Depression Following Spinal Cord Injury

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### Key Points

Depression is a common consequence of SCI.

Depression post SCI can interfere with function and adaptation.

Cognitive behavioural interventions provided in a group setting appear helpful in reducing post-SCI depression and related difficulties.

CBT interventions aimed at both caregivers and care receivers may be effective in reducing symptoms of depression post SCI.

Computer based CBT may improve symptoms of depression, anxiety and stress post SCI.

The benefits of drug treatment for post-SCI depression are largely extrapolated from studies in non-SCI populations.

Programs to encourage regular exercise, reduce stress, and improve or maintain health appear to have benefits in reducing reports of depressive symptoms in persons with SCI.

Several non-traditional approaches to SCI appear to offer improved health practices and a reduction in reported secondary conditions including depression.
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<tr>
<td>BDI</td>
<td>Beck Depression Inventory</td>
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<td>BP</td>
<td>Blood Pressure</td>
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<td>BWSTT</td>
<td>Body weight supported treadmill training</td>
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<td>CBT</td>
<td>Cognitive Behavioural Therapy</td>
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<td>CES-D</td>
<td>Center for Epidemiologic Studies Depression Scale</td>
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<td>CET</td>
<td>Coping effectiveness training</td>
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<td>CSS</td>
<td>Coping Strategies Scale</td>
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<td>CYHQ</td>
<td>Check Your Health Questionnaire</td>
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<td>DASS-21</td>
<td>Depression Anxiety Stress Scale-21</td>
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<tr>
<td>DSM</td>
<td>Diagnostic and Statistical Manual of Mental Disorders</td>
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<tr>
<td>FES</td>
<td>Functional Electrical Stimulation</td>
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<td>FIM</td>
<td>Functional Impairment Measure</td>
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<td>HADS</td>
<td>Hospital Anxiety and Depression Scale</td>
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<td>HDRS</td>
<td>Hamilton Depression Rating Scale</td>
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<td>HPLP-II</td>
<td>Health Promoting Lifestyle Profile II</td>
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<td>HR</td>
<td>Heart Rate</td>
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<td>LCB</td>
<td>Locus of Control Behaviour Scale</td>
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<td>LSQ</td>
<td>Life Satisfaction Questionnaire</td>
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<tr>
<td>LSS</td>
<td>Life Satisfaction Scale</td>
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<td>MAACL R</td>
<td>Multiple Affect Adjective Check List</td>
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<td>MBI</td>
<td>Modified Barthel Index</td>
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<td>MDD</td>
<td>Major Depressive Disorder</td>
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<td>NSCIC</td>
<td>National Spinal Cord Injuries Centre</td>
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<td>OAHMQ</td>
<td>Older Adult Health &amp; Mood Questionnaire</td>
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<td>PADS</td>
<td>Physical Activities with Disabilities Scale</td>
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<td>PHQ-9</td>
<td>Patient Health Questionnaire-9</td>
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<td>PMP</td>
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<td>SCI</td>
<td>Spinal Cord Injury</td>
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<td>SCS</td>
<td>Secondary Conditions Scale</td>
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<td>SF-36</td>
<td>Short Form 36 Item Health Survey</td>
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<td>SGT</td>
<td>Supportive group therapy</td>
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<td>SPS</td>
<td>Self-Perception Scale</td>
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<td>SRHS</td>
<td>Self-Rated Health Scale</td>
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<td>SSQ</td>
<td>Social Support Questionnaire</td>
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<tr>
<td>SSRI</td>
<td>Serotonin Reuptake Inhibitor</td>
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<td>STAI</td>
<td>State Trait Anxiety Inventory</td>
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<td>TMS</td>
<td>Transmagnetic Stimulation</td>
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<td>TSCS</td>
<td>Tennessee Self-Concept Scale</td>
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Depression Following Spinal Cord Injury

1.0 Introduction

Psychological adjustment to catastrophic injuries and illnesses is a topic of much interest for practitioners providing clinical rehabilitation services. This chapter attempts to summarize evidence garnered from spinal cord injury (SCI) research that has investigated the treatment of post-SCI depression and depressive symptoms potentially affecting successful adjustment to SCI. Though limited, these findings can assist in developing a foundation for evidence-based practice, and hopefully lead to improved and more consistent care. It should be emphasized, however, that evidence-based practice constitutes more than the routine use of treatments supported by the best research evidence available. Such practice also necessitates that the practitioner employ his or her clinical judgment in determining the applicability of such research conclusions to the treatment provided each patient (American Psychological Association 2005).

Concerns regarding “depression” are commonly reported by SCI survivors, staff, or their families. Indeed et al. (1995) report that depression is the most frequently researched psychological issue in individuals who have sustained a SCI. Given the losses and innumerable adjustments necessitated following a SCI, an individual will likely encounter repeated strains upon available coping resources. The emergence of depressive symptoms is not then a surprising outcome of such challenges (Kemp et al. 2004) and some early investigators have described it as an “inevitable” outcome (e.g. Hohmann 1975). Of added concern, rates of suicide average approximately 3 to 5 times that reported in the general population (e.g. DeVivo et al. 1991; Charlifue & Gerhart 1991; Hartkopp et al. 1998) and stand in contrast to the reductions achieved in other preventable causes of death following SCI (e.g. septicemia, respiratory illness, diseases of the urinary system) (Soden et al. 2000). The many consequences of SCI pose multiple stressors for families (e.g., 15% of caregivers reported symptoms consistent with Major Depressive Disorder (MDD) ; Dreer et al. 2007) and can also result in emotional challenges for rehabilitation staff (North 1999).

The term “depressed mood” refers to a state of dysphoria that occurs routinely and is considered a normal process (Elliott & Frank 1996). In contrast, a diagnosable “depressive syndrome” refers to a constellation of observable affective, cognitive and neuro-vegetative symptoms of sufficient frequency and severity to negatively impact the functioning of an individual. The Diagnostic and Statistical Manual of Mental Disorders (DSM) (American Psychiatric Association 2000) is a frequently cited classification system for establishing diagnoses of various depressive and other mental disorders. According to the DSM-IV-TR®, depression is not a single entity, but instead represents a range of disorders which are classified according to symptom type, number, severity, duration and functional impact. A diagnosis of MDD in an adult requires at least a two-week period of five or more symptoms, with at least one either depressed mood or a loss of interest or pleasure in almost all activities. Further symptoms may include:

- Significant weight loss when not dieting or weight gain (e.g., a change of more than 5% of body weight in a month), or decrease or increase in appetite nearly every day.
- Insomnia (inability to sleep) or hypersomnia (sleeping too much) nearly every day.
- Psychomotor agitation or retardation nearly every day.
- Fatigue or loss of energy nearly every day.
- Feelings of worthlessness or excessive or inappropriate guilt nearly every day.
- Diminished ability to think or concentrate, or indecisiveness, nearly every day.
- Recurrent thoughts of death (not just fear of dying), recurrent suicidal ideation without a specific plan, or a suicide attempt or a specific plan for committing suicide.

Symptoms together must result in impairment in functioning (social, occupational or other) and are not due to the direct physiological effects of a substance or medical condition. The classification of affective symptoms continues to be revised with the next edition (DSM-V) anticipated for 2013. As an example, a mixed anxiety and depressive disorder is proposed when anxiety and depression are both present, but neither set of symptoms, considered separately is sufficient to justify a diagnosis (American Psychiatrist Association 2010).

Identifying clinical depression is often more difficult than might be anticipated. Rehabilitation staff has been shown to overestimate the incidence of depression in inpatient populations (Cushman & Dijkers 1990) while underestimating patients’ reported coping ability and mental health (Siosteen et al. 2005). Similarly, the life satisfaction and well-being of persons in the community with complete tetraplegic injuries (including those who required ventilator support) was shown to be underestimated by health care professionals (Bach & Tilton 1994). Conversely, Kemp and Mosqueda (2004) caution that symptoms of depression can be overlooked or misidentified in people with disabilities.

Various methodological issues have “served to constrain” the study of depression in the SCI population (Elliott & Frank 1996). The use of ambiguous definitions and the unclear or inconsistent use of diagnostic criteria are two of many such challenges. Others issues include a lack of theoretical models, selection biases, limited longitudinal studies and ethical concerns that limit more rigorous experimental designs.

How best should the occurrence of depression be viewed in the process of adjustment to SCI? Anecdotal models of adjustment have incorporated the “clinical lore” that depression was to be universally anticipated soon after injury (Elliott & Kennedy 2004), and demonstrating the individual’s rational acceptance of the permanence of the injury and associated losses (Frank et al. 1985). Taken further, those individuals who do not evidence depression were considered to be in “denial” and potentially vulnerable to a more precarious adjustment (e.g. Siller 1969). Accordingly, it had been also proposed that depression be induced to encourage appropriate grieving (Nemiah 1957). More recently, both the universality and the benefits of depression in the adjustment process have been questioned by numerous investigative findings (e.g. Howell et al. 1981; Judd et al. 1986). Given the many negative outcomes associated with depression post injury (e.g. longer hospitalization, decreased longevity, increased rates of suicide, reduced health, daily functioning, limited community participation) it is likely best viewed as a secondary complication or sequelae rather than an adaptive process facilitating overall emotional adjustment (Consortium for Spinal Cord Medicine 1998).

Kemp et al. (2004) noted that depression is not simply a necessary consequence of sustaining a SCI, that not all who sustain a SCI become depressed. Tirch et al. (1999) studied depressive symptoms in 11 pairs of monozygotic twins where one of the pair had sustained a SCI. The SCI and non-SCI co-twins did not differ significantly in their self-report lending additional support to the view that SCI does not inevitably lead to increased depression. Further, there is little relationship between depression and the level of SCI or the completeness of the lesion (Kemp et al. 2004). As an example, Hall et al. (1999) sampled 82 individuals with C1-4 quadriplegia between 14 and 24 years post injury, and these individuals reported their self-esteem and quality of life to be high – with 95% feeling they were “glad to be alive”.

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Depression post SCI can be a function of difficulties coping with the multiple environmental, social and health-related problems that follow. If depression is not inevitable following SCI, then it is noteworthy that depression is related to modifiable factors that play a role in its development and maintenance (Kemp et al. 2004). In a summary of the adjustment literature, Elliott & Rivera (2003) described a model determining psychological well-being and physical health post-SCI. The components include demographics, injury characteristics, pre-injury behaviours and psychopathology, personality factors, social/environmental factors and styles of appraisals. The authors highlight how the consequences of physical disability exist within a larger context and that changes in public and health policies can dramatically impact post-injury quality of life.

