Efficacy of cognitive behavior therapy for the management of psychological outcomes following spinal cord injury

A meta-analysis

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Abstract

This meta-analysis evaluated the impact of cognitive behavior therapy (CBT) on the psychological adjustment of adults with spinal cord injury (SCI). A comprehensive search of six electronic databases identified 10 studies (424 participants) that met the inclusion criteria. Pre- and post-data for participants who received CBT were pooled and analyzed. Large and significant group differences were noted for measures of assertiveness, coping, self-efficacy, depression and quality of life. These data suggest that CBT has a significant positive impact on short-term psychological outcomes following SCI. However, further research is needed to establish the long-term benefits.

Keywords

- *cognitive behavior therapy*
- *efficacy*
- *meta-analysis*
- *spinal cord injuries*

Introduction

THE psychological impact of spinal cord injury (SCI) is well documented (see Craig, Tran & Middleton, 2009 for a recent review), with up to 30% of individuals with SCI reporting clinical levels of depression and anxiety, including post-traumatic stress, during the acute post-injury period (Migliorini, New & Tonge, 2009). Moreover, these symptoms can persist for up to 10 years after an injury (Pollard & Kennedy, 2007). This psychological distress significantly impacts on an individual's health outcomes, including social and functional independence (Bombardier, Richards, Krause, Tulsky & Tate, 2004; Raichle, Hanley, Jensen & Carndenas, 2007; Whalley Hammell, 2007), perceived quality of life (Nosek et al., 2004) and long-term healthcare costs (Dryden et al., 2004; French et al., 2007).

There is evidence that these SCI-related emotional outcomes are amenable to specialized psychological interventions, particularly cognitive behavior therapy (CBT). For example, depression and anxiety following SCI has been shown to improve following CBT, with the benefits being maintained over time (Elliott & Kennedy, 2004). Furthermore, CBT programs that incorporate social skills training (Dunn, Van Horn & Herman, 1981) and problem-solving techniques (Shanmugham, Elliot & Palmatier, 2004) have been successfully adapted to meet the specific needs of the SCI group. Similarly, psycho-educational groups which focus on coping skills post-SCI have shown significant efficacy when delivered during inpatient rehabilitation (Duchnick, Letsch & Curtiss, 2009; Kennedy, Duff, Evans & Beedie, 2003).

CBT is considered a valuable treatment option following SCI but the provision and effectiveness of this therapy in medical settings is constrained by a number of factors. Identified barriers to effective inpatient service delivery include: limitations in the availability of trained staff, often only allowing for a consultative service rather than one that provides more comprehensive assessments and interventions (Burton, Murphy & Smith-Tappe, 2005; Kendall & Clapton, 2006); psychotherapy being dependent on other aspects of an individual's medical care, particularly physical rehabilitation schedules (Craig & Hancock, 1994); patient-related variables, such as motivation to engage in psychotherapy (Delsignore & Schnyder, 2007), misconceptions or social stigma associated with psychological treatment (Schoenberg & Shiloh, 2002), and pre-morbid psychological functioning (Kennedy et al., 2000); and SCI-specific variables, particularly time since injury (Kennedy, Taylor & Duff, 2005).

There are also differing opinions about some of the practical aspects of CBT in spinal rehabilitation. For example, the relative efficacy of group- versus individual-based therapy has been debated. Although group-based programs are advocated as a time-efficient and cost-effective inpatient therapy model (Craig, Hancock & Dickson, 1999; Kennedy et al., 2003), group homogeneity can influence the therapy process, with research suggesting that group members with common personality traits are more amenable to group-based work (Huebner, 2004). Studies also suggest that patients prefer individual counseling when discussing emotive issues (Schoenberg & Shiloh, 2002). It follows that group CBT should be optional, augmenting rather than replacing individual CBT (Ehlers & Clark, 2003; Galvin & Godfrey, 2001). Yet despite the need for client-tailored interventions, where treatment is dependent on an individual's psychological problems and his/her response to treatment, few studies have evaluated the efficacy of individualized CBT within the SCI population.

A second important issue is the optimal timing of CBT after an injury has occurred. Some research suggests that counseling that is supportive, but less directive than CBT, is appropriate in the acute post-injury period because the psychological symptoms that become evident during hospitalization may not yet have fully developed (O'Donnell, Creamer, Pattison & Atkin, 2004), or because the patient may be emotionally overwhelmed in the early stages of adjustment to disability (Ehlers & Clark, 2003). However, there is also evidence that early targeted CBT has long-term benefits for those who are at risk of developing psychological problems following a traumatic injury (Bryant, Moulds & Nixon, 2003; O'Donnell, Bryant, Creamer & Carty, 2008). Similarly, while it has been suggested that treatment gains with individual-based CBT are maintained, at least in the short term (Kemp, Kahan, Krause, Adkins & Nava, 2004), there are studies indicating that long-term interventions are required to meet the mental health needs of persons with SCI (Dryden et al., 2004; Migliorini, Tonge & Taleporos, 2008).

The practical constraints on service provision and differences in opinion regarding the optimal way to deliver CBT in SCI settings are, not surprisingly, also apparent in the research that has evaluated its efficacy in spinal rehabilitation. Added to this is

Table 1. Keywords and boolean (logical) operators used in the database searches

	AND ⇨	AND ⇨	AND ⇨	NOT
OR ⇩	traumatic injury physical injury physical disability spinal cord injury spinal injury paraplegia quadriplegia tetraplegia	hospital treatment facility ambulatory care facility rehabilitation centre/center hospitalised/hospitalized patient inpatient outpatient	psychological adjustment psychological therapy counselling/counseling psychotherapy psychological intervention psychoeducation behaviour/behavior therapy cognitive therapy cognitive-behaviour/ behavior therapy cognitive behaviour/ behavior therapy group therapy family therapy	dementia brain injury stroke child* adolesce*

Note: Search includes stated terms and derivatives, e.g. adolesce* matches adolescence, adolescent, adolescents. Both plural and singular terms searched.

heterogeneity in the SCI clinical population (Schwartz, Shanmugham, Trask & Townsend, 2004; Tuszynski et al., 2007) and differences in the tests that are used to measure changes in the emotional and physical functioning of individuals who have undergone CBT (Craig et al., 2009; Dawson, Shamley & Jamous, 2008; Kalpakjian, Bombardier, Schomer, Brown & Johnson, 2009; Steeves et al., 2007). In combination, these factors have made it difficult to evaluate the existing evidence in order to establish guidelines for best clinical practice. In their early meta-analytic review, McAweeney, Tate and McAweeney (1997) reported that, although the benefits of psychosocial intervention following SCI were generally recognized, evaluations of its efficacy within this group were very limited. Similarly, in their systematic review of the CBT literature, Elliot and Kennedy (2004) concluded that the majority of research conducted with SCI groups was underpowered due to quasi-experimental designs.

