

ORIGINAL ARTICLE

The impact of task-oriented client-centered training on individuals with spinal cord injury in the community

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Study design: Quasi-experimental study.

Objectives: The objective of this study was to evaluate the impact of an 8-week, task-oriented client-centered training (TOCCT) on physical function, perception of performance and satisfaction with the activities and achievement of training goals of individuals with spinal cord injury (SCI).

Setting: Khon Kaen, Thailand.

Methods: Participants were 12 persons with SCI living in Ubolratana District, Khon Kaen Province, Thailand. Outcome measures consisted of physical function and perception of performance and satisfaction with the activities, which were assessed at pre- and post-training periods by using the Spinal Cord Independence Measure version III and the Canadian Occupational Performance Measure, respectively. The achievement of training goals was also determined by the Goal Attainment Scale. Data were analyzed by using paired *t*-tests.

Results: The 8-week, TOCCT significantly improved physical function of the participants ($P=0.001$, 95% confidence interval (CI) 3.22–7.12). Another positive impact of the training was found in the perceived levels of performance and satisfaction with the activities ($P=0.001$, 95% CI 1.31–3.49 and 1.68–3.67, respectively). Furthermore, at the end of the study, most of the participants could reach their expected training goals.

Conclusion: The 8-week, TOCCT significantly improved physical function and perception of performance and satisfaction with the activities of individuals with SCI when compared with the pre-training period. The training could also help most of the participants to achieve their training goals. Future studies with randomized controlled trial and longitudinal design are suggested to reveal further benefits of such training on individuals with SCI.

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INTRODUCTION

Spinal cord injury (SCI) can result in impairments of motor, sensory or autonomic functions.¹ In general, individuals with SCI have permanent neurological deficits and disability, and are often exposed to undesirable consequences such as dependence, low quality of life and self-esteem, and social isolation.^{2–3} In Ubolratana District, Khon Kaen Province, Thailand, the database of Ubolratana community hospital in January 2012 reported that there were ~400 persons with disabilities, and ~4% of them were individuals with SCI. To restore maximal functional independence to individuals with SCI, physical therapists of the hospital made great efforts with physical therapy knowledge and skills. However, most of the individuals with SCI were still dependent and had low self-esteem and community involvement, although there were improvements in their muscle strength, flexibility and some activities. It was thus necessary to find out an effective strategy to help these individuals.

At present, the task-oriented client-centered training (TOCCT) has been suggested as an alternative approach for individuals with SCI.⁴ The task-oriented training has focused on specific activities that are important to the patient.⁵ The client-centered care has aimed to

incorporate the patient's own needs and wishes in the rehabilitation process.⁶ In this strategy, the patient and the therapist work together to design a goal and plan of treatment that is motivating and engaging to the client.⁴ An advantage of the TOCCT in upper extremity functions of individuals with tetraplegia was reported in a previous study.⁷ Therefore, the authors were interested in applying the TOCCT to individuals with SCI in Ubolratana community and evaluating its effects on physical function, self-esteem and other aspects of this group of clients. To the best of our knowledge, this was the first study of this issue in Thailand. The two outcomes of this study, physical function and self-esteem, were published before.⁸ In this report, we presented three outcomes, physical function, perception of performance, as well as satisfaction with the activities, and achievement of training goals. The physical function was mentioned again because it was the main outcome measure of the study. However, its details were different between the previous and the current reports. Therefore, the underlying objective of the current report was to evaluate the impact of an 8-week TOCCT on physical function, perception of performance and satisfaction with the activities and achievement of training goals of individuals with SCI.