2.0 Prevalence of Depression Post-SCI

Estimates of the prevalence of depression are affected by the nature of the measures used, how depression is defined, aging characteristics of the samples studied and when symptoms are assessed post-injury (Elliott & Frank 1996). The common research practice of employing self-report measures is both convenient and cost-effective. However, the resulting prevalence rates may reflect subjective anxiety and overall distress rather than symptoms specific to depression, per se. In clinical practice, self-report measures may serve to alert the clinician to the need for additional evaluation and can aid in monitoring symptom severity over time. For reviews of depression and other psychosocial measures frequently used in spinal injury research and practice see Vahle et al. (2000), Richards et al. (2006), Sakakibara et al. (2009), and SCIRE chapter 25 on outcome measures.

In a review, Bombardier et al. (2004) found rates of major depression or probable major depression following SCI vary widely across studies and can range from 7% to 31% of persons, with estimates of MDD typically reported in 15%-23% of individuals. In a recent survey of 568 adult traumatic SCI inpatient rehabilitation clients, approximately 22% met self-reported symptoms consistent with MDD on average less than two months post injury (Krause et al. 2008). Bombardier et al. (2004) surveyed 849 SCI outpatients at one-year post injury and found 11.4% met criteria for MDD. Krause et al. (2000) suggest a 42% overall rate of depression with a 21% probable rate of major depression – indicative of a 4-fold increase of depressive disorders among individuals with SCI when compared with samples of non-disabled individuals. Of note, many studies do not include information regarding use of antidepressants, other medications, or psychotherapeutic interventions in their reports. Accordingly, observed rates of depressive symptoms may potentially be a reflection of multiple additional factors and the “net effect of all treatments” (Krause et al. 2008).

With up to 25% of men and 47% of women affected (Consortium for Spinal Cord Medicine 1998) a recent case-matched comparison found an absence of gender differences in probable major depression and symptom severity (Kalpakjian & Albright 2006). In an Italian sample averaging 6 years post-SCI, Scivoletto et al. (1997) found 16% reported significant symptoms of depression and 13% anxiety. Migliorini et al. (2008) employed an Australian sample who averaged 19 years post-SCI, 37% were identified as depressed, 30% suffered anxiety, 25% experienced significant stress and 8.4% reported post-traumatic stress disorder. Of note, approximately 60% of individuals with one probable diagnosis were likely to suffer at least one other comorbid condition highlighting the potential complexity of mental health issues.

In a 6-year follow-up study of 233 Albertans with SCI, 28.9% were treated for depression following their traumatic SCIs, with approximately 59% of these individuals beginning treatment during their initial hospitalization (both acute and rehabilitation admissions). An additional 10% of people were treated during the remainder of the first year. This exceeded depression
treatment rates reported in able-bodied controls of approximately 11% (Dryden et al. 2004) with those at highest risk reporting permanent neurological deficit, a pre-injury history of depression, or substance abuse (Dryden et al. 2005). Kennedy & Rogers (2000) reported that anxiety, depression and hopelessness gradually increased beginning at week 30 post injury and continued until discharge from rehabilitation (week 48). At that point 60% of SCI clients scored above a clinical cut-off for depression (i.e. Beck Depression Inventory). Krause et al. (2008) suggested that depressive symptoms may not peak during inpatient rehabilitation and it may take additional time for the “low point of emotional adaptation to appear”.

In a cross sectional study, Richardson & Richards (2008) found that rates of clinically significant depressive symptoms (Patient Health Questionnaire-9 (PHQ-9) >10) were reported by approximately 21%, 18%, 12% and 12% of SCI survivors surveyed at 1, 5, 15 and 25 years post injury, suggesting rates tended to decrease with time since injury. Data obtained in earlier studies also suggested that in newly injured persons who met criteria for major and minor depression, many remit within 3 months of onset (Kishi et al. 1994) and that the frequency of reported problems decreases over the first year (Richards 1986). In a longitudinal analysis, Pollard & Kennedy (2007) found a substantial relationship between reported depressive symptoms at 3 months and approximately a decade post injury, with 38% and 35% of SCI survivors surveyed meeting a criterion for moderate depression at these times. Hoffman et al. (2008) followed 411 SCI model system participants and found approximately 20% of at 1 year post injury and 18% at year 5 post-injury reported symptoms consistent with major depression. Further, approximately a third of those reporting scores suggestive of moderate depression at year 1 experienced remission, while approximately 9% were newly depressed at year 5. The authors summarized that the natural history of depression post SCI was variable over time with some showing improvement while others exhibited emotional decline.

It has been questioned whether, despite its reported prevalence, efforts to improve the detection and treatment of depression in individuals with SCI has improved (Bombardier et al. 2004). In an editorial comment, Faber (2005) expressed concern that given possible underestimates, about half of all persons hospitalized for traumatic SCI may benefit from treatment for depression. Similarly, while a substantial percentage of their SCI clinic sample reported symptoms suggestive of major depression, Kemp & Krause (1999) found that none were receiving treatment (psychotherapy or medications). In a review of American veterans with spinal cord injuries and disabilities, Smith et al. (2007) concluded that many may not be receiving adequate treatment for depression and the authors encouraged more aggressive screening and treatment.

As health problems can produce pain, fatigue, sleep disturbances, physical sensations and digestive troubles, the overlap of somatic symptoms can pose diagnostic challenges. Krause, et al. (2008) noted that on average, nearly a third of a large sample of SCI adult inpatient rehabilitation clients cited sleep, energy and appetite changes, while symptoms of persistent depressed mood and anhedonia were reported by approximately 10% and 15% of the sample, respectively. In a large outpatient sample, 80% of SCI survivors with probable MDD reported symptoms of depressed mood, anhedonia, feelings of failure, disturbed sleep and decreased energy (Bombardier et al. 2004). In general, despite the potential for an increase in “false positives,” reports of somatic symptoms merit clinician review given their strong association with affective or more general symptoms of depression (Richardson & Richards, 2008; Krause et al. 2008).

Conclusions
While not universal, for many persons with spinal cord injury, depression can be a complication that poses a significant impediment to their functioning and adaptation.

Identifying depression can be difficult, but is most likely to develop during the initial year post-injury. Though many will experience a remission of symptoms over time, for others depressive symptoms may persist for many years.

Self-report measures of depression should be viewed as screening tools to alert the clinician to arrange a more thorough evaluation. In addition to affective symptoms, endorsement of somatic symptoms (e.g. sleep disturbance, poor energy and appetite disturbance) during inpatient or outpatient contact merits clinical review to clarify possible mechanisms underlying their emergence.

| Depression is a common consequence of SCI. |
| Depression post SCI can interfere with function and adaptation. |

3.0 Interventions for Treatment of Depression following SCI

The American Psychological Association (2005) states that evidence-based practice involves the integration of the best of existing research with clinical expertise and the reality of the patient's needs and wishes. Practical and ethical concerns may limit the availability of SCI research evidence.

Difficulties inherent in conducting intervention studies are numerous (King & Kennedy 1999). The SCI population can be heterogeneous. Most sites do not have access to a large number of patients and obtaining treatment and appropriate control groups requires the participation of multiple sites. Also, ethical concerns over providing the best possible care to all SCI patients are obvious, so that withholding aspects of treatment in order to establish control conditions is no longer acceptable (e.g. Kahan et al. 2006). To date, research strategies have frequently used self-report screening measures (e.g. Beck Depression Inventory, Zung Depression Inventory, PHQ-9, Center for Epidemiological Studies – Depression Scale (CES-D); Older Adult Health and Mood Questionnaire (OAHMQ); Depression ,Anxiety and Distress Scale), and while they offer many benefits (e.g. low cost, quick, easy to complete), they require further evaluation to support a diagnosis of depression.

Typical SCI interventions to encourage post-SCI adjustment are often multi-faceted; thereby posing difficulties in identifying which combination of components can offer optimal care for any particular patient. Further, psychosocial interventions cannot be independent of other aspects of care (e.g. medical, rehabilitation). Wait-list control conditions do not address personal contact, attention and perceived support available in intervention conditions. In addition, many pre-morbid psychological and historical influences are very difficult to determine.

As the nature of SCI studies make it more difficult to limit certain biases, the validity and generalizability of the findings is less clear. Despite these challenges, researchers have made invaluable clinical contributions using smaller groups, non-randomized control groups, or controls chosen from historical data. However, in summarizing the limited research currently available, Elliott & Kennedy (2004) suggested “we have many untested assumptions regarding the available treatments for depression among persons with SCI” and have questioned whether
the current “glaring lack of intervention data” reflects a lack of interest on the part of consumers, researchers and funding agencies with regard to various interventions for treatment of depression in those with SCI. Kahan et al. (2006) stressed that treatment of depression in people aging with a disability is “far from being developed,” noting a “massive dearth” of research of any kind for individuals with disabilities.