In light of these issues, the current study undertook an objective and quantitative meta-analysis of existing research that has examined CBT in adults with a spinal injury. This methodology allows an evaluation of the magnitude of treatment effects, independent of the constraints imposed by small clinical samples on achieving statistical significance, and is therefore well suited to the research that has been conducted in SCI settings. The primary aim of this review was to evaluate the evidence for the short- and long-term efficacy of CBT in SCI rehabilitation, with a particular emphasis on its contribution to post-injury emotional outcomes. A related aim was to examine the treatment and methodological variables that may impact on the outcome of clinical trials.

Method

Literature search and inclusion criteria

Six electronic databases (PubMed, PsycINFO, Cochrane Library, Meditext, CINAHL and Scopus) relevant to rehabilitation psychology were searched using a combination of the keywords presented in Table 1. This initial search was deliberately kept broad in order to ensure that all potentially relevant studies were captured. Additional studies were identified from a manual search of the reference lists of all retrieved studies and from requests for published data made through list serves for the American Psychological Association's Division 22 (Rehabilitation Psychology) and the Australian Psychological Society's Rehabilitation Psychology Interest Group.

To be eligible for inclusion, studies had to meet the following criteria: (1) it was published in English between January 1980 and April 2010 (note: cognitive-behavioral approaches were first

described in the rehabilitation literature in 1980; Swett & Kaplan, 2004); and (2) CBT was the primary intervention used alone or in combination with a control condition. Although randomized controlled trials are considered to be the gold standard of research, quasi-experimental designs are recognized as being relevant to clinical practice and were therefore included in this review (Schutz, Rivers & Ratusnik, 2008). For current purposes, CBT was defined as multimodal in nature (Swett & Kaplan, 2004), combining cognitive and behavioral techniques (e.g. relaxation, cognitive restructuring). Thus, unimodal psychological interventions with either cognitive or behavioral elements (e.g. biofeedback, drug therapies and physical therapies) were excluded. Additionally, (3) CBT had to be delivered on a face-to-face basis (i.e. not by telephone) by a trained health professional (e.g. psychologist, psychiatrist; Page, 1993). This excluded self-management and peer support programs. Participants also had to (4) be adults, aged 18 years and older with (5) a spinal cord injury. Given the very limited availability of psychotherapy outcome research among this population, it was decided that the primary diagnosis could be an acquired SCI or a congenital spinal condition. Outcome measurement was another criterion, with studies requiring (6) standardized psychological assessments (e.g. depression, anxiety, coping) administered pre- and post-intervention; and (7) sufficient data to allow the calculation of Cohen's *d* effect sizes (means and SDs, results of *t* tests or *F* tests from a one-way ANOVA). Authors were contacted to obtain statistical data, where this information was missing or incomplete, with three studies providing data in this manner (Budh, Kowalski & Lundeberg, 2006; Kemp et al., 2004; King & Kennedy, 1999). Importantly, none of the eligible studies was excluded due to insufficient data.

Of the 3,271 studies that were initially identified by the literature searches, 14 met all of the inclusion criteria (see Figure 1). Two studies by Kennedy (Kennedy et al., 2003; King & Kennedy, 1999) and four studies by Craig et al. (1997, 1998a, 1998b, 1999) used overlapping samples. The data from these studies were therefore combined and treated as two studies, to ensure that the data were independent (Lipsey & Wilson, 2001). One other study (Dunn et al., 1981) compared three different treatment conditions to one control group. Thus, in total, the data from 10 independent studies, investigating 12 CBT programs, were analyzed.

Data collection and preparation

The data extracted from each study included: (1) sample demographics (e.g. mean age, gender); (2) injury variables (e.g. time since injury, SCI diagnosis); (3) treatment factors (e.g. treatment setting, therapy frequency); (4) therapist variables (e.g. therapist qualification or training); (5) methodological variables (e.g. source of participants, and whether the study design was randomized or quasi-experimental); and (6) outcome data (or pre- and post-treatment assessments of psychological functioning). To simplify data presentation and interpretation, outcome was classified into the following broad psychological domains: assertiveness, coping, self-efficacy, depression, quality of life, acceptance, anxiety, locus of control and self-esteem. These groupings did not impact on the findings because the data for the different measures in these domains were treated separately. An analysis of the relationship between CBT and its impact on functional independence was also originally planned; however, there were insufficient data, thereby precluding an analysis of this variable. Similarly, the small number of eligible studies precluded a quantitative analysis of the impact of methodological and treatment differences on the efficacy of CBT. Given the limited availability of data, all outcome measures were therefore examined, including those that were employed by single studies. Data extraction was conducted by the first author (DD).

Statistical analysis

Quality assessment The methodological quality of each study was evaluated using a rating tool developed for this review (see Appendix) in order to ensure that only data from high-quality studies were included (Higgins & Green, 2006; Juni, Witschi, Bloch & Egger, 1999). The 20-item rating scale focused on methodological criteria such as sample selection and size, handling of withdrawals and dropouts, psychometric properties of outcome measures and statistical analysis. Individual criteria were rated as being 'met', 'unmet' or 'not addressed or unclear', with 1 point assigned for each criterion that was met. Item scores were tallied to obtain an overall quality score for each study (ranging between 0 and 20). Two reviewers (first author, DD, and a fourth-year psychology student) were involved in the rating process, with each reviewer independently evaluating each study, after which consensus ratings were determined. These ratings were then used to weight effect sizes (see below).