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Table 1 Demographic characteristics of participants (n = 12)

Participant no.	Age (years)	BMI (kg m ⁻²)	Time since injury (years)	Diagnosis	Marital status	Educational level
M1	25	17.2	9	Tetraplegia C6, AIS D	Single	High school
M2	48	27.7	18	Tetraplegia C7, AIS C	Married	High school
M3	64	26.2	42	Tetraplegia C7, AIS D	Single	Primary school
M4	28	22.4	0.5	Paraplegia T3, AIS B	Married	Primary school
M5	36	16.4	15	Paraplegia T4, AIS A	Single	Diploma
M6	45	21.1	4	Paraplegia T4, AIS B	Married	Primary school
F7	45	23.4	2	Paraplegia T4, AIS D	Separated	Primary school
M8	37	24.2	15	Paraplegia T5, AIS A	Separated	Primary school
M9	23	14.3	12	Paraplegia T10, AIS B	Single	Primary school
M10	25	24.0	4	Paraplegia T12, AIS C	Single	High school
M11	56	22.2	3	Paraplegia L1, AIS C	Married	Primary school
M12	36	18.7	4	Paraplegia L2, AIS D	Single	Primary school
Mean ± s.d.	39.0 ± 13.0	21.5 ± 4.1	10.7 ± 11.5			

Abbreviations: AIS, The American Spinal Injury Association Impairment Scale; BMI, body mass index.

MATERIALS AND METHODS

This quasi-experimental community study was conducted during September 2012 to August 2013. We certified that all applicable institutional and governmental regulations concerning the ethical use of human volunteers were followed during the course of this research. The study was approved by The Khon Kaen University Ethics Committee for Human Research (HE552133).

Participants

A group of 12 participants in this report (Table 1) was the same group as published before.⁸ In brief, they were individuals with SCI living in Ubolratana District and were recruited with the following inclusion criteria: requiring partial help to perform daily life and/or outdoor activities, being able to verbally communicate and willing to participate, and cooperating with the study procedures. Volunteers were excluded if they were determined by a practitioner that they had significant psychiatric or general medical morbidity precluding their understanding of the nature of the intervention or undertaking the exercises. The participants consisted of 1 woman and 11 men. Their average age was 39.0 ± 13.0 years (range 23–64 years). The average length of time since injury was 10.7 ± 11.5 years. Nine and three of the participants were paraplegic and tetraplegic, respectively. All participants were injured by trauma. Co-morbidity (pressure sore at the buttocks) was found only in two participants (M5 and M11). The main caregivers of the participants were their family members.

Outcome measures

A research assistant administered the pre- and post assessments to each of the participants with the following outcome measures.

Physical function. Independence in primary daily activities relevant for individuals with SCI was assessed by using the Spinal Cord Independence Measure version III (SCIM III).^{9,10} The total score runs from 0 to 100 points (100 being the greatest physical function). A change of 4 points or more on the total SCIM III score is considered a clinically significant change.¹¹ A detailed description of the SCIM III was given in a previous study by the authors.⁸

Perception of performance and satisfaction with the activities. This variable was assessed by using the Canadian Occupational Performance Measure (COPM).¹² The COPM is a client-centered, individualized outcome measure to allow the clients to identify their difficulties in the areas of self-care, productivity and leisure, and rate their current perception of performance and satisfaction of the individual tasks.

Following problem identification (see details in the Procedures section), the participants were asked to rate their current perception of performance and satisfaction with that level of performance for each of their most problematic activities. Both performance and satisfaction were rated on a 1–10 numeric rating scale (1 = great difficulty, not able to perform at all or not satisfied at all, and 10 = no difficulty, able to perform extremely well or extremely satisfied).

Total scores were calculated by adding together the performance or satisfaction scores for all problems and dividing by the number of problems.

The COPM has been shown to provide test–retest reliability and validity.^{12–14} In respect of the achievement of performance goals, a change of 2 points or more on the COPM is considered a clinically significant change.¹⁵

Achievement of training goals. The Goal Attainment Scale¹⁶ was used to objectively measure the effect of the training program on individual treatment goals. After identifying 2–3 personally most problematic activities of each participant (see details in the Procedures section), the participant and the authors were cooperatively specified treatment goals to be achieved within a particular time frame of 8 weeks. Possible outcomes in each of the treatment goals were identified and expressed as a behavioral statement that was observable. The most likely outcome was what the participant would reasonably expect to occur within 8 weeks. This was recorded as zero (0). Outcomes that would be better than expected (+1), much better than expected (+2), less than expected (–1) and much less than expected (current level of performance, –2) were also described. The validity, reliability and responsiveness to change of the Goal Attainment Scale were demonstrated in previous studies.^{16–18}

Procedures

To follow the TOCCT concept, the study was processed into three phases as published before.⁸ Each phase is summarized as follows:

Client-centered phase. This phase aimed to explore each participant's most problematic activities. The participants were asked to identify daily activities that they wanted to do, needed to do or expected to do. After that, they were asked to rate the importance of each issue using a scale from 1 to 10 (10 being the most important) and to choose at least 2 personally most problematic activities. These activities were used for setting individual treatment goals and training program. Specific, measurable, achievable and realistic goals to be achieved within 8 weeks, or the Goal Attainment Scale, were set jointly between each participant and the authors.

