

# Mental Health after a Spinal Cord Injury

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### Effect of Psychological Interventions on Depressive Symptoms

- Individual based CBT is effective in reducing symptoms of depression post SCI; however, the results may not be maintained at follow-up.
- Cognitive behavioural interventions provided in a group setting appear helpful in reducing post-SCI depression among those with elevated symptoms of depression.
- CBT interventions aimed at both caregivers and care receivers may be effective in reducing symptoms of depression post SCI.
- Telerehabilitation or online CBT improves symptoms of depression post SCI.
- There is conflicting evidence for the effectiveness of coping oriented supportive program on improving symptoms of anxiety post SCI.
- Online chronic pain-based mindfulness programs help reduce symptoms of depression among persons with SCI.
- Meditation and Imagery Interventions may not reduce symptoms of depression among persons with SCI.
- Peer telephone counselling may not be effective in reducing symptoms of depression post SCI.
- Self-esteem programs may not be effective in reducing symptoms of depression post SCI.
- Positive psychology interventions may not be effective in reducing symptoms of depression post SCI.
- Eye Movement Desensitization and Reprocessing Therapy may be effective in reducing symptoms of depression post SCI.

#### Effect of Pharmacotherapy on Depressive Symptoms

- Combining pharmacotherapy with CBT or supportive psychotherapy results in improved mood post SCI.
- Venlafaxine improves depressive symptoms post SCI.

### Effect of Physical Interventions on Depressive Symptoms

- Small group exercise programs improve depressive symptoms in persons with SCI.
- Physical activity counselling and home exercise reduce symptoms of depression post SCI.
- Yoga improves depressive symptoms.
- Body weight supported treadmill training may not improve symptoms of depression post SCI.
- Parastep FNS ambulation training may improve symptoms of depression.
- Increased sport and recreational activities may improve depressive symptoms.
- Massage may be effective in reducing symptoms of depression.

#### Effect of Miscellaneous Interventions on Depressive Symptoms

- Repetitive transmagnetic stimulation may improve symptoms of depression post SCI.
- Hyperbaric oxygen may improve depressive symptoms.
- Education may not improve depressive symptoms post SCI.
- Mesenchymal stromal cells combined with standard SCI rehabilitation may be effective in reducing symptoms of depression post SCI.
- Virtual reality programs may be effective in reducing symptoms of depression post SCI.

- Return to work interventions may not be effective in reducing symptoms of depression post SCI.
  - Multidisciplinary telehealth consultations may not be effective in reducing symptoms of depression post SCI.

#### Effect of Psychological Interventions on Symptoms of Anxiety

- Individual based CBT is effective in reducing symptoms of anxiety post SCI; however, the results may not be maintained at follow-up.
- Cognitive behavioural interventions provided in a group setting appear helpful in reducing post-SCI anxiety among those with elevated symptoms.
- Telerehabilitation or online CBT improves symptoms of anxiety post SCI.
- Evidence for the effectiveness of coping oriented supportive programme on improving symptoms of anxiety post SCI is conflicting.
- Guided videoconferencing ACT may reduce symptoms of anxiety post SCI.
- Eye Movement Desensitization and Reprocessing Therapy may improve anxiety post SCI.

### Effect of Physical Interventions on Symptoms of Anxiety

- Physical activity may improve anxiety post SCI.
- Cranial electrotherapy stimulation may not be effective in reducing anxiety symptoms post SCI.
- Combined transcranial direct current stimulation and visual illusion walking may reduce symptoms of anxiety post SCI.
- Massage may help reduce symptoms of anxiety post SCI.
- Participation in sports may reduce symptoms of anxiety post SCI.

### Effect of Miscellaneous Interventions on Symptoms of Anxiety

- Hyperbaric oxygen may improve symptoms of anxiety post SCI.
- Sexual health education may not improve symptoms of anxiety post SCI.
- Mesenchymal stromal cells combined with standard SCI rehabilitation may improve symptoms of anxiety post SCI.
- Music therapy may improve symptoms of anxiety post SCI.
- Multidisciplinary telehealth consultations may improve symptoms of anxiety post SCI.