Table 1 Systematic Reviews and Meta-Analysis: All Treatments

<table>
<thead>
<tr>
<th>Authors: Country</th>
<th>Date included in the review</th>
<th>AMSTAR score</th>
<th>Number of articles</th>
<th>Method: Level of evidence Questions</th>
<th>Conclusions</th>
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<tr>
<td>Elliot &amp; Kennedy 2004 USA</td>
<td>Time line not stated</td>
<td>AMSTAR=7</td>
<td>N= 9</td>
<td>Comprehensive literature search of English RCT, Cohort studies, case series, and review articles of traumatic SCI in adult age group (18 + years). Databases: MEDLINE, PsycInfo. Level of evidence: Moderate quality: Downgraded high quality studies, non-randomized trials, prospective cohort studies; Low quality: Retrospective observational, retrospective cohort and case-control studies; Very low quality: Case series, case reports, reviews and others. Questions/measures/hypothesis: Examine the effectiveness of depression treatment post SCI.</td>
<td>1. There was moderate level evidence from 3 studies for psychological interventions in improving depressive symptoms post SCI. 2. There was high level evidence from 1 study and low level evidence from 4 studies for the use of antidepressants for depressive symptoms post SCI. 3. Functional electrical stimulation (FES) was supported by 1 moderate level study.</td>
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<td>Dorstyn et al. 2010 Australia</td>
<td>Review of published articles between January 1980 and April 2010</td>
<td>AMSTAR=10</td>
<td>N=10</td>
<td>Comprehensive literature search of English RCT, Cohort studies, case series, and review articles of traumatic SCI in adult age group (18 + years). Databases: MEDLINE, Psych Info, Cochrane Library, Meditext, CINAHL, Scopus. Level of evidence: Effect sizes were provided Questions/measures/hypothesis: Examine the effectiveness of cognitive behavioural therapy (CBT) in improving psychological outcomes post SCI.</td>
<td>1. Effect sizes for assertiveness, coping, self-efficacy, depression, acceptance, anxiety, locus of control and self-esteem ranged from very small to large post CBT treatment. 2. Moderate to large effect sizes were seen in quality of life post CBT treatment.</td>
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<tr>
<td>Mehta et al. 2011 Canada</td>
<td>Review of published articles between January 1990 to October 2010</td>
<td>AMSTAR=10</td>
<td>N=9</td>
<td>Comprehensive literature search of English RCT, Cohort studies, case series, and review articles of traumatic SCI in adult age group (18 + years). A meta-analysis was conducted. Databases: MEDLINE, Psych Info, CINAHL, EMBASE. Level of evidence: Moderate quality: Downgraded high quality studies, non-randomized trials, prospective cohort studies; Low quality: Retrospective observational, retrospective cohort and case-control studies; Very low quality: Case series, case reports, reviews and others. Effect sizes were provided Questions/measures/hypothesis: Examine the effectiveness of Cognitive Behavioural Therapy (CBT) in improving psychological outcomes post SCI.</td>
<td>1. One study demonstrated large effect sizes in the improvement of depression symptoms post CBT treatment; 4 studies demonstrated moderate effects; 4 studies demonstrated small effects. These effects were shown to last for up to two years in individuals diagnosed with MDD prior to the intervention. 2. Moderate effects sizes were seen on anxiety symptoms were seen in 2 studies post CBT treatment; 2 studies reported small effect sizes</td>
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psychological outcomes post SCI. and 1 study reported no effect of CBT on anxiety symptoms post SCI. 3. CBT treatment resulted in small effects on self-esteem, coping and adjustment post SCI.

Three studies examined the effects of interventions aimed towards psychological impairment post SCI. In a systematic review, Elliot & Kennedy (2004) evaluated the effectiveness of depression treatments post SCI through a systematic narrative review of the results. The study found psychological interventions, pharmacological therapy and Functional Electric Stimulation (FES) had moderate to high level of evidence in improving depressive symptoms post SCI. Dorstyn et al. (2010) and Mehta et al. (2011) examined the effectiveness of Cognitive Behavioural Therapy (CBT) on a range of psychosocial issues faced by individuals with SCI. Both studies found small to large effects of CBT on depressive and anxiety symptoms. Dorstyn et al. (2010) also found moderate to large effect sizes in the improvement of quality of life post CBT treatment in individuals with SCI.

3.1 Psychological Interventions

3.1.2 Cognitive Behavioural Therapy

In the SCI population, the application of CBT approaches to aid in the management of anxiety and depression is described as a prudent choice given its demonstrated effectiveness in a wide range of disorders (Craig et al. 1997). CBT strategies can include addressing “irrational” or negative thoughts, increasing opportunities for participating in rewarding activities, and instruction in relaxation, among others. Within this context, issues of assertiveness, social skills and discussions of sexuality have also at times been included to address the unique concerns of SCI individuals. Employing a group setting to provide CBT can also be a cost effective opportunity for peer support, practice of social skills and the opportunity for gaining additional viewpoints. Several authors have described the effects of group CBT interventions for individuals following SCI to reduce psychological distress and/or provide “immunization” against future difficulties.