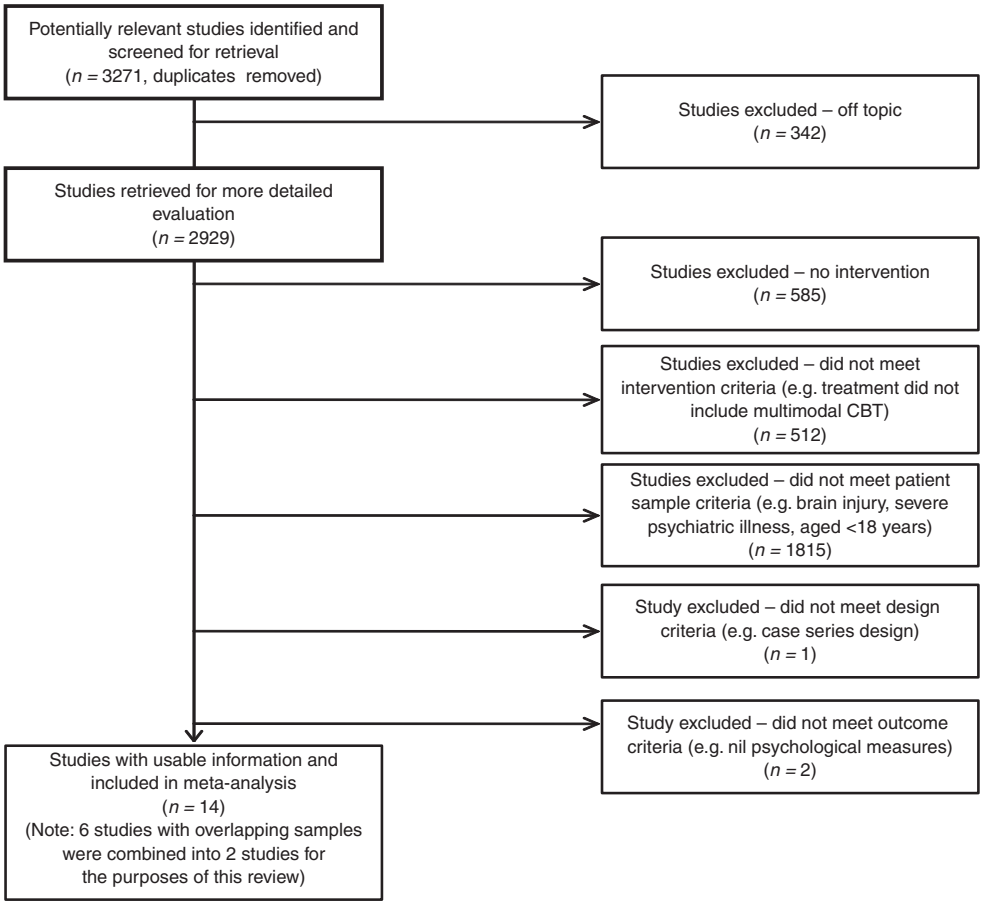

Figure 1. Flow diagram of study selection process

Effect size estimation Treatment efficacy was evaluated using Cohen's *d* effect sizes, based on the formula provided by Morris and DeShon (2002). This involved the calculation of effect sizes for studies that used a repeated measures design, either with independent groups (treatment and control; $N_{studies} = 9$), or a single-group (treatment only; $N_{studies} = 1$) Cohen's *d* is a conservative statistic that is recommended for use with clinical data because it does not presume equality of variance between the patient and control samples (Zakzanis, 2001). As a guideline for the social sciences, Cohen's *d* values of 0.2, 0.5 and 0.8 equate to small, medium and large treatment effects, respectively (Cohen, 1992).

Effect sizes were calculated to determine: (1) immediate treatment effects (change in outcome measures from pre- to post-CBT) and (2) maintenance of treatment gains (post-CBT to follow-up). When means and standard deviations were not reported, the results of *t* and one-way *F* statistics were used to estimate *d* (Wolf, 1986). One study (Hanrahan, 1995) reported the non-parametric Wilcoxon statistic, which cannot directly be converted into a standardized mean effect size. Based on statistical advice (M. W. Lipsey, personal communication, September 3, 2009), this statistic was transformed to its corresponding *t*-score and then converted to *d,* in order to estimate the treatment effect for this study.

Effect sizes were calculated in a multi-stage process. The first stage involved calculating an effect size for each outcome measure that was used by a study. Either the total score or a subscale score was used to calculate treatment effects, but not both, as per Lipsey and Wilson's (2001) recommendation. The effect sizes obtained from different studies that used

the same measure and study design, were then aggregated and averaged. Before doing so, each effect size was weighted by the study's quality rating. This overall weighted mean effect size (d_w) took into account the impact of methodological differences, such as sample size and randomization, on estimates of treatment effect (Lipsey & Wilson, 2001). The direction of each effect size was also standardized across measures so that a positive effect size indicated that CBT was beneficial to outcome whereas a negative *d* indicated poorer outcome. The 95% confidence intervals (CI) were additionally calculated to evaluate the statistical significance of each effect size (Lipsey & Wilson, 2001). A treatment effect is considered significant if a CI does not include zero, suggesting that there are likely to be group differences in the population at large (Dancey & Reidy, 2004).

Fail-safe Ns (N_{fs}) were also calculated to address a potential threat to validity, namely the problem of publication bias (Zakzanis, 2001). This statistic determines how many unpublished studies with non-significant results (i.e. small effects) would be required to call the current findings into question. For the purpose of this study a non-significant value was defined as an effect size of 0.20 (Orwin, 1983), which represents a small treatment effect (Cohen, 1992). Because different measures were used with varying frequency, an N_{fs} was considered adequate if its value was greater than the number of published studies that had used a particular measure (i.e. $N_{fs} > N_{studies}$). This provided a more conservative estimate than other formulas where N refers to the total number of studies that are undergoing a meta-analysis (Lipsey & Wilson, 2001). Fail-safe Ns were calculated using the formula provided by Lipsey and Wilson (2001).

The conclusions drawn from this meta-analysis are based on the combined interpretation of these statistics. As such, any change in psychological outcome, from baseline to post-CBT, was considered significant if it met the following criteria: (1) produced at least a moderate treatment effect (i.e. $d > 0.40$), (2) had a 95% CI that did not span zero, and (3) had a large enough N_{fs} score to suggest that the findings were unlikely to be compromised by the file drawer problem (i.e. $N_{fs} > N_{studies}$).

Results

Characteristics of study participants

The data from 10 independent studies contributed to this meta-analysis, comprising a total sample of 424 participants. The demographic characteristics of participants from studies who provided this information were examined to determine whether the treatment and control groups were well matched (see Table 2). The treatment and control groups were comparable in terms of sample size ($U = 49.0$, $Z = –0.36$, $d_{sample\ size} = –0.25$, $p = 0.97$), age ($U = 42.5$, $Z = –0.12$, $d_{age} = –0.13$, $p = 0.90$), gender (male: 76% vs. 82%, $\chi^2(1) = 0.06$, $p = 0.81$), injury type (paraplegia: 53% vs. 54%, $\chi^2(1) = 0.03$, $p = 0.87$) and injury severity (complete lesion: 52% vs. 53%, $\chi^2(1) = 0.59$, $p = 0.44$), suggesting that it is unlikely these were confounding variables. Although there were no significant group differences in time since injury ($U = 24.5$, $Z = –0.30$, $d_{time\ in\ months} = –0.29$, $p = 0.77$), this result should be treated with caution as it was based on limited data ($N_{studies} = 7$). The total sample comprised participants undertaking rehabilitation in the immediate post-injury period (47 days post-SCI) and outpatients, with longer-term physical disability (up to 22 years), the latter figure reflecting the fact that three studies included participants with congenital spinal or neurological conditions (e.g. spina bifida; Budh et al., 2006; Glueckauf & Quittner, 1992; Hanrahan, 1995).

