooled, there was no statistically significant difference between groups (MD= 0.22, 95% CI= -0.15 to 0.58, p=0.24) and the percentage of variation across studies (I^2=0%, p=0.58) post-intervention. See figure 2d for more details. Similarly, there

was no statistically significant difference between groups (MD= 0.03, 95% CI= -0.43 to 0.49, p=0.90) and percentage of variation across studies (I^2=7%, p=0.34) at follow-up. See figure 2e for more details. Sensitivity analysis based on the stage of stroke (involving studies that recruited participants in the sub-acute and chronic stages) at follow-up, still revealed that, there was no statistically significant difference between groups (MD= -0.16, 95% CI= -0.72 to 0.41, p=0.59). Similarly, the percentage of variation across studies was not statistically significant (I^2=2%, p=0.31). See figure 2f for more details.

Motor Function

For upper limb, there was no statistically significant difference between groups (MD= 0.30, 95% CI= 0.01 to 0.59, p=0.05); and in the percentage of variation across studies (I^2=43%, p=0.10) post-intervention. See figure 3a for more details.

When upper and lower limbs studies were pooled, there was statistically significant difference between groups in favour of CIMT (MD= 0.30, 95% CI= 0.04 to 0.56, p=0.02); but no statistically significant percentage of variation across studies (I^2=35%, p=0.15) post-intervention. See figure 3b for more details.

Amount of Use of the Upper Limb

There was statistically significant difference between groups in favour of CIMT (MD= 0.75, 95% CI= 0.61 to 0.88, p<0.00001); but no statistically significant percentage of variation across studies (I^2=35%, p=0.18) post-intervention. See figure 4a for more details.

Quality of Use of the Upper Limb

There was statistically significant difference between groups in favour of CIMT (MD= 0.71, 95% CI= 0.58 to 0.85, p<0.00001); but no statistically significant percentage of variation across studies (I^2=0%, p=0.44) post-intervention. See figure 4b for more details.

Activities of Daily Living

There was no statistically significant difference between groups post-intervention (MD= 0.14, 95% CI= -0.20 to 0.48, p=0.42); and in the percentage of variation across studies (I^2=0%, p=0.90). See figure 5 for more details.

Discussion

The results showed that, CIMT improved PROsHS and the secondary outcomes significantly post-intervention and at follow-up. However, there was no statistically significant difference between CIMT and the control group in PROsHS, but CIMT improved motor function, and quantity and quality of movement better than the control. The lack of difference between groups in PROsHS could be because of risks of bias such as due to lack of concealed allocation and blinding of subjects or therapists or assessors in some of the included studies. Bias can distort the true treatment effect, increase attrition and the use of co-interventions [34-35]. In addition, most of the studies were not very clear on the control interventions used. Therefore, it is possible that participants in the control group performed tasks that were similar to the ones in CIMT. Furthermore, time since stroke in the studies differ significantly between studies and most participants were either within the sub-acute or chronic stages of stroke. Time since stroke is an important indicator of recovery of PROsHS following CIMT [13].

In addition, PROsHS following CIMT may depend on the side affected and age. In previous studies, it was shown that patients with left sided hemiplegia (right side lesion), those who were more than 68 years old and those who were more than 17 months post stroke exhibited better improvement in PROsHS [11, 13]. Specifically, family role, energy and mood domains improved significantly in those who were greater but not less than 10 months post stroke, those with right sided lesion and those who were more than 68 years old respectively [13]. In the present study, the participants who had left side lesion (right sided hemiplegia) are equal in number with those who have right side lesion. However, it is possible the CIMT group had more participants with left sided hemiplegia than the ones in the control group which could limit improvement. Furthermore, most of the studies have low sample sizes. Low sample size can overestimate or underestimate findings [36-37].

Similarly, coping is an important strategy for improved PROsHS after stroke [38]. Consequently, this could explain why there was no significant difference between groups at follow-up, as the participants might have begun to cope with their impairments and disability with the passage of time. Nevertheless, one of the strengths of this study is that, both qualitative synthesis and meta-analysis were used in the study methodology. This can help to provide robust evidence on the subject matter. However, the number of studies included in this study which is small is one of the limitations of its findings. In addition, the studies are heterogenous in terms of the outcome measures they used, and other characteristics such as the time since stroke of the participants, types of stroke, the severity of stroke, the types of tasks practiced, the intensity of tasks practiced, the length of time for constraint and the types of control intervention used. Therefore, there is a need for more CIMT studies investigating its effect on PROsHS compared to the traditional therapy.

Conclusion

There is evidence that CIMT improves PROsHS after stroke, although it is not superior to the conventional therapy based on the current litrature. However, there are not many studies comparing the effects of CIMT and conventional therapy on PROsHS.