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### 1.0 Executive Summary

Depression is one of the most common mental health concerns after spinal cord injury (SCI). As many as 40% of people experience depression during rehabilitation and around 1 in 5 people experience depression a year after the injury. Depression can be a serious problem after SCI. It can interfere with recovery and rehabilitation and is related to longer hospital stays, higher levels of pain, and lower quality of life after injury. Additionally, physical and lifestyle changes after SCI can lead to cognitive and behavioural symptoms of anxiety including excessive worrying, catastrophic thinking, and perceived lack of control. Chronic anxiety has been significantly correlated with other secondary conditions including depression and chronic pain. Appropriate management of these secondary conditions, through a multidisciplinary approach, is imperative as they have been shown to contribute to slower recovery, increased negative outcomes, and greater rates of rehospitalization and health care utilization.

What are the management options for mental health post SCI?

Currently, cognitive behaviour therapy has the strongest evidence for managing mental health concerns post SCI. Pharmacological approaches such as venlafaxine may improve mood among those with nociceptive pain. Physical interventions such as small group exercise programs and increase in recreational activities may improve symptoms of depression and anxiety. There is limited evidence for the effectiveness of repetitive transmagnetic stimulation in improving symptoms of depression.

#### Gaps in the Evidence

Though pharmacological treatment is commonly prescribed for managing depression and anxiety symptoms post SCI, there is limited evidence supporting its use. Since individuals with SCI may be on several medications to manage their secondary complications, evaluation of safety and efficacy of these among the population is warranted. Additionally, studies evaluating the combination of non-pharmacological, behavioural, and pharmacological approaches should be evaluated.

### 2.0 Introduction

Psychological adjustment to catastrophic injuries and illnesses is a topic of much interest for practitioners providing clinical rehabilitation services. Depression and anxiety symptoms are associated with negative outcomes among individuals with SCI including lower functional independence, more secondary complications, and less community and social integration (Fann et al., 2011; Paul Kennedy & Rogers, 2000). This chapter attempts to summarize evidence garnered from SCI research that has investigated the management of post-SCI mental health 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 employs his or her clinical judgment in determining the applicability of such research conclusions to the treatment provided for each patient.

### 3.0 Depression

Concerns regarding "depression" are commonly reported by SCI survivors, staff, or their families. Elliott and Umlauf (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 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. 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 individuals' reported coping ability and mental health (Siösteen, Kreuter, Lampic, & Persson, 2005).

### 3.1 Prevalence of Depression Post-SCI

A recent meta-analysis reported rates of probably depression between 19 -26% with average prevalence of 22% (Williams & Murray, 2015). Bombardier and colleagues (2004) surveyed 849 SCI outpatients at 1-year post injury and found 11.4% met criteria for major depressive disorder. 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 the 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, Bombardier, & Carter, 2008). As health problems can produce pain, fatigue, sleep disturbances, physical sensations and digestive troubles, the overlap of somatic symptoms can pose diagnostic challenges. 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 (Krause et al., 2008; Richardson & Richards, 2008).

### 3.2 Interventions for Treatment of Depression following SCI

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 individuals and obtaining treatment and appropriate control groups requires the participation of multiple sites. Also, ethical concerns over providing the best possible care to all individuals

with SCI are obvious, so that withholding aspects of treatment in order to establish control conditions is no longer acceptable (e.g. (Kahan, Mitchell, Kemp, & Adkins, 2006). To date, research strategies have frequently used self-report screening measures (e.g. Beck Depression Inventory, Zung Depression Inventory, Patient Health Questionnaire-9, Center for Epidemiological Studies – Depression Scale; Older Adult Health and Mood Questionnaire; 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.