Treatment characteristics

The average length of CBT was 10 sessions (SD = 4.4, $N_{studies} = 10$ range 6–20 sessions) over a 9-week period (SD = 5.9, range 4–24 weeks). This equated to approximately 120 minutes per session (SD = 59.4, range 30–270 minutes), with sessions held on a weekly ($N_{studies} = 8$), or fortnightly ($N_{studies} = 1$) basis. In one study (Kemp et al., 2004) session frequency was tapered over a longer time period (6 months). Group therapy was the primary mode of treatment ($N_{studies} = 7$) and in three studies group therapy augmented individual-based therapy. The focus of CBT included management of mood ($N_{studies} = 4$), social skills training ($N_{studies} = 3$), management of SCI-related neuropathic pain ($N_{studies} = 2$) or a combination of these aims ($N_{studies} = 1$). CBT, as a specialized intervention, was delivered or monitored by a psychologist in all but one study, which did not report this information. Control conditions included standard medical care on an individualized basis ($N_{studies} = 3$), no-treatment control ($N_{studies} = 3$), or a waiting-list control group ($N_{studies} = 2$). In one study (Duchnick et al., 2009), supportive counseling was examined as a comparative treatment to CBT.

Table 2. Demographic and injury details for the study participants

	CBT					*Control*				
	$N_{studies}$	$N_{participants}$	*Mean*	*SD*	*Range*	$N_{studies}$	$N_{participants}$	*Mean*	*SD*	*Range*
Sample size	10	226	18.8	12.2	4.0–45.0	9	198	22.0	12.8	6–41.0
Age (years)	9	207	40.8	6.9	31.0–53.2	8	183	41.1	9.7	30.5–54.6
Time since injury										
In days	2	65	102.1	78.3	46.7–157.5	2	60	90.7	43.9	59.6–121.8
In years	5	96	8.6	4.8	3.40–15.8	4	75	13.1	7.3	5.5–21.9
Gender										
Male	9	138				8	134			
Female	9	44				8	30			
Marital status										
Not married	4	54				4	57			
Married	4	57				4	61			
Employment status										
Employed	3	40				3	56			
Unemployed	3	24				3	24			
Injury type										
Paraplegia	8	75				7	77			
Tetraplegia	8	66				7	66			
Lesion										
Incomplete	7	59				6	63			
Complete	7	64				6	73			

$N_{studies}$ = number of studies providing data; $N_{participants}$= number of participants providing data; SD = standard deviation of the mean.

Evaluation of study quality

In terms of methodological quality, the mean quality rating was 14.6 (SD = 1.9) from a possible total score of 20 (see Table 3). Of note is that most of the identified studies employed quasi-experimental designs with small sample sizes to examine the effects of CBT. Allocation to treatment was randomized in four studies but blinding of group allocation was not possible or detailed in any of the studies. In four studies, participants were closely matched on demographic and/or injury variables, although two studies required historic control groups, due to the limited availability of suitably matched controls. Another study (Hanrahan et al., 1995) did not include a control group. A variety (N = 23) of self-report questionnaires were used with clinician-based ratings included in two studies. Similarly, few studies (N = 2) reported masking of assessors to group assignment. Dropout rates were also variable, ranging from 0% to 43% ($N_{studies}$ = 9).

Early effects of CBT at post-test

The weighted effect sizes (d_w) for all measures evaluating early CBT treatment effects, grouped by psychological domain and rank ordered by size, are provided in Table 3. A total of 26 different psychological measures of depression, anxiety and coping post-SCI, were used by these studies, with some measures providing multiple scores. The Beck Depression Inventory (BDI), Hospital Anxiety and Depression Scale (HADS) and State Anxiety Inventory (SAI) were the most commonly used measures, having been employed in two or three studies each (see Table 3). Their associated weighted effect sizes were positive and ranged from very small (d_w = 0.04; SAI) to moderate (d_w = 0.59; BDI). Additionally, the effect size for the BDI was statistically significant, suggesting a stronger degree of confidence in this finding.

Notably, individual measures of assertiveness (Behavioral Assertiveness Test – BAT; SCI Assertion Questionnaire – SCIAQ; Disability and Assertiveness Role-Play Test – DART), coping (Humor subscale, COPE; Pain Response Self Statements Catastrophising subscale – PRSS), self-efficacy (Pain Self-Efficacy Questionnaire – PSEQ), depression (Older Adult Health and Mood Questionnaire – OAHMQ), and quality of life Medical Outcomes Short Form Health Survey Mental Component subscale – SF-12) were all associated with large and significant treatment effects immediately after CBT.

CBT was associated with moderate, albeit non-significant, improvements in acceptance of SCI

Table 3. Treatment effects for psychological measures administered to participants immediately post-CBT