Task-oriented phase. Information gathered from the first phase was analyzed by the authors. Factors that limited or facilitated for the chosen tasks and were trainable were determined for each participant. This task-oriented analysis was based on a concept that skill acquisition was the result of a proper interaction between different factors of the person, the task and the environment.⁴ Then, an individually tailored training program was designed by using principles of training physiology, motor learning and, if needed, the use of assistive devices.⁴ Recommendations for the home-based training program was 30 min per set, 2 sets per day and at least 3 days per week. The participants were facilitated to perform the programs by themselves with the help of caregivers, if necessary.

Implementation and evaluation phase. Before and after implementing the TOCCT programs, pre- and post-implementation assessments for the three

outcome measures were established by a research assistant. The individual training program was conducted for 8 weeks. During this time, the authors visited each participant at his/her residence with a frequency of 1–2 times per week. These home visits aimed to monitor the compliance of the program and offer advice.

Data analysis

Descriptive statistic analysis was used for demographic data of the participants. Paired *t*-tests were applied for comparing the pre- and post-implementation data of the SCIM III and COPM. The 95% confidence intervals were determined.

The Shapiro–Wilk test was used to verify normality of distribution. Statistical analysis was performed using the SPSS version 17.0 (Statistical Package for the Social Sciences, SPSS Inc., Chicago, IL, USA); alpha was set at a value of $P < 0.05$.

RESULTS

The results of each phase of the TOCCT are presented as follows. Tables 2 and 3 were the same tables as published before.⁸ However, they were presented again in this report as they were baseline information, which could provide more understanding of the study results to the readers.

Table 2 The most problematic activities, current level of performance and expected goals to be achieved within 8 weeks of participants ($n = 12$)

Participant no.	Most problematic activities	Current level of performance	Expected goals
M1	Use of toilet	Needs assistance to transfer wheelchair to and from toilet, cleans self-independently	Uses toilet independently in all tasks, but needs special setting (slope, grab bars and shower chair)
	Sitting	Sits in cross-legged position for ~ 2 h, needs handhold support	Maintains balance without handhold support at least 5 min
	Mobility outdoors	Needs total assistance to operate manual wheelchair	Needs supervision while moving in manual wheelchair
M2	Use of toilet	Needs total assistance	Uses toilet independently in all tasks, but needs special setting (slope, grab bars and shower chair)
	Eating	Needs adaptive devices and assistance, cannot grip sticky rice and open containers	Needs adaptive devices, but eats independently
M3	Standing up	Stands up from a bed or chair only by pulling an overhead bar	Stands up from a bed or chair independently by using walker
	Transferring: ground–bed	Unable to do	Needs partial assistance
	Walking	Walks with a walker on flat and non-slippery surfaces for ~ 10 meters, needs minimal assistance	Walks with a walker independently on any surfaces for ~ 10 m
M4	Transferring: ground–wheelchair	Needs moderate assistance	Transfers independently
	Transferring: bed–wheelchair	Needs moderate assistance	Transfers independently
M5	Transferring: bed–wheelchair	Needs moderate assistance	Transfers independently
	Wheelchair skills	Moves independently in manual wheelchair, but only on flat and non-slippery surfaces	Moves independently in manual wheelchair on any surfaces, can cross obstacles
M6	Transferring: ground–wheelchair	Unable to do	Transfers independently
	Transferring: wheelchair–motorcycle	Unable to do	Transfers independently
F7	Walking	Walks by pushing manual wheelchair for ~ 30 m	Walks independently without walking aids for ~ 10 m
	Weaving baskets	Cannot do because of back pain resulting in too short period of sitting	Prolonged sitting at least 2 h
M8	Use of toilet	Manages urination and defecation on bed with minimal assistance, cleans self-independently	Uses toilet independently in all tasks, but needs special setting (slope, grab bars and shower chair)
	Wheelchair skills	Moves independently in manual wheelchair, but only on flat and non-slippery surfaces	Moves independently in manual wheelchair on any surfaces, can cross obstacles
	Cooking	Unable to do	Sits on wheelchair, cooks and prepares meals, as well as cleans dishes independently
M9	Standing	Stands in parallel bars with KAFO, does not take body weight on legs, needs handhold support	Stands in parallel bars with KAFO, takes body weight on legs without handhold support for ~ 3 min
	Walking	Unable to do	Walks in parallel bars with KAFO for ~ 5 steps
M10	Walking on knees	Unable to do	Walks on knees independently for ~ 5 steps
	Walking	Walks in parallel bars independently	Walks with crutches on flat and non-slippery surfaces
	Wheelchair skills	Moves independently in manual wheelchair, but only on flat and non-slippery surfaces	Moves independently in manual wheelchair on any surfaces, can cross obstacles
M11	Use of toilet	Needs total assistance	Uses toilet independently in all tasks, but needs special setting (slope, grab bars and shower chair)
	Standing	Stands in parallel bars, does not take body weight on legs, needs handhold support	Stands in parallel bars, takes body weight on legs without handhold support
M12	Walking	Walks with a walker independently on flat and non-slippery surfaces for ~ 20 m	Walks with a 3-point cane on any surfaces for ~ 20 m
	Climbing stairs	Ascends and descends for ~ 3 steps with support of both handrails	Ascends and descends for ~ 5 steps with support of a handrail