Authors Year Country Date of Studies Included AMSTAR Score Total Sample Size	Method	Conclusions
Alashram et al. (2021) Jordan Review of published articles between inception and January 2021	Method: Comprehensive literature search of experimental studies examining the effects of the Lokomat on the impairments following incomplete SCI. Databases: PubMed, SCOPUS, PEDro, REHABDATA, MEDLINE, EMBASE, and web of science Level of evidence: 13 RCTs (PEDro scores ranged from 2-8, with a median score of 6), 2 clinical controlled trails, and 1 pilot study.	<ol> <li>There is insufficient evidence for the effect of the Lokomat on depression, balance, cardiorespiratory fitness, and quality of life, among individuals with SCI.</li> </ol>
N=16	Questions/measures/hypothesis:	
	To examine the impacts of the Robot- assisted gait training (RAGT) 'Lokomat' on the impairments following SCI.	
Davari et al. (2020) Iran reviews of published articles up to December 2018 AMSTAR=9 N=9	Method: A systematic review and meta-analysis of English RCTs on humans including any age group; comparing Pregabalin to Gabapentin or placebo; and measuring neuropathic pain as an outcome. Databases: PubMed, Cochrane Library, Embase, Scopus, the Web of Science. Level of evidence: Poor methodological quality RCTs: using Cochrane Collaboration's tool.	<ol> <li>Anxiety and depression symptoms were improved by Pregabalin use when compared to placebo (p&lt;.05).</li> </ol>
	Questions/measures/hypothesis:	

Table 1. Systematic Reviews and Meta-Analysis: All Treatments

	to examine the safety and efficacy of pregabalin (PGB) and gabapentin (GBP) in the treatment of neuropathic pain due to SCI.		
<u>Hearn &amp; Cross</u> (2020) United Kingdom Review of published articles from 1996 to 2019. AMSTAR=8 N=5	Method: Comprehensive literature search of English studies with adults (18yr+) living with SCI, regardless of etiology, who had mindfulness training as a part of their intervention. Databases: PsycINFO, PsycARTICLES, MEDLINE Level of evidence: Three of the papers were of poor/low quality, while two were moderate quality according to the Cochrane Collaboration Risk of Bias tool. Questions/measures/hypothesis: To synthesize and critically appraise available quantitative and qualitative evidence on the effects of Mindfulness-Based Interventions (MBIs) on pain and pain-related outcomes, depression, anxiety, and QoL in people with SCI; to make specific recommendations for future research based on current knowledge.	1. 2.	One study reported no change in depressive symptoms, while the other four studies reported significant improvements in depression symptoms (p<.05). Four studies examined anxiety but only one reported significant decrease in anxiety symptoms (p<.05), and another study showed no change. The other studies did not use statistical analysis to determine the impact of their interventions. Two studies examined changes in QoL, both of which reported no significant changes in QoL following MBIs.
Yu et al. (2020) China Published up to January 31, 2019 AMSTAR=7 N=11	Method: Reviewed RCTs that compared noninvasive brain stimulation (NIBS) with sham stimulation for neuropathic pain (NP), depression, and anxiety levels for SCI patients, and conducted a meta- analysis. Databases: Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE, Embase, PsycINFO, Physiotherapy Evidence Database (PEDro) Level of evidence: 10 RCTs with level 1a evidence (PEDro=>6), and one RCT with level 1b evidence (PEDro=5). Questions/measures/hypothesis:	2.	Noninvasive brain stimulation showed no beneficial effect over sham stimulation on the improvement of depression (p>.05), but had significant effect on improvement of anxiety symptoms (p<.05).