Domain	*Scale*	*Subscale*	*Study design*	$N_{studies}$	$N_{participants}$	d_w	*SD d*	*Min. d*	*Max d*	*95% CI*		N_{fs}	*Study references*[a]	*Quality score*
										lower	*upper*			
Assertiveness	BAT	Non-compliance	Treat vs. Cont	1	22	1.96*				0.87	3.05	9	Dunn et al., 1981	14
		Assertiveness	Treat vs. Cont	1	22	1.36*				0.35	2.37	6	Dunn et al., 1981	14
		Requests	Treat vs. Cont	1	22	1.14*				0.15	2.13	5	Dunn et al., 1981	14
	SCIAQ	Likelihood	Treat vs. Cont	1	34	0.89*				0.19	1.59	3	Glueckauf et al., 1992	14
		Social anxiety	Treat vs. Cont	1	34	0.88*				0.17	1.59	3	Glueckauf et al., 1992	14
	DART	Directed looking	Treat vs. Cont	1	34	0.78*				0.08	1.48	3	Glueckauf et al., 1992	14
		Affect	Treat vs. Cont	1	34	0.76*				0.06	1.46	3	Glueckauf et al., 1992	14
		Speech	Treat vs. Cont	1	34	0.50				–0.19	1.19	2	Glueckauf et al., 1992	14
		Vocal resonance	Treat vs. Cont	1	34	0.25				–0.43	0.93	0	Glueckauf et al., 1992	14
		Smiles	Treat vs. Cont	1	34	–0.06				–0.74	0.62	0	Glueckauf et al., 1992	14
	RAS		Treat vs. Cont	1	34	0.64				–0.05	1.33	2	Glueckauf et al., 1992	14
Coping	SAMS	Imagery	Treatment only	1	6	1.13				–0.88	3.14	5	Hanrahan, 1995	12
		Positive self-talk	Treatment only	1	6	0.94				–1.07	2.95	4	Hanrahan, 1995	12
	COPE	Humor	Treat vs. Cont	1	38	1.01*				0.34	1.68	4	King & Kennedy, 1999[b]	16
		Planning	Treat vs. Cont	1	38	0.61				–0.04	1.26	2	King & Kennedy, 1999[b]	16
		Active coping	Treat vs. Cont	1	38	0.51				–0.14	1.16	2	King & Kennedy, 1999[b]	16
		Restraint coping	Treat vs. Cont	1	38	0.43				–0.22	1.06	1	King & Kennedy, 1999[b]	16
		Positive interpretation	Treat vs. Cont	1	38	0.33				–0.31	0.97	1	King & Kennedy, 1999[b]	16
		Denial	Treat vs. Cont	1	38	0.31				–0.33	0.93	1	King & Kennedy, 1999[b]	16
		Suppress activity	Treat vs. Cont	1	38	0.30				–0.35	0.93	1	King & Kennedy, 1999[b]	16

Table 3. (Continued)

Domain	Scale	Subscale	Study design	$N_{studies}$	$N_{participants}$	d_w	SD d	Min. d	Max d	95% CI lower	95% CI upper	N_{fs}	Study references[a]	Quality score
		Instrumental support	Treat vs. Cont	1	38	0.29				–0.35	0.95	1	King & Kennedy, 1999[b]	16
		Substance use	Treat vs. Cont	1	38	0.16				–0.48	0.80	0	King & Kennedy, 1999[b]	16
		Venting emotion	Treat vs. Cont	1	38	0.10				–0.54	0.74	0	King & Kennedy, 1999[b]	16
Coping	COPE	Mental disengagement	Treat vs. Cont	1	38	0.05				–0.59	0.69	0	King & Kennedy, 1999[b]	16
		Behavioral disengagement	Treat vs. Cont	1	38	0.05				–0.59	0.69	0	King & Kennedy, 1999[b]	16
		Emotional support	Treat vs. Cont	1	38	0.00				–0.64	0.64	0	King & Kennedy, 1999[b]	16
		Religion	Treat vs. Cont	1	38	–0.05				–0.69	0.59	0	King & Kennedy, 1999[b]	16
	PRSS	Catastrophizing	Treat vs. Cont	1	36	0.91*				0.22	1.60	4	Perry et al., 2010	16
	SPSI-R	Rational	Treat vs. Cont	1	51	0.23				–0.35	0.81	1	Shanmugham et al., 2004	15
		Negative	Treat vs. Cont	1	51	0.14				–0.43	0.71	0	Shanmugham et al., 2004	15
		Positive	Treat vs. Cont	1	51	0.11				–0.46	0.68	0	Shanmugham et al., 2004	15
		Avoidant	Treat vs. Cont	1	51	–0.01				–0.58	0.56	0	Shanmugham et al., 2004	15
		Impulsive	Treat vs. Cont	1	51	–0.24				–0.82	0.34	0	Shanmugham et al., 2004	15
Self-efficacy	PSEQ		Treat vs. Cont	1	36	1.13*				0.43	1.83	5	Perry et al., 2010	16
	MSES		Treat vs. Cont	1	36	0.13				–0.52	0.78	0	Perry et al., 2010	16
Depression	OAHMQ		Treat vs. Cont	1	43	0.98*				0.32	1.64	4	Kemp et al., 2004	14
	BDI		Treat vs. Cont	2	107	0.59*	0.47	0.27	0.93	0.20	0.98	4	Craig et al., 1998a; King & Kennedy, 1999[b]	17 16
	HADS	Depression	Treat vs. Cont	2	74	0.18	0.14	0.09	0.25	–0.29	0.65	0	Budh et al., 2006[b]; Perry et al., 2010	11 16
	CES-D		Treat vs. Cont	1	40	–0.24				–0.86	0.38	0	Duchnick et al., 2009	18

(Continued)

Table 3. (Continued)

Domain	Scale	Subscale	Study design	$N_{studies}$	$N_{participants}$	d_w	SD d	Min. d	Max d	95% CI lower	95% CI upper	N_{fs}	Study references[a]	Quality score
Quality of life	LSQ		Treatment only	1	28	0.98				−1.00	2.95	4	Kemp et al., 2004[b]	14
	SF-12	Mental	Treat vs. Cont	1	36	0.96*				0.25	1.63	4	Perry et al., 2010	16
		Physical	Treat vs. Cont	1	36	0.05				−0.61	0.71	0	Perry et al., 2010	16
	MPI-SCI	Life interference	Treat vs. Cont	1	36	0.86*				0.18	1.54	3	Perry et al., 2010	16
	CAC		Treatment only	1	28	0.86				−1.11	2.83	3	Kemp et al., 2004[b]	14
	SIP	Psychosocial	Treat vs. Cont	1	51	0.51				−0.07	1.09	2	Shanmugham et al., 2004	15
Acceptance	AD		Treat vs. Cont	1	34	0.65				−0.04	1.34	2	Glueckauf et al., 1992	14
	COPE	Acceptance	Treat vs. Cont	1	36	0.32				−0.32	0.96	1	King & Kennedy, 1999[b]	16
	SCL	Acceptance	Treat vs. Cont	1	38	0.05				−0.60	0.70	0	Perry et al., 2010	16
Anxiety	HADS	Anxiety	Treat vs. Cont	2	74	0.38	0.24	0.18	0.51	−0.09	0.85	2	Budh et al., 2006[b]; Perry et al., 2010	11 16
	SAI		Treat vs. Cont	3	147	0.04	0.41	–0.17	0.53	−0.28	0.36	2	Craig et al., 1998a; Duchnick et al., 2009; King & Kennedy, 1999[b]	17 18 16
Locus of control	MHLOC	Internal	Treat vs. Cont	1	51	0.20				−0.37	0.77	0	Shanmugham et al., 2004	15
		Chance	Treat vs. Cont	1	51	–0.05				−0.62	0.52	0	Shanmugham et al., 2004	15
		Others	Treat vs. Cont	1	51	–0.21				−0.79	0.37	0	Shanmugham et al., 2004	15
	LCB		Treat vs. Cont	1	69	0.09				−0.39	0.57	0	Craig et al., 1998[b]	17
Self-esteem	RSE		Treat vs. Cont	1	69	–0.13				−0.61	0.48	0	Craig et al., 1997	17

Treat vs. Control: effect size calculated on independent groups (i.e. treatment vs. control); Treatment only: effect size calculated on dependent groups (i.e. pre-post intervention scores for treatment only); $N_{studies}$ = number of studies providing data; $N_{participants}$ = number of participants providing data; d_w = weighted mean effect size (note: weighting only applied to total effect sizes based on two or more studies); SD = standard deviation of *d*; Minimum d_w = minimum effect size; Maximum d_w = maximum effect size; CI = confidence interval; N_{fs} = approximate fail-safe *N*.