<table>
<thead>
<tr>
<th>Author Year</th>
<th>Country</th>
<th>PEDro Score*</th>
<th>Research Design</th>
<th>Sample Size</th>
<th>Methods</th>
<th>Outcomes</th>
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<tr>
<td>Dorstyn et al. 2012</td>
<td>Australia</td>
<td>PEDro=6</td>
<td>RCT</td>
<td>N=40</td>
<td>Population: Age=53.5yr; Gender: males=69%, females=31%; Level of injury: paraplegia=24, tetraplegia=16. Treatment: SCI individuals were randomly assigned to receive telecounselling or standard inpatient care. Individuals in the treatment group received 12 weeks of biweekly phone motivational interviewing intervention for 20 mins. Outcome Measures: Depression Anxiety Stress Scale-21 (DASS-21)</td>
<td>1. Small improvement in depression (d=0.32), anxiety (d=0.24) and stress levels (d=0.27) were seen among individuals that received telecounselling compared to standard treatment group post intervention. 2. 4 of the 8 individuals in the treatment group that reported mild, moderate or extremely severe levels of depression and/or anxiety reported no symptoms postintervention; with maintenance up to follow-up. 3. Individuals in the standard care group reported increase in clinically</td>
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<td>Author Year Country</td>
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<td>Heutink et al. 2012 Netherlands</td>
<td><strong>Population:</strong> Mean age=58.8 yr; Gender: males=39, females=22; Duration of pain=5.4 yr; Type of pain=neuropathic. <strong>Treatment:</strong> SCI Individuals with chronic neuropathic pain were randomly assigned to receive interdisciplinary pain management which included Cognitive Behavioural Therapy (CBT) and education or wait list control group. The intervention consisted of 10 sessions over 10 week period with a comeback session 3 weeks after the 10th session. <strong>Outcome Measures:</strong> Chronic Pain Grade Questionnaire; Hospital Anxiety and Depression Scale (HADS).</td>
<td>1. No significant difference in HADS depression was seen between the two groups or over time. 2. Individuals in the CBT group found significant improvement in anxiety (p&lt;0.027) and participation in activities (p&lt;0.008) compared to the control group.</td>
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<td>Schulz et al. 2009 USA</td>
<td><strong>Population:</strong> Mean age=53 yr; Mean time since injury=8 yr. <strong>Treatment:</strong> Participants with SCI and their caregivers were randomly placed into 3 groups: caregiver only intervention; dual target intervention; information only control condition. Interventions were provided through computer telephone over a 6 month period. The intervention involved knowledge and cognitive behavioural skills for coping with SCI. <strong>Outcome Measures:</strong> Center for Epidemiologic Studies Depression Scale (CES-D), health symptoms, self-care problems, social integration.</td>
<td>1. Significant improvement in individuals with SCI’s CES-D and health symptoms were seen in the dual treatment group compared to the caregiver only group (p=0.014 vs. p=0.031). 2. Clinically significant improvement was also seen in caregivers in the dual target group compared to the caregiver only and control group on CES-D, burden, health symptoms.</td>
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<tr>
<td>Duchnick et al. 2009</td>
<td><strong>Population:</strong> Coping effectiveness training (CET): Mean age=50.8yr; Gender: males=95%; Level of injury: tetraplegia=40%; Severity of injury: AIS A=30%, B=30%, C=5%, D=35%; Supportive group therapy (SGT): Mean age=54.6yr; Gender: males=100%; Level of injury: tetraplegia=70%; Severity of injury: AIS A=20%, B=20%, C=20%, D=40%. Depression status=mild (no severe psychiatric condition score based on Mini-Mental State Examination). <strong>Treatment:</strong> Participants were randomly allocated into either the CET group or the SGT group. Each inpatient group met 1x/wk for 60 min. The CET group focused on: stress and appraisal, problem solving, communication skills, behavioral strategies, cognitive strategies and social support/assertiveness. SGT group emphasized the sharing of experiences and information related to SCI, emotional and cognitive reactions, and support and education from peers and psychologist. <strong>Outcome Measures:</strong> Center for</td>
<td>1. No baseline differences were found. 2. Mood change was not affected by treatment condition. 3. Significant decrease in anxiety (STAI) and depression (CES-D) was seen at discharge (p&lt;0.05). However, both anxiety (p=0.001) and depression (p&lt;0.05) increased significantly between discharge and follow-up (3 mo).</td>
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<td>Author Year</td>
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<td>PEDro Score*</td>
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<tr>
<td>Craig et al. 1997</td>
<td>Australia</td>
<td>Cohort</td>
<td>Prospective Controlled Trial</td>
<td>N=69</td>
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<td></td>
<td>Epidemiologic Studies Depression Scale (CES-D), State Trait Anxiety Inventory (STAI).</td>
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<td>Population: SCI: Age = 16-73 yr; Gender: males=57, females=12; Severity of injury: complete = 68%-71%; Chronicity = acute. Depression status=mixed group</td>
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<td>Treatment: 10 wk program. Small groups (4-5/group), for 1.5 hr/wk. Provided cognitive and behavioural skills to cope with the psychological and social difficulties encountered upon entering the community. Cognitive Behavioural Therapy (CBT) included muscle relaxation, visualization techniques, self-hypnosis and cognitive restructuring, social skills and assertiveness training, and sexuality sessions.</td>
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<td>Outcome Measures: State Trait Anxiety Inventory (STAI), Beck Depression Inventory (BDI), Rosenberg Self-Esteem scale.</td>
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<td>1. Significantly greater self-esteem for treatment group (p&lt;0.01). Taking this into account, no significant differences between the groups were found immediately after injury or 1 yr later.</td>
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<td>2. No significant initial differences were found between the groups on anxiety and depression when comparing pre, post and 1 yr scores.</td>
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<td>3. BDI scores were significantly lower for both conditions 1 yr after injury (p=0.014).</td>
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<td>4. Neither anxiety nor self-esteem scores improved significantly over 1 yr.</td>
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<td>5. Those who scored &gt;14 on the depressive mood scale were analyzed using repeated measures ANOVA. 22 persons (from both groups) were examined. Significant differences were noted between the groups (p&lt;0.01).</td>
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<td>6. Significant differences were also noted across time for the BDI scores (p&lt;0.01). Post hoc tests showed that the treatment group had significantly greater levels of improvement across time (p&lt;0.05).</td>
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<td>Perry et al. 2010</td>
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<td>Population: Mean age=43.8yr;</td>
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<td>1. A trend towards improvement on the</td>
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<td>Author Year</td>
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<td>PEDro Score*</td>
<td>Research Design</td>
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<tr>
<td>Australia</td>
<td>PCT</td>
<td>N=36</td>
<td>Prospective controlled trial</td>
<td>N&lt;sub&gt;Treatment&lt;/sub&gt;=19; N&lt;sub&gt;Control&lt;/sub&gt;=17</td>
<td>M/F=28/8; Level of injury: tetraplegia=13, paraplegia=20, Severity of injury: complete=13, incomplete=23; Duration of pain=60.5 mo; Type of pain=mixed. <strong>Treatment:</strong> SCI patients with chronic pain were placed in either the multidisciplinary cognitive behavioural pain management program (PMPs) group which involved a pharmacological treatment plan and individual and group based CBT for pain; or the usual care group. <strong>Outcome Measures:</strong> Hospital Anxiety and Depression Scale (HADS).</td>
<td>HADS depression score was seen in the PMP group at 1 mo post treatment; however, the HADS depression scores returned to pre-treatment levels at 9 mo follow-up.</td>
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<td>King &amp; Kennedy 1999</td>
<td>UK</td>
<td>Prospective controlled trial</td>
<td>N&lt;sub&gt;Initial&lt;/sub&gt;=38; N&lt;sub&gt;Final&lt;/sub&gt;=38</td>
<td>Population: Age=16-65 yr; Chronicity = acute; Depression status=mild <strong>Treatment:</strong> Consisted of 60-75 min sessions 2x/wk with 6-9 people. Sessions included a mixture of didactic presentations, practical exercises and time allocated for open group discussions. Following components made up the program: appraisal training, cognitive behavioural coping skills training, and strategies for choosing an adaptive match between appraisals and coping skills, and obtaining and maintaining social support. <strong>Outcome Measures:</strong> Functional Impairment Measure (FIM), Social Support Questionnaire (SSQ), Beck Depression Inventory (BDI), State Trait Anxiety Inventory (STAI), COPE.</td>
<td>Pre-intervention comparisons of groups: 1. The intervention group used religion significantly more and humour significantly less as coping strategies (p&lt;0.05) than did controls. 2. There were no pre-intervention differences between the groups on range of injury, social support, FIM scores, other coping strategies, depression or anxiety. Post-intervention comparison of groups: 1. Depression and Anxiety: Across time there were significant decrease in the depression scores (p&lt;0.05) but not for anxiety (p=ns). 2. Coping: No significant differences between the groups or across time.</td>
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<td>Norbrink Budh et al. 2006</td>
<td>Prospective controlled trial</td>
<td>N=38</td>
<td>N&lt;sub&gt;Treatment&lt;/sub&gt;=27; N&lt;sub&gt;Control&lt;/sub&gt;=11</td>
<td>Population: Treatment: Mean age=53.2yr; Gender: males=9, females=18; Level of injury: C=15, Th=6, L/S=6; Severity of injury: AIS: A=4, C=3, D=19, E=1; Controls: Mean age=49.9yr; Gender: males=5, females=6; Level of injury: C=4, Th=7; Severity of injury: AIS: A=6, D=5; Depression status=mixed. <strong>Treatment:</strong> The intervention group received education, Cognitive Behavioural Therapy (CBT), relaxation and body awareness training totaling 5 hr/wk for 10 wk while matched controls received no treatment for neuropathic pain. Depression was assessed as a secondary outcome. <strong>Outcome Measures:</strong> Hospital Anxiety and Depression Scale (HADS).</td>
<td>1. At 1 yr follow up, the sign test showed no significant change in depression and anxiety levels HADS in the treatment group from baseline. 2. However, the treatment group showed systematic decrease in anxiety and depression as measured by relative change in position (95% confidence interval) at 1 yr follow up. 3. Depression also decreased systematically in the treatment group compared to the control group at 1 yr follow up; however, the sign test showed no significant change.</td>
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<tr>
<td>Dorstyn et al. 2010</td>
<td>Prospective controlled trial</td>
<td>N=24</td>
<td>N&lt;sub&gt;Treatment&lt;/sub&gt;=11; N&lt;sub&gt;Control&lt;/sub&gt;=13</td>
<td>Population: Treatment: Mean age=53.2yr; Gender: males=9, females=2; Level of injury: paraplegia=6, quadriplegia=5; Severity of injury: complete =8, incomplete=3; Control: Mean age=44.5yr; Gender: males=11,</td>
<td>1. Mood had no effect on functional independence measure outcomes at admission or discharge. 2. Total DASS-21 scores did not change significantly over time in the treatment group however, depression</td>
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<td>Author Year</td>
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<td>PEDro Score*</td>
<td>Research Design</td>
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<td>Kennedy et al. 2003</td>
<td>UK</td>
<td>Cohort</td>
<td>N&lt;sub&gt;Initial&lt;/sub&gt;=85; N&lt;sub&gt;Final&lt;/sub&gt;=85</td>
<td>Population: SCI: Age = 16-65 yr; Cause of injury: trauma; Chronicity = acute. Depression status=mild (BDI=15) Treatment: Consisted of 60-75 min sessions 2x/wk for 3.5 wk in small groups of 6-9 participants. Session topics were: normalizing stress, appraisal skills, problem solving, examination of thoughts feeling and behavior, awareness of negative assumptions, and choosing appropriate ways both to cope and to increase social supports. Outcome Measures: Beck Depression Inventory (BDI), State Trait Anxiety Inventory (STAI), Coping Strategies Scale (CSS), Self-Perception Scale (SPS), and Functional Impairment Measure (FIM). Measures were taken before and immediately after the intervention, and at a 6wk follow-up with the intervention group, and every 6 weeks with the historic control group.</td>
<td>subscores varied significantly. 3. Mean depression subscores decreased significantly post interventions; however increased significantly at 3 mo follow-up. 4. Similarly, DASS-21 total scores, anxiety subscores and stress subscores decreased post interventions and increased at 3 mo follow up. 5. DASS-21 scores for the control group did not change significantly over time. 6. At 3 mo follow-up, 78% of individuals in the treatment group met clinical levels of caseness on the DASS-21; only 1 individual in the control group met these criteria. 7. These individuals lacked continued psychological support.</td>
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<td>Craig et al. 1999</td>
<td>Australia</td>
<td>Case Control</td>
<td>N&lt;sub&gt;Initial&lt;/sub&gt;=58; N&lt;sub&gt;Final&lt;/sub&gt;=58</td>
<td>Population: SCI: Age = 16-73 yr; Gender: males = 57, females = 12; Severity of injury: complete = 68%-71%; Chronicity = acute. Depression status=mixed group. Treatment: 10 wk in small groups. Each session lasted 1.5-2 hrs replacing normal</td>
<td>Percentages are reported for each area measured. 1. Re-admission: More control were readmitted following discharge (p&lt;0.05). 2. Drug usage: Controls were found to have higher self-reported drug usage</td>
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<tr>
<td>Author Year Country</td>
<td>PEDro Score* Research Design</td>
<td>Sample Size</td>
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<td>Craig et al. 1998b</td>
<td>Australia</td>
<td>Prospective Controlled Trial (longitudinal) (Continuation of Craig et al. 1997)</td>
<td>N\text{\textsubscript{Initial}}=69; N\text{\textsubscript{Final}}=58</td>
<td>rehab therapy. Patients underwent Cognitive Behavioural Therapy (CBT) attempts to change behaviour and feeling associated with the problem and considered maladaptive. Main aim of the program was to provide cognitive and behavioural skills to cope with the psychological and social difficulties encountered upon entering the community (as described above). <strong>Outcome Measures:</strong> Re-admissions, drug usage, relationships, social discrimination, self-reports of adjustment than the treatment group (cases) (p&lt;0.05). 3. Relationships and Social discrimination: No significant differences were noted between the two groups in relation to the types of relationship each person developed. 4. Self-reports of adjustment: Treatment groups said they had a higher number of persons who felt they had adjusted well compared to the controls (p&lt;0.01).</td>
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<td>Migliorini et al. 2011</td>
<td>Australia</td>
<td>Pre-Post</td>
<td>N=3</td>
<td><strong>Population:</strong> Age range= 41-65yr; males=2, females=1; Severity of injury: incomplete=2, complete=1 <strong>Treatment:</strong> Participants were offered a computer based Cognitive Behavioural Therapy (CBT) intervention involving 10 modules. <strong>Outcome Measures:</strong> Depression Anxiety Stress Scale-21 (DASS-21), PWI, SCL EWQ 1. A reduction in DASS-21 depression and stress scale was seen in 2 patients; anxiety scale in all three patients. 2. Overall quality of life improved in 1 patient and remained the same in 2 patients.</td>
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**Discussion**
In Australia, Craig et al. reported several studies (1997; 1998a; 1998b; 1999) employing a 10 week CBT-based group treatment format involving newly injured SCI rehabilitation inpatients with permanent injuries. They developed a CBT-based treatment protocol implemented by a psychologist and an occupational therapist. Treatment groups consisted of 4-5 individuals and sessions approximated 1.5 to 2 hours weekly. A matched control group of SCI patients received traditional rehabilitation services. Measures of depression, anxiety and self-esteem were completed when individuals were no longer immobilized in bed, after conclusion of therapy (3 months post injury) and at one year post injury. Prior to treatment, the treatment group reported greater self-esteem than did control, but did not differ on other outcome measures. Anxiety did not change over time. Both treatment and control groups reported fewer symptoms of depression at 12 months post injury. Taking into account pretreatment group differences in self-esteem, there was no significant improvement over time for either group. Given that neither group had high levels of depressive mood before treatment, a further analysis of those with elevated scores on depression revealed that the mean score for the treatment group (n = 10) showed improvement after treatment and further gains one year later. Controls (n = 12) who were moderately to severely depressed initially remained at these levels over the year. Patients with initially high levels of anxiety (in either condition) showed decreases in symptoms over the year, with a trend for those in the treatment group to improve more so than did those in the control group. CBT did not significantly impact upon self-esteem in individuals with recent onset SCI. The authors conclude that clinicians servicing SCI rehabilitation wards should evaluate individuals soon after admission to identify those with high levels of depression and/or anxiety and then recommend CBT. Further, not all persons with SCI are depressed, anxious or low in self-esteem, and may not require intervention.

In a follow-up report, Craig et al. (1998a) surveyed a subset of the SCI CBT treatment group participants and SCI controls (noted above) at 24 months post injury. Group differences were not significant for measures of depression and anxiety. At 1 and 2 years post injury, subjects were less depressed but levels of anxiety were essentially unchanged. For those subjects with elevated depressive symptoms prior to treatment, levels of depression over the long term were lower for the treatment than the control group. Differences over time were also noted, with the short-term improvements in the depressive symptoms of the treatment group maintained over the two-year period. In contrast, controls did not show improvement in the short term and were only slightly improved after 1 to 2 years. Interestingly, the authors report that none of the treatment group had sought further treatment for depression between the 12 and 24-month period. Both groups became less anxious over time. The small number of subjects precluded identification of significance, but an inspection of the data revealed that the treatment group lowered their elevated anxiety scores to within the normal range at two years, while the control subjects’ scores averaged approximately one standard deviation above general population norms. The authors conclude that not all individuals with recent onset SCI require specialized psychological intervention. For those with elevated levels of reported depression and anxiety, these symptoms hypothetically could return to normal levels in the absence of intervention. However, such improvements could require a protracted period and result in both increased health costs and a diminished quality of life. This study further suggests the merits of screening and ongoing benefits of an intervention program.