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Table 1: Characteristics of the Included Studies

Study	N	Stroke phase	Mean age (years)	Intervention	Outcomes	Findings
Wolf et al. (2006)	222 CIMT=106 Control=116	Sub-acute and chronic	CIMT=61.0±13.5 Control=63.3±12.6	CIMT group received shaping practice, six hours/day for two weeks and constraint for 90% of the waking hours/ day. Control group received usual care for six hours/ day for two weeks	Motor function (WMFT), real world arm use, (MAL) and quality of life, hand and physical function (SIS).	CIMT group had better improvement in all outcomes compared to the control
Wu et al. (2007)	26 CIMT=13 Control=13	Acute, sub-acute and chronic	mCIMT=71.44±6.42 Control=71.94±6.74	mCIMT group received two hours of tasks practice, five times a week for three weeks. In addition constraint was used for six hours every week day. Control group received traditional therapy for the same period.	Motor function (WMFT), ADL (FIM), real world arm use, (MAL) and quality of life (SIS).	mCIMT group improved better than the control in all the outcomes and daily function and physical domains of HRQoL

Key: CIMT= Constraint induced movement therapy, WMFT=Wolf motor function test, MAL=motor activity log, SIS=stroke impact scale, FIM=functional independence measure, ADL=activities of daily living, HRQoL=Health related quality of life, mCIMT =modified CIMT.

Table 1: Characteristics of the Included Studies (continued)

Study	N	Stroke phase	Mean age	Intervention	Outcomes	Findings
Dromerick et al. (2009)	52 Low CIMT=19 High CIMT= 16 Control=17	Acute	63.9±14.0	Low and High CIMT= two and six hours of shaping practice respectively per day. CIMT groups had constraint for 90% of the waking hours/ day. Control group received usual care for six hours/ day. Treatment in all groups was carried out 5 times a week for two weeks.	Motor function (ARAT), real world arm use, (MAL) and quality of life (SIS).	No significant difference between groups in the outcomes of interest. However, High CIMT group improved less than the Low CIMT group.
Dahl et al. (2008)	30 CIMT=18 Control=12	Sub-acute and chronic	CIMT=62.0±8.0 Control=60.0±12.0	CIMT group= tasks practice for six hours and constraint for 90% of the waking hours/ day for ten days. Control group received traditional therapy for the same period	Motor function (WMFT), ADL (FIM), real world arm use, (MAL) and quality of life (SIS).	Functional ability and performance improved better in the CIMT group only.

Key: CIMT= Constraint induced movement therapy, ARAT=action research arm test, MAL=motor activity log, SIS=stroke impact scale, FIM=functional independence measure, ADL=activities of daily living.

Table 1: Characteristics of the Included Studies (continued)

Study	N	Stroke phase	Mean age (years)	Intervention	Outcomes	Findings
Lin et al. (2009)	60 CIMT=20 BAT= 20 Control=20	Chronic	CIMT=55.28±9.34 BAT=51.58±8.67 Control=50.70±13.93	CIMT group received two hours tasks practice and two hours and constraint for six hours/ day. BAT group received simultaneous movement of both limbs for two hours/ day. Control group received traditional therapy for two hours/ day. All the groups received their interventions, five days a week for three weeks.	Motor function (FMA), real world arm use, (MAL), quality of life (SIS) and ADL (FIM)	CIMT produced greater functional gain in people with stroke

Key: CIMT= Constraint induced movement therapy, BAT= Bilateral training, FMA=Fugl Meyer motor assessment, MAL=motor activity log, SIS=stroke impact scale, FIM=functional independence measure, ADL=activities of daily living.

Table 1: Characteristics of the Included Studies (continued)

Study	N	Stroke phase	Mean age	Intervention	Outcomes	Findings
Yu et al. (2015)	21 CIMT=10 Control =11	Sub-acute and chronic	CIMT =56.8±11.0 Control=54.2±11.1	CIMT= sit to stand, stepping over obstacles in different directions, walking in treadmill, climbing stairs. Control=gait correction, treadmill, functional mobility and postural trainings. Both were carried out for 90 mins a day, 5 times a week for 2 weeks.	Giat performance (PWV, FWV, SSI, TSI), mobility (TUG and RMI), balance (BBS) and quality of life (SSQoL).	CIMT improved outcomes post-intervention. However, there was no significant difference between groups in the outcomes of interest.
Candan et al. (2019)	30 CIMT=15 Control =19	Acute and sub-acute	CIMT =55.13±14.70 Control =57.67±12.20	mCIMT with constraint for 90% of the waking hours and NDT for (bilateral) experimental and groups respectively, 1.5 hrs, 5 times a week for 4 weeks.	Motor function (motricity index) and quality of life (SIS and SSQoL).	All the outcomes of interest improved better in the CIMT group.

Key: CIMT= Constraint induced movement therapy, ARAT=action research arm test, MAL=motor activity log, SIS=stroke impact scale, FIM=functional independence measure, ADL=activities of daily living, FM=Fugl-Meyer, EMNSA= Erasmus modification of the Nottingham sensory assessment and 9PHT=9 peg-hole test, TUG=Time up and go test, RMI=Rivermead mobility index, mCIMT =modified CIMT, SSQoL=Stroke specific quality of life questionnaire, BBS=Berg balance scale, NDT=Neurodevelopmental therapy, PWV=Preferred walking velocity, FWV=Fast walking velocity, SSI=Spatial symmetry index and TSI=Temporal symmetry index.