Test abbreviations: BAT Behavioral Assertiveness Test; SCIAQ Assertion Questionnaire; DART Disability and Assertiveness Role-Play Test; RAS Rathus Assertiveness Schedule; SAMS Self Assessment of Mental Skills; COPE Coping strategies; PRSS Pain Response Self Statements Scale; SPSI-R Social Problem Solving Inventory-Revised; PSEQ Pain Self Efficacy Questionnaire; MSES Mooring Self Efficacy Scale; OAHMQ Older Adult Health and Mood Questionnaire; BDI Beck Depression Inventory; HADS Hospital Anxiety and Depression Scale; CES-D Center for Epidemiological Studies Depression Scale; LSQ Life Satisfaction Questionnaire; SF-12 Medical Outcomes Short Form Health Survey-12; MPI-SCI Multidimensional Pain Inventory–SCI version; CAC Community Activities Checklist; SIP Sickness Impact Profile; AD Acceptance of Disability Scale; SCL Spinal Cord Lesion-Related Coping Strategy Questionnaire; SAI Spielberger State Anxiety Inventory; MHLOC Multi-dimensional Health Locus of Control; LCB Locus of Control of Behavior Scale; RSE Rosenberg Self Esteem Scale.

[a]Identified studies highlighted with asterisk in references section. [b]Data provided by author on request. *Effect size met the study criteria; $d > 0.40$, $N_{fs} > N_{studies}$, 95% CIs did not span zero.

(Acceptance of Disability – AD) and less improvement, compared with control participants, in locus of control (Multi-dimensional Health Locus of Control – MHLOC) and self-esteem (Rosenberg Self-Esteem Scale – RSE) (Table 3).

Longer-term effects of CBT at follow-up

Follow-up assessments of treatment and control participants ranged from 6 weeks to 2 years post-treatment and were undertaken in five studies (see Table 4). With the exception of humor as a coping strategy (COPE Humor subscale), which had deteriorated, all treatment effects were non-significant. Thus, at follow-up most treatment effects were minimal or not sustained.

Discussion

The current study was designed to evaluate the effectiveness of CBT for improving the immediate and long-term psychological outcomes of individuals with a SCI. Meta-analytic techniques were employed to consolidate and critique the available literature. The data from 10 independent studies and a total of 424 individuals with SCI were analyzed.

The results were favorable in terms of the short-term efficacy of CBT with substantial, positive effects associated with group programs that focused on assertiveness skills training (Dunn et al., 1981; Glueckauf & Quittner, 1992), management of mood (Craig et al., 1998a; King & Kennedy, 1999) and management of chronic pain following SCI (Perry, Nicholas & Middleton, 2010). Similarly, the use of humor as a coping skill improved as a consequence of CBT (King & Kennedy, 1999). Other aspects of coping also increased, although to a non-significant degree.

Also important is the finding that the longer-term (i.e. up to 2 years post-injury) effects of CBT on many psychological outcomes were weak and non-significant. At best, modest treatment gains were maintained on measures of assertiveness and acceptance up to 6 months post-CBT, whereas measures of depression and anxiety were associated with minimal or no improvement. Changes in the use of coping skills, over time, were also observed. The positive and negative effect sizes associated with the COPE subscales suggest that both maladaptive and adaptive coping strategies were employed by CBT participants.

These findings support the current literature on psychological adjustment to SCI. CBT has been consistently associated with immediate decreases in anxiety and depression (Craig et al., 2009; Middleton & Craig, 2008; Pollard & Kennedy, 2007), when delivered in the post-acute period. The rehabilitation environment may also contribute to the adjustment process (Middleton & Craig, 2008), as patients have the opportunity to enhance their interpersonal and social skills in a supportive setting, and as physical gains are made (Ruff, Adamson, Ruff & Wang, 2007). Conversely, symptoms of anxiety and depression can increase after primary rehabilitation is complete, when individuals with SCI are faced with new challenges in the transition to community living and integration (Middleton & Craig, 2008). Indeed, it has been suggested that a subset of individuals require a continuum of mental health services throughout the lifespan (Migliorini et al., 2008).

In clinical practice, however, there is often a shortfall in outpatient mental health services for people with SCI. Resources (e.g. access to specialist services as follow-up) are limited and other factors, such as transport access and cost, also impact on clients' satisfaction with community-based services (Cox, Amsters & Pershouse, 2001). Accordingly, there is a need to improve psychological services for this group in a cost-effective manner (Burton et al., 2005). Within this context, telecommunication-based interventions are emerging as a service delivery option for persons living in the community with chronic disabilities (Kairy, Lehoux, Vincent & Visintin, 2009). However, use of this medium for specialized and highly individualized service delivery, such as psychological interventions for people with SCI, still needs to be trialed and evaluated (Cox et al., 2001).