Abbreviation: KAFO, knee-ankle-foot orthoses.

Table 3 An example of the task-oriented analysis of a participant (M1)

Goals	Factors	Use of toilet		Sitting		Mobility outdoors	
		+/-	Therapy	+/-	Therapy	+/-	Therapy
Person	Muscle strength/endurance	-	√	-	√	-	√
	Mobility	+		+		+	
	Co-ordination	+		+		+	
	Sensibility	+		+		+	
	Flexibility	-	√	-	√	-	√
	Pain	+		-	√	+	
	Cognition, for example, attention, perception, motivation, emotion	+		+		+	
Task	Task category functional goal, stability, movement variability	+		+		+	
	Complexity	+		+		+	
	Speed	+		+		-	√
	Task prerequisites, for example, sitting balance, trunk control, hand function	-	√	-	√	-	√
	Skill components, for example, wheelchair skills, transferring	-	√	+		-	√
Environment	Location	-	√	+		+	
	Caregiver	+		+		+	

+ Denotes facilitator; - denotes barrier; √ denotes to be trained.

Table 4 Number (%) of participants who had a clinically meaningful change in scores of the SCIM III and the COPM, and mean ± s.d. of the scores at pre- and post-implementation assessments and comparisons within groups (n = 12; P-values obtained through paired t-tests)

Outcome measures	Change scores ^a	No. (%)	95% CI	Pre- implementation	Post- implementation	Mean difference (95% CI)	P-value
SCIM III (0–100)	≥ 4.0	9 (75.0)	42.8 to 92.5	63.2 ± 13.3	68.3 ± 14.2	5.2 ± 3.1 (3.22 to 7.12)	0.001
	< 4.0	3 (25.0)	5.9 to 57.2				
COPM performance (1–10)	≥ 2.0	8 (66.7)	34.9 to 90.1	4.7 ± 1.3	7.1 ± 1.6	2.4 ± 1.7 (1.31 to 3.49)	0.001
	< 2.0	4 (33.3)	9.9 to 65.1				
COPM satisfaction (1–10)	≥ 2.0	8 (66.7)	34.9 to 90.1	4.4 ± 1.4	7.1 ± 2.0	2.7 ± 1.6 (1.68 to 3.67)	0.001
	< 2.0	4 (33.3)	9.9 to 65.1				

Abbreviations: CI, confidence interval; COPM, The Canadian Occupational Performance Measure; SCIM III, The Spinal Cord Independence Measure version III.
^aClinically meaningful changes of the SCIM III and COPM are at least 4 and 2 points, respectively.