In a related study, Craig et al. (1998b) used the Locus of Control Behaviour Scale (LCB) to assess subjects’ perceptions that circumstances were within or beyond their control. No treatment differences were found when comparing SCI CBT group participants and controls over a two-year post injury period. Both groups averaged scores in the range suggestive of a more internal rather than external orientation. When subjects with scores suggestive of an external locus of control scores were identified (9 treatment subjects and 16 controls), the
treatment group showed a significant reduction in externality over time while controls did not. The finding supports the conclusion that CBT was effective for those in the treatment group who perceived living with a SCI (and related concerns) to be out of their control. Associations of locus of control scores and depressive mood (Beck Depression Inventory) almost all reached significance for the control group when assessed pre-treatment, post treatment, and at one and two year intervals. In contrast, no associations were evident between LCB scores and reports of depressive symptoms in SCI treatment subjects, even for those who were external in their perceptions prior to participation in the CBT group. The authors speculated that CBT “positively interfered in the determination of depressive mood”. While there may be a substantial group at risk for developing psychological difficulties following spinal cord injury, the majority did not show problematic levels of externality and helplessness. As such, the authors concluded that CBT for all SCI survivors is costly and unnecessary.

Craig et al. (1999) continued a long term (2 years post injury) assessment of persons with SCI who previously participated in a non-randomized longitudinal controlled trial of CBT during their inpatient admission to a rehabilitation ward (1991-1992). These responses were compared with those of control subjects who received only traditional rehabilitation services during their hospital stay. Treatment subjects indicated 15% fewer hospital readmissions, 25% less drug use and much more often reported a positive adjustment than did controls. Of concern, approximately 40% of controls frequently used drugs. Forty three percent of controls reported that they had not adjusted well, while only one treatment subject held a similar view. Neither group reported the occurrence of suicide over the two years. Self-reports of adjustment were negatively correlated with Beck Depression Scale scores. The groups did not differ in the frequency of relationship breakups, with the majority of those married at the time of injury remaining so at two years. Further, about half who were unmarried had formed new relationships. The findings again are seen as suggesting benefits of CBT group treatment in encouraging positive adjustment following SCI.

Two studies conducted at the National Spinal Cord Injuries Centre (NSCIC) in the UK investigated group Coping effectiveness training (CET). CET includes CBT, didactic, and practical elements. The first (King & Kennedy 1999) was a pilot study of CET, and the second (Kennedy et al. 2003) continued the work with additional subjects and measures. Both studies used matched historic controls from the NSCIC database, although there did remain some significant pre-intervention differences between groups. Results suggest that their intervention package produced a number of positive changes, including less depression and anxiety, less use of alcohol, and more positive self-perception. Participants said that they found the sharing of views and experiences and reviews of “real life” scenarios to be most valuable aspects of the group.

In an RCT conducted by Duchnick et al. (2009), 41 individuals from an inpatient rehabilitation hospital were randomized into either a CET group or Supportive group therapy (SGT). The SGT group received minimal structure and skills training compared to the CET group. Both groups were led by two doctoral level psychologists with SCI rehabilitation experience. Sessions were 1 hour each week for the duration of their inpatient rehabilitation (8-12 weeks). No significant difference was initially evident at baseline in the CES-D and State Trait Anxiety Inventory (STAI) scores between the two groups. Both groups showed significant improvement in depression and anxiety scores at discharge (p<0.05). However, both depression and anxiety scores at 3 month follow-up had returned to initial levels.

In a level 2 study Norrbrink et al. (2006) investigated the effects of an outpatient comprehensive pain management program for individuals with SCI and neuropathic pain. The intervention
group received education, CBT, relaxation and body awareness training totaling five hours weekly over a 10 week period while matched controls received no treatment. At 1 year follow up, the sign test showed no significant change in depression and anxiety levels Hospital Anxiety and Depression Scale (HADS) in the treatment group from baseline. However, the treatment group showed a systematic decrease in anxiety and depression as measured by relative change in position (95% confidence interval) at one year follow up. Depression also decreased systematically in the treatment group compared to the control group at 1 year follow up; however, the sign test showed no significant change. Reported levels of pain intensity, health related quality of life and life satisfaction did not differ between groups or over time.

Dorstyn et al. (2010) conducted a small prospective controlled trial to examine the effectiveness of CBT on the mood of individuals with SCI. In the study, those with subclinical Depression Anxiety Stress Scale-21 (DASS-21) scores were assigned to the control group, while patients with moderate to severe scores were offered individual CBT treatment for a range of 7 to 22 sessions (30-60mins each). Low dose amitriptyline was prescribed for a subset of the treatment group to help manage their distress while several control participants were similarly medicated for neuropathic pain. The authors found mood had no effect on the functional outcome of patients at admission or discharge. In the treatment group, the total DASS-21 scores did not change significantly over the treatment course; however depression, anxiety and stress subscale scores were found to decrease significantly post intervention and then increase significantly at 3 month follow-up post discharge. The control groups’ remained stable over the period of investigation. At 3 month follow-up, 78% of individuals in the treatment group met clinical levels of “caseness” on 1 or more clinical subscales while only 1 individual in the control group met these criteria.

In another study, Dorstyn et al. (2012) conducted a randomized controlled trial in which SCI inpatients were randomly assigned to a telecounseling or standard care group. The study found improvement in depressive and anxiety symptoms in the telecounseling group; while those in the standard care group reported increase in symptomotology.

In a prospective controlled trial, Perry et al. (2010) placed SCI individuals with chronic pain into a multidisciplinary cognitive behavioural pain management, involving pharmacological and CBT treatment, or a usual care control group. A trend towards improved HADS score was also seen in the treatment group post treatment; however, scores returned to pre-treatment scores by 9 month follow-up. In this study, CBT was aimed at improving symptoms of pain rather than depression. This may explain the non-significant improvement of depressive symptoms post treatment and the deterioration of depressive symptoms back to baseline at follow up.

In a unique study, Schulz et al. (2009) examined the effectiveness of CBT on improving the quality of life in caregivers and care recipients. The study found significant improvement in depressive symptoms in the dual target group compared to the caregiver-only group (p=0.014). However, no significant improvement was seen in the CES-D scores of the care receivers.

Migliorini et al. (2011) conducted a pilot study examining a computer based CBT intervention for individuals with SCI found all 3 patients experienced reduced anxiety; while two patients also experienced reduction in depression and stress based on the DASS-21. A large number of individuals did not complete the study; however, no significant differences were seen in their baseline characteristics compared to those who completed the study.

In an RCT, Heutink et al. (2012) found SCI individuals in a 10 week interdisciplinary pain management program showed no improvements in depressive symptoms compared to those in
standard care. However, significant improvements in anxiety and participation in activities was seen.

**Conclusion**

*There is level 2 evidence (from several studies; Table 2) to support the use of small group CBT based treatment packages to decrease depressive symptoms following SCI.*

*Follow-up findings (1 year post treatment) showed maintenance of affective improvement in four level 2 studies; conversely, evidence from two level 2 studies found that post intervention reduction of depressive symptoms were not sustained at follow up of up to one year.*

*There is level 1b evidence (from one randomized controlled trial; Schulz et al. 2009) that providing CBT to caregivers and care receivers results in improved depressive symptoms in care receivers.*

*There is level 4 evidence (from a pre-post study; Migliorini et al. 2011) that computer based CBT may improve symptoms of depression, anxiety and stress post SCI.*

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**Cognitive behavioural interventions provided in a group setting appear helpful in reducing post-SCI depression and related difficulties.**

**CBT interventions aimed at both caregivers and care receivers may be effective in reducing symptoms of depression post SCI.**

**Computer based CBT may improve symptoms of depression, anxiety and stress post SCI.**

---

**3.2 Combined Psychotherapy and Pharmacotherapy for Treatment of Depression in SCI**

Several case series studies have reported positive results using pharmacotherapy for depression in SCI individuals; for example, amitriptyline (Kim et al. 1977; Fullerton et al. 1981) mianserin and nomifensine (Judd et al. 1986), and tetracyclic and tricyclic antidepressants (Judd et al. 1989). Though reports of depressive symptoms were infrequent, Osteraker & Levi (2005) note that 25% and 30% of an inpatient Swedish SCI rehabilitation sample were prescribed antidepressants at admission and discharge, respectively. In an electronic record review of over 17,000 veterans with “SCI and disorders” who sought inpatient or outpatient services during a three year period, Smith et al. (2007) noted that 22% had at least one encounter with a diagnosis of “depression”. The majority of these depressed individuals (72%) received antidepressant therapies, typically a selective serotonin reuptake inhibitor (SSRI) - most often sertraline. In a Canadian centre, approximately a third of traumatic spinal cord injured individuals and approximately 40% of those with non-traumatic spinal cord injuries received antidepressant therapy during inpatient rehabilitation in addition to other counseling and therapeutic services (2006-2008; J. Conlon, personal communication, December 16, 2008).