	The aim of meta-analysis was to examine the effectiveness of NIBS in the treatment of NP, and depression and anxiety symptoms among individuals with SCI.		
<u>Onakpoya et al.</u> (2019) United Kingdom Database inception to January 2018 AMSTAR=8 N=26	<ul> <li>Method: A meta-analysis of RCTs of adults who received pregabalin to manage neuropathic pain.</li> <li>Databases: MEDLINE, Embase, Cochrane Central Register of Controlled Trials (CENTRAL)</li> <li>Level of evidence: 26 RCTs with moderate to high risk of biases measured by Cochrane Risk of Bias criteria.</li> <li>Questions/measures/hypothesis:</li> <li>The objective of this rapid review was to evaluate the evidence for benefits and harms of pregabalin in the treatment of neuropathic pain in adults, using evidence from published randomized clinical trials (RCTs).</li> </ul>	1. 2. 3.	Out of the four studies that looked at anxiety and depression symptoms, there were no significant differences in the HADS-anxiety scores between groups (p=.14) or in HADS- depression scores between groups (p=.54). Moderate quality evidence showed that pregabalin significantly reduced sleep interference scores (p<0.00001). Four studies assessed QOL, using EuroQoL-5, showed conflicting results for the effect of pregabalin on QOL improvement after SCI.
Yu et al. (2019) China Review of published articles from 1946-May 2018 (Pubmed), 1974- May 2018 (EMBASE) and May 2018 (Cochrane Library) AMSTAR=7 N=5	Method: Comprehensive literature search of RCTs of SCI participants with SCI-induced neuropathic pain. Meta Analysis was conducted. Databases: Pubmed, EMBASE, Cochrane Library Level of evidence: 3 RCTs, Moderate quality (III Grade): one crossover clinical trial and one open-label trial Questions/measures/hypothesis: To show the efficacy of pregabalin and also confirm the safety of using pregabalin for the treatment of SCI- related neuropathic pain.	1. 2. 3.	Pregabalin administration elevated the mental status of patients with SCI- induced neuropathic pain. Decreased Hospital Anxiety and Depression Scale (HADS) anxiety and depression scores were found in pregabalin and placebo groups at the endpoints. HADS anxiety and depression scores of the pregabalin group was significantly lower than those of the placebo

			group HADS anxiety (p=.05) and HADS depression (p=.002).
<u>Dorstyn et al</u> . (2011) Australia Review of published articles between January 1980 and April 2010	Method: Comprehensive literature search of English RCT, Cohort studies, case series, and review articles of traumatic SCI in adult age group (18+yr). Databases: MEDLINE, Psych Info, Cochrane Library, Meditext, CINAHL, Scopus. Level of evidence: Effect sizes were provided	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. Moderate to large effect sizes were seen in quality-of-life post CBT
AMSTAR=10 N=10	Questions/measures/hypothesis: Examine the effectiveness of cognitive behavioural therapy (CBT) in improving psychological outcomes post SCI.		treatment.
	Method: Comprehensive literature search of English RCT, Cohort studies, case series, and review articles of traumatic SCI in adult age group (18+yr). A meta-analysis was conducted. Databases: MEDLINE, Psych Info, CINAHL, EMBASE.	1.	One study demonstrated large effect sizes in the improvement of depression symptoms post CBT treatment; 4 studies demonstrated moderate effects; 4 studies demonstrated
<u>Mehta et al.,</u> (2011) Canada Review of published	Level of evidence: <i>Moderate quality:</i> Downgraded high-quality studies, non- randomized trials, prospective cohort studies; <i>Low quality:</i> Retrospective observational, retrospective cohort and case-control studies; <i>Very low</i> <i>quality:</i> Case series, case reports.		small effects. These effects were shown to last for up to 2yr in individuals diagnosed with major depressive disorder prior to the intervention.
articles between January 1990 to October 2010 AMSTAR=10 N=9	<ul> <li>reviews, and others. Effect sizes were provided</li> <li>Questions/measures/hypothesis:</li> <li>Examine the effectiveness of Cognitive Behavioural Therapy (CBT) in improving psychological outcomes post SCI.</li> </ul>	2.	Moderate effects sizes were seen on anxiety symptoms were seen in 2 studies post CBT treatment; 2 studies reported small effect sizes 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.
Elliot & Kennedy (2004) USA Timeline not stated AMSTAR=7 N=9	Method: 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.	1. 2. 3.	There was moderate level evidence from 3 studies for psychological interventions in improving depressive symptoms post SCI. 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. Functional electrical stimulation (FES) was supported by 1 moderate level study.

Three studies examined the effects of interventions aimed towards psychological impairment post SCI. In a systematic review, Elliot and 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 had moderate to high level of evidence in improving depressive symptoms post SCI. Dorstyn et al., (2011) 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., (2011) also found moderate to large effect sizes in the improvement of quality of life post CBT treatment in individuals with SCI.