Client-centered phase

The most problematic activities, current level of performance and expected goals to be achieved within 8 weeks of each participant were summarized in Table 2. There were 28 problematic activities identified by the participants. Ten of them (35.7%) were wheelchair transferring and skills. Walking and toileting were the second (25%) and third (14.3%) ranks of most problematic activities, respectively.

Task-oriented phase

In this phase, an individually tailored training program was designed for each participant. Table 3 shows an example of the task-oriented analysis of a participant (M1). An 8-week, home-based training program of this participant consisted of strengthening, endurance and stretching exercises 4 days per week, training by a physical therapist twice a week, training at a local rehabilitation center every 2 weeks and group meeting with other participants once a month. Adaptation of a toilet was arranged for this participant during weeks 4–6 of the program.

Implementation and evaluation phase

At the end of the study, it was revealed that the 8-week TOCCT significantly improved physical function of the participants ($P=0.001$, 95% confidence interval 3.22–7.12) and the perception of performance and satisfaction with the activities ($P=0.001$, 95% confidence interval 1.31–3.49 and 1.68–3.67, respectively; Table 4). The mean changes in

total scores of the SCIM III and COPM were 5.2, 2.4 and 2.7, respectively. Nine (75.0%) participants showed a clinically significant change in the SCIM III score. The clinical changes in the COPM, both perceived levels of performance and satisfaction with the activities, were found in 8 (66.7%) participants.

Furthermore, half of the participants (M4, M5, M6, F7, M8 and M10) could reach their expected or better than expected goals of all of the most problematic activities (Table 5). Three participants (M1, M3 and M11) reached their expected goals in some activities. No achievement of the expected goals of most problematic activities was seen in 3 participants (M2, M9 and M12).

DISCUSSION

This study demonstrated that an 8-week TOCCT program could significantly improve physical function of individuals with SCI. Nine participants had a clinically significant change in the SCIM III score (i.e. at least 4 points).¹¹ In addition, at the end of the study, 8 participants demonstrated clinically meaningful improvements in perceived levels of performance and satisfaction with their identified goals assessed by the COPM. This finding added support to the positive effect of the TOCCT in individuals with SCI reported in a previous study.⁷ Furthermore, the changes in the COPM performance and satisfaction in this study could achieve the clinically significant improvements as the mean changes were greater than 2 points.¹⁵ This

Table 5 Scores of the Goal Attainment Scale of the most problematic activities at pre- and post-implementation assessments of participants (n = 12)

Participant no.	Most problematic activities	Goal Attainment Scale	
		Pre	Post
M1	Use of toilet	-2	0
	Sitting	-2	-1
	Mobility outdoors	-2	-1
M2	Use of toilet	-2	-1
	Eating	-2	-1
M3	Standing up	-2	-1
	Transferring: ground to bed	-2	-1
	Walking	-2	0
M4	Transferring: ground to wheelchair	-2	+1
	Transferring: bed to wheelchair	-2	+1
M5	Transferring: bed to wheelchair	-2	+1
	Wheelchair skills	-2	+1
M6	Transferring: ground to wheelchair	-2	0
	Transferring: wheelchair to motorcycle	-2	0
F7	Walking	-2	0
	Weaving baskets	-2	0
M8	Use of toilet	-2	+2
	Wheelchair skills	-2	0
	Cooking	-2	0
M9	Standing	-2	-1
	Walking	-2	-1
M10	Walking on knees	-2	0
	Walking	-2	0
	Wheelchair skills	-2	+1
M11	Use of toilet	-2	+1
	Standing	-2	-1
M12	Walking	-2	-1
	Climbing stairs	-2	-1

Abbreviations: F, female; M, male. Goal Attainment Scale: 0, expected outcome; +2, much better than expected; +1, better than expected; -1, less than expected; -2, much less than expected (current level of performance).

outcome was likely associated with the reported improvements in the physical function of the participants.