The limitations to this meta-analysis need to be considered when interpreting these results. First, the search was restricted to published studies. The search terms were broad and the reference lists of all eligible studies were examined for additional studies but it is possible that some studies, including those that are not in the public domain (e.g. dissertations), were not included in this meta-analysis, which could alter the findings

Table 4. Treatment effects for psychological measures administered to participants at follow-up

						First follow-up					
									95% CI		
Domain	*Scale*	*Subscale*	*Study design*	$N_{studies}$	$N_{participants}$	*Time interval*	*d*	N_{fs}	*lower*	*upper*	*Study references*[a]
Assertiveness	RAS		Treatment only	1	19	6 months	0.49	2	−1.49	2.47	Glueckauf et al., 1992
	SCIAQ	Likelihood	Treatment only	1	19	6 months	0.22	0	−1.74	2.18	Glueckauf et al., 1992
		Social anxiety	Treatment only	1	19	6 months	−0.26	0	−2.22	2.18	Glueckauf et al., 1992
	DART	Smiles	Treatment only	1	14	6 months	0.03	0	−1.93	1.99	Glueckauf et al., 1992
		Speech	Treatment only	1	14	6 months	0.00	0	−1.96	1.96	Glueckauf et al., 1992
		Directed looking	Treatment only	1	14	6 months	−0.12	0	−2.08	1.84	Glueckauf et al., 1992
		Vocal resonance	Treat vs. Cont	1	14	6 months	−0.28	0	−2.24	1.68	Glueckauf et al., 1992
		Appropriate affect	Treatment only	1	14	6 months	−0.37	0	−2.33	1.59	Glueckauf et al., 1992
Coping	COPE	Restraint	Treat vs. Cont	1	38	6 weeks	0.47	1	−0.17	1.11	King & Kennedy, 1999[b]
		Denial	Treat vs. Cont	1	38	6 weeks	0.18	0	−0.46	0.82	King & Kennedy, 1999[b]
		Emotional support	Treat vs. Cont	1	38	6 weeks	0.18	0	−0.46	0.82	King & Kennedy, 1999[b]
		Religion	Treat vs. Cont	1	38	6 weeks	0.13	0	−0.51	0.77	King & Kennedy, 1999[b]
		Venting emotion	Treat vs. Cont	1	38	6 weeks	0.06	0	−0.58	0.70	King & Kennedy, 1999[b]
		Behavioral disengagement	Treat vs. Cont	1	38	6 weeks	0.05	0	−0.59	0.69	King & Kennedy, 1999[b]
		Instrumental support	Treat vs. Cont	1	38	6 weeks	−0.02	0	−0.66	0.62	King & Kennedy, 1999[b]
		Mental disengagement	Treat vs. Cont		38	6 weeks	−0.05	0	−0.69	0.59	King & Kennedy, 1999[b]
		Planning	Treat vs. Cont	1	38	6 weeks	−0.06	0	−0.70	0.58	King & Kennedy, 1999[b]
		Positive interpretation	Treat vs. Cont	1	38	6 weeks	−0.09	0	−0.73	0.55	King & Kennedy, 1999[b]
		Suppress activity	Treat vs. Cont	1	38	6 weeks	−0.16	1	−0.79	0.48	King & Kennedy, 1999[b]
		Substance use	Treat vs. Cont	1	38	6 weeks	−0.36	1	−1.00	0.28	King & Kennedy, 1999[b]
		Active coping	Treat vs. Cont	1	38	6 weeks	−0.38	1	−1.02	0.26	King & Kennedy, 1999[b]
		Humor	Treat vs. Cont	1	38	6 weeks	−0.83*	3	−1.49	−0.17	King & Kennedy, 1999[b]
Acceptance	COPE	Acceptance	Treat vs. Cont	1	38	6 weeks	0.32	1	−0.32	0.96	King & Kennedy, 1999[b]
	AD		Treat vs. Cont	1	33	3 months	0.21	1	−0.49	0.91	Duchnick et al., 2009
	SCL	Acceptance	Treatment only	1	17	1 month	0.00	0	−1.96	1.96	Perry et al., 2010
	AD		Treatment only	1	19	6 months	−0.01	0	−1.01	0.99	Glueckauf et al., 1992

Table 4. (Continued)

					First follow-up						Second follow-up						
									95% CI						95% CI		
Domain	*Scale*	*Subscale*	*Study design*	$N_{studies}$	$N_{participants}$	*Time interval*	*d*	N_{fs}	*lower*	*upper*	$N_{participants}$	*Time interval*	*d*	N_{fs}	*lower*	*upper*	*Study references*[a]
Anxiety	HADS	Anxiety	Treatment only	1	17	1 month	0.14	0	−1.82	−2.10	13	9 months	0.10	0	−1.86	−2.06	Perry et al., 2010
	SAI		Treat vs. Control	1	33	3 months	0.09	0	−0.59	−0.77							Duchnick et al., 2009
			Treat vs. Control	1	38	6 weeks	−0.11	0	−0.75	−0.53							King & Kennedy, 1999 [b]
			Treat vs. Control	1	69	1 year	−0.04	0	−0.52	−0.44	58	2 years	0.07	0	−0.45	−0.59	Craig et al., 1998a
Depression	HADS	Depression	Treatment only	1	17	1 month	0.03	0	−1.96	−1.99	13	9 months	0.58	2	−1.39	−1.97	Perry et al., 2010
	CES-D		Treat vs. Control	1	33	3 months	−0.05	0	−0.73	−0.63							Duchnick et al., 2009
	BDI		Treat vs. Control	1	38	6 weeks	−0.07	0	−0.71	−0.57							King & Kennedy, 1999 [b]
			Treat vs. Control	1	69	1 year	−0.10	0	−0.58	−0.38	58	2 years	0.06	0	−0.45	−0.31	Craig et al., 1998a
Locus of control	LCB		Treat vs. Control	1	69	1 year	−0.08	0	−0.56	−0.40	58	2 years	−0.13	0	−0.65	−0.39	Craig et al., 1998b
Quality of life	MPI-SCI	Life interference	Treatment only	1	17	1 month	−0.08	0	−2.04	−1.88	13	9 months	−0.62	2	−2.59	−1.35	Perry et al., 2010
	SF-12	Physical	Treatment only	1	17	1 month	−0.02	0	−1.98	−1.94	13	9 months	−0.20	0	−2.16	−1.76	Perry et al., 2010
		Mental	Treatment only	1	17	1 month	−0.58	2	−2.54	−1.38	13	9 months	0.42	1	−1.55	−2.39	Perry et al., 2010
Self-efficacy	MSES		Treatment only	1	17	1 month	−0.02	0	−1.96	−1.94	13	9 months	−0.47	1	−2.43	−1.49	Perry et al., 2010
	PSEQ		Treatment only	1	17	1 month	−0.17	0	−2.13	−1.79	13	9 months	−0.65	2	−2.62	−1.32	Perry et al., 2010
Coping	PRSS		Treatment only	1	17	1 month	−0.13	0	−2.09	−1.83	13	9 months	−0.17	0	−2.13	−1.79	Perry et al., 2010
Self-esteem	RSE		Treat vs. Control	1	69	1 year	−0.24	0	−0.72	−0.24							Craig et al., 1997

Treat vs. Control: effect size calculated on independent groups (i.e. treatment vs. control); Treatment only: effect size calculated on dependent groups (i.e. pre-post intervention scores for treatment only), $N_{studies}$ = number of studies providing data; $N_{participants}$= number of participants providing data; *d* = mean effect size; SD = standard deviation of *d*; Minimum d_w = minimum effect size; Maximum d_w = maximum effect size; CI = confidence interval; N_{fs} = approximate fail-safe *N*.