Table 1: Characteristics of the Included Studies (continued)

Study	N	Stroke phase	Mean age	Intervention	Outcomes	Findings
Wu et al. (2012)	57 dCIT-TR=20 dCIT=19 Control=18	Sub-acute and chronic	dCIT-TR=54.0±9.7 dCIT=56.3±12.2 Control=58.6±11.6	dCIT-TR and dCIT =tasks practice was carried for 1 hour per day for 2 weeks with constraint for 6 hours per day. The control group received usual for the same period.	Motor function (ARAT), real world arm use, (MAL), ADL (FIM) and quality of life (SIS).	dCIT-TR and dCIT improved outcomes post-intervention. However, there was no significant difference between groups in the outcomes of interest.
Van Delden et al. (2013)	60 mCIMT=22 mBATRAC=19 DCIMT =19	Acute and sub-acute	mCIMT =59.8±13.8 mBATRAC =62.6±9.8 DCIMT =56.9±12.7	mCIMT and mBATRAC (bilateral) =tasks practice was carried for 1 hour per day, 3 times a weeks for 6 weeks with constraint for 6 hours per day. The control group received usual for the same period.	Motor function (ARAT, FM and motricity index), ADL (FIM), real world arm use, (MAL). Sensory function (EMNSA), distal extremity motor function (9PHT) and quality of life (SIS).	There was no significant difference between groups in the outcomes of interest.

Key: ARAT=action research arm test, MAL=motor activity log, SIS=stroke impact scale, FIM=functional independence measure, ADL=activities of daily living, FM=Fugl-Meyer, EMNSA= Erasmus modification of the Nottingham sensory assessment and 9PHT=9 peg-hole test, dCIT-TR=,distributed constraint induced therapy with trunk restraint, dCIT= distributed constraint induced therapy, mBATRAC= modified bilateral arm training with rhythmic auditory cueing, mCIMT =modified CIMT

Table 2: Methodological Quality of the Included Study

Study	Eligibility criteria specified (Yes/No)	Random allocation	Concealed allocation	Comparable subjects	Blind subjects	Blind therapists	Blind assessors	Adequate follow-up	Intention to treat analysis	Between group comparison	Point estimation and variability	Score
Wolf et al. (2006)	Yes	1	1	1	0	0	1	0	1	1	1	8/10
Wu et al. (2007)	Yes	1	0	1	1	0	0	1	1	1	1	7/10
Dahl et al. (2008)	Yes	1	1	0	0	1	1	1	1	1	1	8/10
Lin et al. (2009)	Yes	1	1	1	1	0	1	0	1	1	1	8/10
Dromerick et al. (2009)	Yes	1	0	1	0	0	1	1	1	1	1	7/10
Yu et al. (2015)	Yes	1	0	1	1	0	1	1	1	1	1	8/10
Candan et al. (2019)	Yes	1	0	1	0	0	1	0	1	1	1	6/10
Wu et al. (2012)	Yes	1	1	1	1	0	1	0	1	1	1	8/10
Van Delden et al. (2013)	Yes	1	1	1	0	0	1	0	1	1	1	7/10

Figure Legend

Figure 1: The Study Flowchart

Figure 2a: Persons reported outcome of health status post intervention (upper limb)

Figure 2b: Persons reported outcome of health status post intervention (lower limb)

Figure 2c: Persons reported outcome of health status at follow-up ((lower limb)

Figure 2d: Persons reported outcome of health status post intervention (upper and lower limb)

Figure 2e: Persons reported outcome of health status at follow-up (upper and lower limb)

Figure 2f: Persons reported outcome of health status at follow-up (upper and lower limb) involving studies that recruited participants in the sub-acute and chronic stage

Figure 3a: Motor function post intervention (upper limb)

Figure 3b: Motor function post intervention (upper and lower limb)

Figure 4a: Quantity of movement post intervention (upper limb)

Figure 4b: Quality of Movement post intervention (upper limb)

Figure 5: Activities of daily living (upper limb)

Appendix

Pubmed Search Strategy

(cerebrovascular disorder OR stroke OR cerebrovascular disease OR hemiplegia OR hemiparesis) AND ("forced use" OR "constraint induced movement therapy" OR "constraint induced therapy" OR "tasks practice" OR "shaping practice" OR "motor rehabilitation") AND (quality of life OR life quality OR hrqol)

CENTRAL Search Strategy

"stroke" in Title Abstract Keyword AND "constraint-induced therapy" in All Text AND "Quality of Life" in All Text - (Word variations have been searched)

PEDro Search Strategy

Stroke AND constraint induced movement therapy AND Quality of life

OT Seeker

[Any Field] like 'Stroke' AND [Any Field] like 'CIMT

Web of Science Search strategy

(cerebrovascular disorder OR stroke OR cerebrovascular disease OR hemiplegia OR hemiparesis) AND ("forced use" OR "constraint induced movement therapy" OR "constraint induced therapy" OR "tasks practice" OR "shaping practice" OR "motor rehabilitation") AND (quality of life OR life quality OR hrqol)