After termination of the program, six (50.0%) of the participants could reach their expected training goals. All of them were paraplegic with the time since injury between 0.5 and 15 years. Two of them were diagnosed with complete injury (The American Spinal Injury Association Impairment Scale (AIS) A) and four were incompletely injured (AIS B, C or D). The ranges of age and body mass index of the six participants were 25–45 years and 16–24 kg m⁻², respectively. On the basis of this information, therefore, the authors presumed that the beneficial effects of the TOCCT to individuals with paraplegia did not depend on length of time since injury, completeness of injury, age and body mass index of the individuals. This probably indicated an unlimited use of the TOCCT for individuals with paraplegia in various demographic characteristics.

Three participants did not achieve the expected training goals. This was seen in the ones whose self-selected most problematic activities were standing and/or walking. Improvements in these activities could not occur immediately after training on each day.¹⁹ When no significant changes in the activities were shown after daily training programs, the participants may have felt disappointed and did not regularly perform their training programs, resulting in non-success in

reaching the expected goals. Furthermore, it should be noted that a participant, M2, met an unexpected event during the study period, that is, his mother passed away at week 7 of the training. This may have made him exhausted and discontinued his training program, thereby failing to achieve his expected training goals.

In the study procedures, the client-centered phase was slightly complicated. In this phase, the authors had to pay attention specifically to ensure that the participants would be greatly involved in the procedure, that is, selecting their most problematic daily activities and specifying expected goals to be achieved within 8 weeks. Various strategies were applied to deal with the participants in this phase. Half of the participants with long length of time since injury, that is, >5 years, often showed some depression about their illness, felt hopeless and rarely expressed ideas regarding their most problematic activities and training goals. Hence, the authors had to visit them quite often to motivate them by using video clips of other cases who had similar severity of disability to them and could progress the ability. Their caregivers were also asked to cooperate with this procedure. These strategies could motivate this type of participants to actively involve themselves in the client-centered phase. Actually, the key success for completing the client-centered phase was building familiarity with the participants, being a good listener, expressing deep sincerity to solve problems and respecting wishes, rights and customs of the participants.

Two limitations of the study were presented. The first one was that there were only 12 individuals with SCI participating in the study because the study area was limited to a small district with 6 villages. However, this sample size was sufficient for presenting normal distribution and statistical significance of the data. The second limitation of the study was the lack of a control group because of a small study area. Thus, a quasi-experimental trial was established. A randomized controlled trial design should be considered for future studies. Moreover, to determine the long-term effects of the training program, a longitudinal study design should be conducted.

Despite some limitations, this study demonstrated beneficial effects of the TOCCT on individuals with SCI in community. The client-centered procedure could help in more in-depth understanding of health needs and daily life activities of the individuals, and give them a state of owning the intervention programs. The reality information obtained from the client-centered phase could be helpful for the task-oriented procedure for designing a training program tailored to specific activities of interest to the person. Specific rehabilitation goals rather than general ones were targeted. A study in individuals with neurological disorder reported that a home-based client-centered program was more suitable than a therapist-centered program because of its relevance for the individual patient.²⁰ In addition, the lack of the participation of clients in rehabilitation teams resulted in the discontinuity of rehabilitation services.²⁰

In conclusion, an 8-week TOCCT could significantly improve physical function and perception of performance and satisfaction with the activities of individuals with SCI in Ubolratana District, when compared with the pre-training period. Furthermore, the training could help most of the participants achieve their training goals. The TOCCT may be applied by physical therapists as an alternative rehabilitation approach for improving quality of life and independence of individuals with SCI in the community.