Test abbreviations: RAS Rathus Assertiveness Schedule; SCIAQ Assertion Questionnaire; DART Disability and Assertiveness Role-Play Test; COPE Coping strategies; AD Acceptance of Disability Scale; SCL Spinal Cord Lesion-Related Coping Strategy Questionnaire; HADS Hospital Anxiety and Depression Scale; SAI Spielberger State Anxiety Inventory; CES-D Center for Epidemiological Studies Depression Scale; BDI Beck Depression Inventory; LCB Locus of Control of Behavior Scale; MPI-SCI Multidimensional Pain Inventory–Spinal Cord Injury version; SF-12 Medical Outcomes Short Form Health Survey-12; MSES Mooring Self Efficacy Scale; PSEQ Pain Self Efficacy Questionnaire; PRSS Pain Response Self Statements Scale; RSE Rosenberg Self Esteem Scale.

[a]Identified studies highlighted with asterisk in references section. [b] Data provided by author on request. *Effect size met the study criteria; $d > 0.40$, $N_{fs} > N_{studies}$, 95% CIs did not span zero.

(Lipsey & Wilson, 2001). Fail-safe Ns were calculated in an attempt to address this problem. Furthermore, the paucity of psychological intervention studies among the SCI group has been consistently noted (Elliot & Kennedy, 2004; McAweeney et al., 1997).

Second, studies with a methodologically weak research design, in particular the study by Hanrahan (1995), which did not employ a control group, or that by Kemp et al. (2004) where *d* was calculated from paired *t* tests, were associated with large treatment effects favoring the efficacy of CBT. There is an argument that a Cohen's *d* calculated from such studies may inflate the effect size estimate because the research design does not account for spontaneous recovery in psychotherapy; a factor which is controlled for in the randomized controlled trial, or RCT (Wolf, 1986). Effect sizes were weighted by methodological quality to assist with this problem; however, weighting could only be applied in cases where there was more than one study contributing to the calculation of a (mean) effect size. At the same time, the practical and ethical limitations of using RCTs in rehabilitation psychology are recognized (Schutz et al., 2008; Tate, Kalpakjian & Kwon, 2008). Alternative options to the RCT include a more detailed examination of within-subject variation, such as multiple-baseline designs (Schwartz et al., 2004).

Third, the majority of effect size estimates were based on single studies, which are considered to be less reliable than estimates based on multiple studies (Lipsey & Wilson, 2001). However, given that there was limited overlap in the measures utilized by the identified studies, it was necessary to consider all available results. It would be an advantage for future research to use the same measures of behavioral outcome in order to allow for greater comparison between studies and thereby increase the strength of these findings.

Fourth, one needs to be cautious when interpreting effect sizes that are based on multidimensional inventories. For example, the COPE, utilized by King and Kennedy (1999), yields 15 factors that reflect conceptually distinct aspects of coping. Rather than aggregating the results in an 'overall coping index', the subscales were considered separately, as recommended by the authors (Carver, Scheier & Weintraub, 1989). However, this also increases the likelihood of making a type I error. The role of situation-specific variants, particularly the duration of SCI, should also be considered when measuring coping style. For example, in this meta-analysis, the Denial subscale was interpreted as a maladaptive coping response, based on research indicating that poorer acceptance of SCI is associated with higher distress (Elfstrom, Kreuter, Ryden, Persson & Sullivan, 2002). However, denial can also be viewed as a functional response in the early stages of SCI rehabilitation, as it serves to minimize distress (Carver et al., 1989).

Fifth, a criticism of meta-analytic procedures is that variations in treatment, methodology and sample characteristics are difficult to interpret based on a mean index of effect size. Statistical tests of homogeneity, such as the within-comparison heterogeneity index (Lipsey & Wilson, 2001), address this criticism. However, statistical power for testing homogeneity in this meta-analysis was limited due to the small number of studies (Lipsey & Wilson, 2001), even if there was appreciable heterogeneity, as is the case in the SCI clinical population (Schwartz et al., 2004). Furthermore, many of the earlier studies did not provide the necessary data to analyze the impact of important injury variables, such as severity of SCI and time since injury. With injury classification now standardized in spinal rehabilitation (Marino et al., 2003), future research should provide a more accurate description of the study participants.

Despite these limitations, the findings of this meta-analysis support the effectiveness of CBT in optimizing the early emotional outcomes of adults who have sustained a SCI. CBT delivered during inpatient rehabilitation was associated with stronger effects, although more research is needed to evaluate the impact of this specialized intervention in managing the long-term, emotional consequences of SCI and in ensuring that the short-term benefits of CBT are sustained over a longer period of time.

Appendix

Table A1. Quality rating scale

Item	*Study variables*	*Yes (score 1)*	*No (score 0)*	*Not addressed or unclear (score 0)*
	Sample			
1	Sample size was ≥ 20 per group			
2	Cognitive injuries excluded (e.g. severe brain injury, dementia)			
3	Participants with severe psychiatric illness excluded (eg. substance abuse, psychosis)			
4	Clinical characteristics of sample (e.g. disability severity) described			
5	Demographic characteristics of sample (e.g. age, sex) described			
6	Participants matched on injury characteristics (e.g. treatment and control groups with acquired spinal cord injury)			
7	Source of participants (i.e. inpatients or outpatients) provided			
8	No. of subjects withdrawn at study onset reported			
9	No. of subjects lost to follow-up reported			
10	Characteristics of attrition group (i.e. decliners/withdrawals) compared with those in study			
	Measurement			
11	Published, or close adaptation of, outcome measures used			
12	Dependent variables measured pre-intervention			
13	Dependent variables measured post-intervention			
	Design			
14	Participants randomly assigned to treatment or control group			
15	Masked or independent evaluation (i.e. those assessing outcomes masked to group assignment)			
	Intervention			
16	Treatment standardized (by manual or specific training of therapist)			
17	Duration of individual sessions (minutes, hours) reported			
18	Details on length of intervention (no. weeks, months) provided			
	Results			
19	Significant test statistics reported to enable the calculation of an effect size (e.g. Mean, SD, *t*-score, one-way *F* ratio or *p* value)			
20	Non-significant tests statistics reported to enable the calculation of an effect size (e.g. Mean, SD, *t*-score, one-way *F* ratio or *p* value)			
	Total (Max 20)			

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References marked with an asterisk indicate studies included in the meta-analysis.

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