Overall, support for pharmacological treatment of depression in individuals with SCI is largely an extrapolation from the extant literature concerning use in the general population and comparative trials of medications and cognitive behavioural interventions are “sorely needed” (Elliott & Kennedy 2004).
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<th>Author Year</th>
<th>Country</th>
<th>PEDro Score*</th>
<th>Research Design</th>
<th>Sample Size</th>
<th>Methods</th>
<th>Outcomes</th>
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<td>Kemp et al. 2004</td>
<td>USA</td>
<td>Pre-post</td>
<td>N\text{init}=43; N\text{final}=28</td>
<td>Population: SCI: Age = 20-74 yr; Gender: males 32; females=11; Time since injury=5-37 yr; 28 treated for depression, 15 acted as quasi-controls. Depression status=major depression using Older Adult Health and Mood Questionnaire (OAHMQ)</td>
<td>Treatment: 6 mo of individual outpatient treatment. Two components: psychotherapy and medication were offered to all. Cognitive Behavioural Therapy (CBT) began once a week for the first 2 months then was reduced to twice a month. All were prescribed an antidepressant based upon their needs and physician’s decision. Average number of therapy session completed was 14/17 (range 6-17).</td>
<td>1. Depression Outcomes: A decrease was observed in depression scores from 0-24wk in the treatment group (p&lt;0.001). 2. Paired t-tests indicated a 24% decline in depression scores from 0-8wk (time 1=15.7, time 2=11.9, p&lt;0.001) and from 8-24 wk (6.7) (p&lt;0.001). 3. 8 subjects continued to score in the range for major depression. If cases with variable treatment adherence were eliminated 100% of participants treated no longer had scores in the range of major depression. 4. Community activities: There was a significant increase in community activities from 0-24 wk of treatment (p&lt;0.001). 5. T-tests showed a 40% increase in activities from 0-8wk (time 1=11.1, time 2=15.5, p&lt;0.001). 6. A further increase was noted between 8 and 24 wk (time 2=15.5, time 3=22.3, p&lt;0.001). The correlation between the change in number of depressive symptoms and the change in the # of community activities was high (-0.81, p&lt;0.001). 7. Life satisfaction: While a significant overall effect was observed for life satisfaction scores (p&lt;0.001), significant differences in life satisfaction were noted only between 8 and 24 wk (time 2=23.5, time 3=28.4, p&lt;0.001). 8. Non-treatment group: Scores on the depression measure did not change significantly over time.</td>
</tr>
<tr>
<td>Kahan et al. 2006</td>
<td>USA</td>
<td>Prospective Controlled Trial</td>
<td>Overall N=76; SCI N=41</td>
<td>Population: Treatment group: SCI=28, Other conditions=26; Mean age=51.4 yr Gender: males=52.7%, females=46.3%; Time since injury=26.2 yr; Quasi control group: SCI=13, Other=9; Mean age=44.2 yr Gender: males=45.5%, females=54.4%; Time since injury=18.8 yr. Depression status=major depression evaluated using Older Adult Health and Mood Questionnaire (OAHMQ).</td>
<td>Treatment: Treatment group received a mixture of outpatient cognitive behavioral psychotherapy and antidepressant medication (individualized), for 30 wk.</td>
<td>1. Depression Outcomes: Depression rate of the treatment group was improved between all time points (p&lt;0.001). 2. At baseline, OAHMQ scores in 53/54 treatment subjects classified as “experiencing major depression” and 1/54 had “significant depression symptoms”. By T3, 41 subjects classification had improved and 13 remained the same with an improved OAHMQ score (p&lt;0.001). Overall, 71% of SCI subjects’ depression improved following treatment. 3. At baseline, treatment and control groups’ depression scores were</td>
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<tr>
<td>Author Year</td>
<td>Country</td>
<td>PEDro Score*</td>
<td>Research Design</td>
<td>Sample Size</td>
<td>Methods</td>
<td>Outcomes</td>
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<tr>
<td>Judd et al. 1989 USA Pre-Post N=14</td>
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<td></td>
<td></td>
<td>Community Activities Checklist - community activity involvement. Treatment group: @ baseline (T1), 10 weeks (T2) &amp; 30 weeks (T3). Control group: @ 2 points (routine medical visits) spanning 2 years. similar, but were significantly different after treatment (p≤0.001). Mean depression scores reduced by 50% &amp; 12% in treatment &amp; control groups, respectively. 4. Community activity scores: Improved scores for the treatment group (p≤0.001). 2, 14 &amp; 22 subjects engaged in 25+ activities/week at T1, T2 &amp; T3, respectively. 5. SCI subjects were found to participate in a significantly fewer community activities, as compared to other subjects (p≤0.05). 6. Life satisfaction: Scores improved for the treatment group (p≤0.001). 9, 16 &amp; 30 subjects were “mostly to very satisfied” @ T1, T2 &amp; T3, respectively.</td>
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<tr>
<td>Judd et al. 1986 USA Pre-Post N=9</td>
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<td>Population: Mean age=31.6 yr; Gender: males=9, females=5; Level of injury: paraplegia=7; tetraplegia=7; Depression status=clinically depressed evaluated using DSM-III. Treatment: Patients received supportive psychotherapy and were prescribed tetracyclic and tricyclic antidepressants during rehabilitation period. Outcome Measures: Beck Depression Inventory (BDI) 1. 13 of the 14 patients had improvement in BDI score at discharge (average BDI at discharge=8). 2. 1 patient required inpatient care in the psychiatric unit.</td>
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</table>

Discussion

Kemp et al. (2004) used a pre-post treatment design to assure access to services and avoid ethical concerns that might arise in a randomized trial. A total of 43 community living adult SCI survivors were identified as depressed using the OAHMQ and confirmed by clinical interview. Citing distance problems, 15 subjects subsequently declined participation but served as a “quasi-control” group. The 28 remaining subjects began a combined 6-month trial of antidepressant medications and individual cognitive behavioural psychotherapy. The participants were somewhat older but did not differ from non-participants in terms of level of injury, gender, or race/ethnicity. Medications employed included SSRI and tricyclic antidepressants. A clinical psychologist provided psychotherapy that included education regarding the signs, symptoms and consequences of depression, cognitive restructuring, problem solving and encouraging greater community involvement (average of 14 sessions).
During the treatment trial, four subjects discontinued their medications, one discontinued psychotherapy and three developed medical complications. When these eight subjects were excluded, all of the remaining 20 subjects improved, no longer meeting criteria scores for major depression (12 appeared mildly depressed and eight appeared non-depressed). Their participation in community activities doubled over the 24 weeks, while life satisfaction showed improvement, primarily during the final 16 weeks of the program. The average depression score for non-treated subjects did not change significantly over a 24-month follow-up period and suggests that untreated depression can become a chronic disorder.

In a subsequent investigation combining a reanalysis of previous SCI participant data (40 of 43 were presented in above study) and an expansion to include 36 community dwellers with polio, cerebral palsy, stroke, rheumatoid arthritis, or other impairments, Kahan et al. (2006) explored the effects of a 6 month program of CBT and antidepressant therapy in an adult sample reporting major depression (54 received treatment and 22 no treatment). A pre-post treatment design was employed to assure access to services and avoid ethical concerns that might arise in a randomized trial. A clinical psychologist provided psychotherapy that included education regarding the signs, symptoms and consequences of depression, cognitive restructuring, problem solving and encouraging greater community involvement (average of 8 sessions; ranging from 4 to 17). Most commonly used were SSRIs (18 participants) while 7 took tricyclic antidepressants.

On average, depression scores declined 50% over the course of treatment. Seventy six percent improved to a less severe category of depression, while 24% remained unchanged. Of those who improved, approximately 30% no longer were classified as depressed. Of those who reported continued major depression despite treatment, they showed a decrease in the number of symptoms reported. In contrast, approximately a third of the no-treatment group improved, over half remained unchanged, and the remainder became worse. While the small sample sizes precluded statistical analysis, a pattern of improvement across disability subgroups was apparent. Benefits of treatment were significant by approximately 10 weeks.

The authors conclude that community dwelling individuals who have long term impairments and report depression can derive benefit from a combined intervention, with six months of treatment suggested as a minimum standard. The frequency of participation in community activities was specifically targeted and doubled over the course of treatment. Further, reported life satisfaction also improved, despite persistent dissatisfaction in physical status.

Furthermore, in two pre-post studies Judd et al. (1989; 1986) found improvement in inpatients’ (Beck Depression Inventory) BDI and anxiety levels post pharmacological and psychological treatment. Fullerton et al. (1981) interviewed 30 SCI rehabilitation patients using the SADS and identified nine as depressed. While three initiated treatment with amitriptyline, one patient responded and side effects required the intervention be discontinued in the remaining two. Depression was reported to have remitted in all patients at time of discharge (average 12 weeks).

**Conclusion**

*Evidence of the benefits of pharmacotherapy alone and in combination with individual psychotherapy in the treatment of depressive symptoms in individuals with SCI is encouraging, although support is largely from investigations in other populations.*
There is level 4 evidence (from one prospective controlled trial and three pre-post studies; Kahan et al. 2006; Kemp et al. 2004; Judd et al. 1989, 1986) indicating the effectiveness of pharmacotherapy combined with cognitive behavioral psychotherapy for treatment of depression in SCI and other chronic disabling conditions.

The benefits of drug treatment for post-SCI depression are largely extrapolated from studies in non-SCI populations.

### 3.3 Exercise for Depression following SCI

Strategies to encourage health, reduce secondary complications and consequently support positive emotional adjustment following SCI have emerged as a source of increasing research interest. As examples, the following studies review the impact of regular exercise upon various measures of physical health and emotional well-being.

#### Table 4 Exercise for Depression following SCI

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Country</th>
<th>PEDro Score*</th>
<th>Research Design</th>
<th>Sample Size</th>
<th>Methods</th>
<th>Outcomes</th>
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</thead>
<tbody>
<tr>
<td>Hicks et al.</td>
<td>2003</td>
<td>Canada</td>
<td>PEDro=8</td>
<td>RCT</td>
<td>NInitial=43; NFinal=32</td>
<td>Population: Age=19-65 yr; Gender: both; Time since injury=1-24 yr.</td>
<td>1. Quality of life components: Exercisers reported less stress, fewer depressive symptoms, and greater satisfaction with their physical functioning than the controls. (p=0.06). Exercisers reported less pain (p&lt;0.01) and a better Q of L (p&lt;0.05).</td>
</tr>
</tbody>
</table>
| Ginis et al.   | 2003      | Canada    | PEDro=6      | RCT             | NInitial=34; NFinal=34 | Population: Mean age= 8.6 yr; Gender: 23 males, 11 females; Mean time post-injury: 10.4 yr | 1. After 3 months, when compared to controls, exercisers had:   
   - ↑ QOL (p=0.007)  
   - ↑ satisfaction with physical function (p<0.01) |