DATA ARCHIVING

There were no data to deposit.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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- 1 Somers MF. *Spinal Cord Injury: Functional Rehabilitation*, 3rd edn. Pearson: Boston, MA, USA. 2010; pp 8–33.
- 2 Ahmadzadeh G, Kouchaki A, Malekian A, Aminorro'aya M, Boroujeni AZ. The process of confrontation with disability in patients with spinal cord injury. *Iran J Nurs Midwifery Res* 2010; **15**: S356–S362.
- 3 Blanes L, Carmagnani MS, Ferreira LM. Quality of life and self-esteem of persons with paraplegia living in Sao Paulo, Brazil. *Qual Life Res* 2009; **18**: 15–21.
- 4 Spooren AI, Janssen-Potten YJM, Kerckhofs E, Bongers HMH, Seelen HAM. ToCUEST: a task-oriented client-centered training module to improve upper extremity skilled performance in cervical spinal cord-injured persons. *Spinal Cord* 2011; **49**: 1042–1048.
- 5 Mathiowetz V. Task-oriented approach to stroke rehabilitation. In Gillen G(ed.) *Stroke Rehabilitation: A Function-based Approach*. 3rd edn. Mosby: St. Louis, MO, USA, 2001; 80–99.
- 6 Cott CA. Client-centred rehabilitation: client perspectives. *Disabil Rehabil* 2004; **26**: 1411–1422.
- 7 Spooren AI, Janssen-Potten YJM, Kerckhofs E, Bongers HMH, Seelen HAM. Evaluation of a task-oriented client-centered upper extremity skilled performance training module in persons with tetraplegia. *Spinal Cord* 2011; **49**: 1049–1054.
- 8 Chompoonimit A, Nualnetr N. The effects of task-oriented client-centered training on physical function and self-esteem of persons with spinal cord injury in Ubolratana District, Khon Kaen Province. *J Med Tech Phys Ther* 2014; **26**: 288–303.
- 9 Itzkovich M, Gelernter I, Biering-Sorensen F, Weeks C, Laramie MT, Craven BC *et al*. The Spinal Cord Independence Measure (SCIM) Version III: reliability and validity in a multi-center international study. *Disabil Rehabil* 2007; **29**: 1926–1933.
- 10 Glass CA, Tesio L, Itzkovich M, Soni BM, Silva P, Mecci M *et al*. Spinal Cord Independence Measure, Version III: applicability to the UK spinal cord injured population. *J Rehabil Med* 2009; **41**: 723–728.
- 11 Scivoletto G, Tamburella F, Laurenza L, Molinari M. The spinal cord independence measure: how much change is clinically significant for spinal cord injury subjects. *Disabil Rehabil* 2013; **35**: 1808–1813.
- 12 Donnelly C, Eng JJ, Hall J, Alford L, Giachino R, Norton K *et al*. Client-centred assessment and the identification of meaningful treatment goals for individuals with a spinal cord injury. *Spinal Cord* 2004; **42**: 302–307.
- 13 Bodiam C. The use of the Canadian occupational performance measure for the assessment of outcome on a neurorehabilitation unit. *Br J Occup Ther* 1999; **62**: 123–126.
- 14 Dedding C, Cardol M, Eysen IC, Dekker J, Beelen A. Validity of the Canadian Occupational Performance Measure: a client-centred outcome measurement. *Clin Rehabil* 2004; **18**: 660–667.
- 15 Law M, Polatajko H, Pollock N, McColl MA, Carswell A, Baptiste S. Pilot testing of the Canadian Occupational Performance Measure: clinical and measurement issues. *Can J Occup Ther* 1994; **61**: 191–197.
- 16 Hurn J, Kneebone I, Cropley M. Goal setting as an outcome measure: a systematic review. *Clin Rehabil* 2006; **20**: 756–772.
- 17 Bravo G, Dubois MF, Roy PM. Improving the quality of residential care using goal attainment scaling. *J Am Med Dis Assoc* 2005; **6**: 173–180.
- 18 Gordon JE, Powell C, Rockwood K. Goal attainment scaling as a measure of clinically important change in nursing-home patients. *Age Ageing* 1999; **28**: 275–281.
- 19 Dobkin B, Barbeau H, Deforge D, Ditunno J, Elashoff R, Apple D *et al*. The evolution of walking-related outcomes over the first 12 weeks of rehabilitation for incomplete traumatic spinal cord injury: the multicenter randomized spinal cord injury trial. *Neurorehabil Neural Repair* 2007; **21**: 25–35.
- 20 Nualnetr N, Srisoparb W, Eungpinichpong W. The application of community neurorehabilitation using a family-centred approach to persons with disability: a case study in stroke survivors. *Asia Pacific Disabil Rehabil J* 2010; **21**: 71–79.