The benefits of drug treatment for post-SCI depression are largely extrapolated from studies in non-SCI populations.
<table>
<thead>
<tr>
<th>Author Year Country</th>
<th>PEDro Score* Research Design</th>
<th>Sample Size</th>
<th>Methods</th>
<th>Outcomes</th>
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<tbody>
<tr>
<td>Latimer et al. 2005</td>
<td>Canada PEDro=1 RCT</td>
<td>N=23</td>
<td>ergometry exercise &amp; 45-60 min of resistance exercise, 2d/wk, in small groups. Control group: Asked to continue normal daily activities and not begin an exercise routine for 3 mo Outcome Measures: Perceived Quality of Life (PQOL); Center for Epidemiologic Studies Depression Scale (CES-D).</td>
<td>- ↑ satisfaction with physical appearance (p=0.007). - ↓ depression (p=0.02)</td>
</tr>
<tr>
<td>Hicks et al. 2005</td>
<td>Canada Pre-Post</td>
<td>N=14</td>
<td>Population: Intervention group: Mean age:37.54 yr; Gender: 9 males, 4 females; Level of injury: Tetraplegia (7), Paraplegia (6); Mean time post-injury: 9.23 yr; Control group: Mean age:43.30 yr; Gender: 5 males, 5 females; Level of injury: Tetraplegia (4), Paraplegia (6); Mean time post-injury:15.70 yr Treatment: Intervention group: A 6 mo exercise program 2d/wk in small groups (avg 3-5 people), ran by student volunteer personal trainers. Control group: Asked to continue normal daily activities and not begin an exercise routine within 6 mo Outcome Measures: Perceived Stress Scale (PSS); Center for Epidemiologic Studies Depression Scale (CES-D); Perceived Quality of Life (PQOL); measured at at baseline, 3 and 6 mo</td>
<td>1. At baseline, ↑ stress levels were related to ↑ depression rates (p&lt;0.05). At 6 mos, the exercise group's stress and depression association had ↓ but remained significant in the control group (p&lt;0.05). 2. At baseline, ↑ stress levels were associated to ↓ perceived QOL (p&lt;0.05). At 3 and 6 mo the exercise group's stress and QOL association ↓, but remained ↑ across all time points for the control group (p&lt;0.05). 3. Exercise was found to buffer the effects of stress on QOL and depression.</td>
</tr>
<tr>
<td>Warm et al. 2004</td>
<td>USA Pre-Post</td>
<td>N=16</td>
<td>Population: Chronic incomplete SCI: N=14; Tetraplegic=11, Paraplegic=3; Gender: males=11, females=3; Age range= 20-53 yr; Mean time post injury=7.4 yr; ASIA: B=2, C=12. Treatment: Body weight supported treadmill training (BWSTT) -robotic – up to 45 min, 3x/week, 144 sessions (12 mo). Outcome Measures: Center for Epidemiologic Studies Depression Scale (CES-D).</td>
<td>1. Increased life satisfaction and increased physical function satisfaction (p&lt;0.05), after BWSTT. 2. No change in depression or perceived health.</td>
</tr>
<tr>
<td>Warms et al. 2004</td>
<td>USA Pre-Post</td>
<td>N=16</td>
<td>Population: Gender: males=13, females=3; Mean age= 43.2 yr; Mean time post injury=14.4 yr. Treatment: “Be Active in Life” program: included educational materials (2 pamphlets, 2 handouts), a home visit with a nurse (90 min. scripted motivational interview, goal and personal action plan establishment), and follow up calls at day 4, 7, 11 &amp; 28 (approx. 8 min each). Program lasted for 6 wk, and had a final follow up 2 wk post-completion. Outcome Measures: Self Rated Health Scale (SRHS), Center for Epidemiologic Studies Depression Scale (CES-D)</td>
<td>1. Physical activity: Counts/day increased in 60% of subjects and self-reported activity increased in 69% of subjects, but both were not significant. 2. Self-rated abilities: no change. Exercise self-efficacy: ↑ (p=0.01). 3. Self-rated health: increased (p=0.04). 1. Depression: no change.</td>
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</tbody>
</table>
Author Year  
Country  
PEDro Score*  
Research Design  
Sample Size  
<table>
<thead>
<tr>
<th>Methods</th>
<th>Outcomes</th>
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| Population: Traumatic complete paraplegics; N=15; Gender: males=12, females=3; Mean age = 28.8 yr; Mean time post injury=3.8 yr.  
Treatment: Electrically stimulated walking program - 32-sessions, using the Parastep® FNS ambulation system.  
Outcome Measures: Tennessee Self-Concept Scale (TSCS), Beck Depression Inventory (BDI) | 1. Physical Self-Concept: decreased after electrically stimulated walking (p<0.05). Those with lower baseline score had the most significant improvements.  
2. Depression: decreased after electrically stimulated walking (p<0.05). |
| Population: Gender: males=30, females=5; Age: 18-61 yr; Level of injury: paraplegia = 20, tetraplegia=15.  
Treatment: Back-Up: 1 wk single or multi-activity course in an integrated, residential environment. Activities include skiing, horseback riding, waterskiing, canoeing, rappelling and gliding. Questionnaires were completed at baseline and end of 1 wk activity courses  
Outcome Measures: Life Satisfaction Questionnaire (LSQ), Hospital Anxiety and Depression Scale (HADS) | 1. Significant improvement (p=0.016) in life satisfaction and satisfaction with leisure (p=0.007)  
2. Anxiety levels were significantly reduced (p<0.01).  
3. No overall improvement in perceived manageability however some difference (p=0.016) post-test was observed for engage “in what happens around me” indicating some use of Perceived Manageability strategy.  
4. Self-efficacy scores improved post-test (p=0.012).  
3. HADS scores demonstrated significant (p<0.01) improvement in anxiety levels over the duration of the course. |
| Population: Gender: males=24, females=13; Mean age=32.03 yr; Level of injury: tetraplegic=12, paraplegic=25; Mean time post injury=6.51 yr  
Treatment: Intervention group: 3 mos. Functional Electrical Stimulation (FES) exercise program; Control group: no intervention.  
Outcome Measures: Multiple Affect Adjective Check List (MAACL) | 1. Increased in depression & hostility for those who had unrealistic expectations of the FES program (p<0.01 & p<0.05, respectively).  
2. No other significant effects were found. |

Discussion

In a series of Canadian studies, Ginis et al. (2003), Hicks et al. (2003) and Latimer et al. (2004) reported RCT investigations of sedentary community dwelling SCI adult volunteers who participated in 3, and later 9 month trials of twice weekly, 60-90 minute sessions of stretching, aerobic arm ergometry and resistance exercises or a “wait” control condition who were asked to continue usual activities and refrain from beginning an exercise program. Among other findings, Exercisers reported less stress, fewer depressive symptoms and greater satisfaction with physical functioning than did controls. While the average frequency of depressive symptoms in the intervention group did not vary substantively over the 9 months (and remained below clinically significant levels), depressive symptoms in the control group increased and the average exceeded levels considered “at risk” for clinical depression. The authors suggested the benefits of exercise as offering a prophylactic or stabilizing effect on pain – perhaps reducing the propensity for flare-ups, and the potential benefits of targeting sources of recurrent pain (i.e.
shoulder pain). Consistent with the Chronic Pain Process Model, a series of regression analyses the nine-month data revealed that changes in perceived pain mediated changes in stress, and the change in stress mediated a change in reported depression. It was recommended that clinicians prescribe exercise as a therapeutic modality for improving and maintaining well-being among people with SCI.

A Canadian pre-post study (Hicks et al. 2005) examined the effect of Body weight supported treadmill training (BWSTT) provided three times a week. This study reported an increase in life satisfaction and physical function satisfaction after one year of exercise; however, there was no change in reports of depressive symptoms.

Two studies (Bradley et al. 1994; Guest et al. 1997), examined the effects of an electrically stimulated walking program on SCI individuals. In a cohort study, Bradley et al. (1994) reported a significant increase in depression in participants with “unrealistic” expectations of their program. In contrast, Guest et al. (1997) used a pre-post design and found a decrease in reported depression after completion of their study intervention. Warms et al. (2004) reported no change in participant depression levels after six weeks of increased physical activity through a “Be Active in Life” intervention program. A pre-post study (Kennedy et al. 2006), found an intensive 1-week residential program (“Back Up”) involving participation in recreational activities resulted in fewer symptoms of anxiety and depression.

Conclusion

Regular physical exercise may contribute to a reduction of pain, stress, and depression as well as potentially offering a prophylactic effect on sources of recurrent pain and in preventing a decline in quality of life following SCI.

There is level 1a evidence (from three randomized controlled trials; Hicks et al. 2003; Ginis et al. 2003; Latimer et al. 2005) that exercise based programs reduced subjective pain, stress and resulting depressive symptoms.

There is level 1b evidence (from one randomized controlled trial and one pre-post study; Ginis et al. 2003; Guest et al. 1997) that exercise reduces depressive symptoms.

There is level 2 evidence (from one cohort study; Bradley et al. 1994) that individuals with unrealistic expectations report more depressive symptoms following a FESexercise program.

Programs to encourage regular exercise, reduce stress, and improve or maintain health appear to have benefits in reducing reports of depressive symptoms in persons with SCI.

3.4 Other Treatments for Depression following SCI

Table 5 Other Treatments for Depression following SCI
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<tr>
<th>Author Year</th>
<th>Country</th>
<th>PEDro Score</th>
<th>Research Design</th>
<th>Sample Size</th>
<th>Methods</th>
<th>Outcomes</th>
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| Defrin et al. 2007 | Israel | PEDro=10 | RCT | N=12 | **Population**: Mean age=54 yr; Gender: males=7, females=4.  
**Treatment**: Patients were randomly placed into two groups: real or sham 10 daily motor repetitive transmagnetic stimulation (rTMS) treatments (500 trains at 5 Hz for 10s; total of 5000 pulses at intensity of 115% of motor threshold) over a 2 wk period, using figure-of-8 coil over the vertex. Primary outcome measure was of pain; while depression was a secondary outcome measure for the treatment.  
**Outcome Measures**: Beck Depression Inventory (BDI) | 1. Real and sham TMS groups showed a significant decrease in BDI values following the treatment period in comparison to pretreatment BDI values (P<0.01).  
2. This reduction was maintained by both groups at follow-up (4.5 wk) (P<0.01).  
3. Only patients in the rTMS treatment group exhibited a decreased level of depression during follow-up in comparison to the values at the end of treatment (P<0.05). |
| Diego et al. 2002 | USA | PEDro=8 | RCT | N=20 | **Population**: Mean age=39 yr; Gender: males=15, females=5; Level of injury: tetraplegia; Time since injury =>1 yr.  
**Treatment**: One group received a 40 min massage 2x/wk for 5 wk by a massage therapist while the other was taught an exercise routine that they performed 2x/wk on their own.  
**Outcome Measures**: State Trait Anxiety Inventory (STAI), Center for Epidemiologic Studies Depression Scale (CES-D). | 1. Interaction effect on STAI scores (p<0.01).  
2. Massage group had significantly lower anxiety scores immediately after treatment on the first (p<.001) and the last (p<0.01) sessions.  
3. CES-D scores obtained on first day vs. last day assessment by group. Repeated measures ANOVA showed a group by day interaction effect (p<0.05).  
4. t-tests revealed greater decrease in CES-D depression scores for the massage therapy group (p<0.05). |
| Zemper et al. 2003 | USA | PEDro=4 | RCT | N Initial=67; N Final=43 | **Population**: Participants recruited from an outpatient clinic or Center for Independent living. Intervention group was more educated and had fewer retirees despite random assignment.  
SCI: Mean age=47 yr; Gender: males=30, females=13; Level of injury: paraplegia=42%, tetraplegia=39%, ambulatory=3%; Mean time since injury=14 yr; Marital status: single=28%, married=23%, divorced=8%.  
**Treatment**: A series of six 4 hr workshop sessions held over a 3 mo period, promoting health and wellness. Sessions included lifestyle management, physical activity, nutrition, preventing secondary conditions, individual coaching sessions, follow-up phone calls during the 4 mo following the workshops. Controls participated in pre/post assessment but received no intervention.  
**Outcome Measures**: Health Promoting Lifestyle Profile II (HPLP II), Secondary Conditions Scale (SCS), Self-rated Abilities for Health Practices Scale (SAHP), Physical Activities with | 1. The intervention group showed statistically significant improvement after intervention in several areas as compared to the control group:  
SAHP: (p<0.05) HPLP-II: (p<0.001). Nutrition HPLP-II subscale: improvement in nutritional awareness and behaviour (p <0.05) Stress HPLP-II subscale: Increased use of stress management techniques and decreases in perceived stress (p =0.01).  
2. SCS: fewer and less serious secondary conditions (p<0.001) Depression was less though did not reach significance.  
3. Physical Activity – (self-reported on various scales of the HPLP-II): Increased reported physical activity and improved physical fitness (p=0.001).  
4. However there was no improvement in either measured PADS or physical fitness measures. |
### Author Year Country PEDro Score* Research Design Sample Size

<table>
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<tr>
<th>Author Year</th>
<th>Country</th>
<th>PEDro Score*</th>
<th>Research Design</th>
<th>Sample Size</th>
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<tr>
<td>Dunn et al. 2000 USA</td>
<td>Prospective Controlled</td>
<td>N\textsubscript{Initial}=371; N\textsubscript{Final}=371</td>
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</table>

#### Methods

- **Disabilities Scale (PADS)**

#### Outcomes

1. An overall difference between the two groups was found (p=0.0004).
2. Medical Follow-up group reported a significantly higher subjective rating than did the No-F/U group on 3 variables: Health (p=0.0068), Independence (p=0.005), Absence of depression (p<0.0001). (Fisher’s protected least significant diff. test).
3. A MANOVA showed a main effect on education on health, independence and absence of depression (p=0.0098). Further analysis showed that as education increased subjects reported greater health, and independence and lower depression.

### Discussion

Dunn et al. (2000) reported that veterans approaching 20 years post SCI with access to medical follow-up through a specialty comprehensive outpatient program reported better health, independence, and less depression than a demographically similar (civilian) group without access to follow-up care. Neither group reported “depression” with sufficient frequency to earn it a top ten ranking from a list of 40 possible complications. However, those without access to medical follow-up who did endorse depression considered it of sufficient intensity to rank it among the ten most severe problems. While the types of secondary complications were similar, these were less frequent and less severe in those receiving health care. Noting a variety of methodological concerns that limit conclusions and generalizability, the authors reported that their findings were consistent with those in other studies (involving SCI and other patient groups).

Zemper et al. (2003) examined a **holistic wellness program** for SCI patients. The intervention in this RCT study involved six group workshop sessions focused upon lifestyle management (including sexual health and stress management), physical activity, nutrition, and preventing secondary complications. It also included individual coaching sessions and follow-up phone calls. Assessments were completed at three times: prior to the series, two weeks following completion and four months later. Results of this study pointed to improvements in awareness and behavior in areas of health practices, nutrition, and stress. Also secondary conditions were fewer and less serious. Reports of depression intensity decreased but did not reach significance. Self-reports indicated improvements in physical activity, while more objective tests showed no improvement in physical fitness.

With a university clinic group of 20 outpatients with quadriplegic injuries, Diego et al. (2002) compared the effects of a 5-week massage therapy program to those of an independently performed exercise routine conducted over a similar period. Subjects were stratified according to range of motion and then assigned to either of the two treatment groups. While both groups averaged pretreatment depression scores approaching the clinically depressed range, only the massage therapy group showed a decrease in reported post treatment depression symptoms. The massage therapy group also reported lower anxiety immediately after treatment on the first
and last days of the protocol. The authors suggested that the significant gains in upper limb muscle strength and wrist range of motion demonstrated by the massage therapy group may have contributed to their reported reduction in subjective distress.

One RCT (Defrin et al. 2007) evaluated the effectiveness of transmagnetic stimulation (TMS) in reducing pain post-SCI. This study found a significant decrease in depression in individuals treated with TMS compared to those in the control group at time of follow-up 2-6 weeks post treatment.

Conclusion

There is level 2 evidence (from one randomized controlled trial; Zemper et al. 2003) that a wellness and health promotion program does not significantly decrease intensity of depressive symptoms.

There is level 2 evidence (from one prospective controlled trial; Dunn et al. 2000) that access to medical follow-up for individuals with SCI results in better health, independence, less depression and fewer secondary complications.

There is level 1b evidence (from one randomized controlled trial; Diego et al. 2002) that massage therapy can reduce depressive symptoms.

There is level 1b evidence (from one randomized controlled trial; Defrin et al. 2007) for the effectiveness of transcutaneous magnetic stimulation in reducing depressive symptoms.

Several non-traditional approaches to SCI appear to offer improved health practices and a reduction in reported secondary conditions including depression.

4.0 Final Comments

This chapter has summarized research highlighting several promising approaches to the management of post-SCI depression. Additionally, there is also some evidence for the effectiveness of these approaches for related therapeutic targets such as anxiety and self-esteem. However, many of the studies cited note limitations that may introduce caution regarding the generalizability of conclusions to other samples and settings. These have included:

- Small samples sizes and high rates of attrition (due to illness or other factors)
- Possible selection biases
- Ethical concerns that may preclude randomized designs
- Multifaceted interventions complicate understanding of most relevant component(s)
- Impact of social contact in the intervention group often not accounted for in “standard treatment” or “wait list” controls
- Potential impact of adjunctive psychological interventions is unclear
- Use of antidepressant medications not consistently reported
- Lacking long term follow up
- Variability of outcome measures limit comparisons across studies
When leavened with clinical judgment, this research offers preliminary empirical support to guide the practitioner in employing evidenced-based therapeutic strategies. Future investigations, particularly those employing more stringent research designs, will continue to expand the options and confidence of clinical efforts to assist those individuals who have sustained spinal cord injuries. The reader is encouraged to also consider the following topic reviews of depression and SCI (Consortium for Spinal Cord Medicine 1998; Elliott & Frank 1996; Elliott & Kennedy 2004) and also, more generally, a recent of the science review of SCI rehabilitation (Sipski & Richards 2006).
5.0 Summary

While not universal, for many persons with spinal cord injury, depression can be a complication that poses a significant impediment to their functioning and adaptation.

Identifying depression can be difficult, but is most likely to develop during the initial year post-injury. Though many will experience a remission of symptoms over time, for others depressive symptoms may persist for many years.

Self-report measures of depression should be viewed as screening tools to alert the clinician to arrange a more thorough evaluation. In addition to affective symptoms, endorsement of somatic symptoms (e.g. sleep disturbance, poor energy and appetite disturbance) during inpatient or outpatient contact merits clinical review to clarify possible mechanisms underlying their emergence.

There is level 2 evidence (from several studies; Table 2) to support the use of small group CBT based treatment packages to decrease depressive symptoms following SCI.

Follow-up findings (1 year post treatment) showed maintenance of affective improvement in four level 2 studies; conversely, evidence from two level 2 studies found that post intervention reduction of depressive symptoms were not sustained at follow up of up to one year.

There is level 1b evidence (from one randomized controlled trial; Schulz et al. 2009) that providing CBT to caregivers and care receivers results in improved depressive symptoms in care receivers.

There is level 4 evidence (from a pre-post study; Migliorini et al. 2011) that computer based CBT may improve symptoms of depression, anxiety and stress post SCI.

Evidence of the benefits of pharmacotherapy alone and in combination with individual psychotherapy in the treatment of depressive symptoms in individuals with SCI is encouraging, although support is largely from investigations in other populations.

There is level 4 evidence (from one prospective controlled trial and three pre-post studies; Kahan et al. 2006; Kemp et al. 2004; Judd et al. 1989, 1986) indicating the effectiveness of pharmacotherapy combined with cognitive behavioral psychotherapy for treatment of depression in SCI and other chronic disabling conditions.

Regular physical exercise may contribute to a reduction of pain, stress, and depression as well as potentially offering a prophylactic effect on sources of recurrent pain and in preventing a decline in quality of life following SCI.

There is level 1a evidence (from three randomized controlled trials; Hicks et al. 2003; Ginis et al. 2003; Latimer et al. 2005) that exercise based programs reduced subjective pain, stress and resulting depressive symptoms.

There is level 1b evidence (from one randomized controlled trial and one pre-post study; Ginis et al. 2003; Guest et al. 1997) that exercise reduces depressive symptoms.
There is level 2 evidence (from one cohort study; Bradley et al. 1994) that individuals with unrealistic expectations report more depressive symptoms following a FES exercise program.

There is level 2 evidence (from one randomized controlled trial; Zemper et al. 2003) that a wellness and health promotion program does not significantly decrease intensity of depressive symptoms.

There is level 2 evidence (from one prospective controlled trial; Dunn et al. 2000) that access to medical follow-up for individuals with SCI results in better health, independence, less depression and fewer secondary complications.

There is level 1b evidence (from one randomized controlled trial; Diego et al. 2002) that massage therapy can reduce depressive symptoms.

There is level 1b evidence (from one randomized controlled trial; Defrin et al. 2007) for the effectiveness of transcutaneous magnetic stimulation in reducing depressive symptoms.
References