### 3.3 Psychological Interventions

#### 3.3.1 Cognitive Behavioural Interventions

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, Hancock, Dickson, & Chang, 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 individuals with SCI. 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.

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
	СВТ	
Zhao et al. (2021) China RCT PEDro=4 Level 2 N=72	Population: Intervention Group (psychological intervention; n=36): Mean age=49.39±13.88yr; Gender: males=26, females=10; Mean time post injury=not reported; Level of injury: Tetraplegia=100%; Severity of injury: AIS A=7, AIS B=23, AIS C=6; Depression status=moderate to severe as measured by the Zung Self- Rating Depression Scale <i>Control group</i> (conventional systemic treatment; n=36): Mean age=45.03±14.04yr; Gender: males=29, females=7; Mean time post injury=not reported; Level of injury: Tetraplegia 100%; Severity of injury: AIS A=8, AIS B=20, AIS C=8; Depression Status= Moderate to severe as assessed by the Zung Self- Rating Depression Scale. <b>Intervention:</b> Participants were randomly divided into psychological intervention or Conventional systemic treatment group. Psychological intervention group: received a mix of cognitive behavioural	<ol> <li>There were significant differences in the SAS and SDS scores between the intervention group (psychological intervention group) and the control group (conventional systemic treatment group) at 3 months (p&lt;.01), 6 months (p&lt;.01), 1yr (p&lt;.01), and 2yr (p&lt;.01) post-surgery.</li> </ol>

Table 2. Cognitive Behavioural Therapy Interventions

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
	psychotherapy, supportive psychotherapy, and medication in addition to conventional treatment. Conventional systemic treatment group: received general symptomatic treatment, surgical treatment, routine postoperative nursing, routine postoperative neurological exercise, postoperative respiratory exercise and the company of family members or nursing workers. Outcome measures were assessed pre-surgery, 3mo after surgery, 6mo after surgery, 1yr after surgery and 2yr after surgery.	
	Outcome Measures: Zung Self- Rating Anxiety Scale (SAS), Zung Self-Rating Depression Scale (SDS), Medical Outcomes Study 36-item Short Form Health Survey (SF-36), American Spinal Injury Association (ASIA), Japanese Orthopedic Assessment (JOA).	
Burke et al. (2019) Ireland RCT PEDro=6 Level 1b N <sub>Initial</sub> =69 N <sub>Final</sub> =68	<b>Population:</b> <i>Intervention</i> <i>Group</i> (Internet delivered cognitive behavioural pain management program (CBT- PMP); n=35): Mean age=50±12.3yr; Gender: males=25, females=10; Mean time post injury=16±11.8yr; Level of injury: cervical=10, thoracic-13, lumbar=7, unknown=8; Severity of injury: AIS A=1, AIS C=2, AIS D=3, unknown=29; Depression	<ol> <li>No significant difference between intervention and control groups for WHOQOL-BREF and ISCI-QOLBDS (p&gt;.05).</li> <li>No significant group X time interaction for the HADS questionnaire, PSQI for sleep or CPAQ for pain acceptance (p&gt;.05 for all).</li> </ol>

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
	the HADS. <i>Control group</i> (usual care; n=34): Mean age=52±13.8yr; Gender: males=27, females=7; Mean time post injury=16±12.6yr; Level of injury: cervical=7, thoracic=17, lumbar=7, unknown=3; Severity of injury: AIS A=3, AIS B=2, AIS C=1, AIS D=2, Unknown=26; Depression Status=borderline abnormal as assessed by the HADS. Intervention: Participants were randomized to receive internet delivered cognitive behavioural therapy pain management program (CBT- PMP) SPIRE (1 module and assignment/wk for 6wk) or the control group (continued to manage pain as per usual). Outcomes measures were assessed at baseline, post- intervention 6wk, and 3mo post-program completion.	<ul> <li>s. Post-intervention there was a moderate linear relationship observed between number of module where users engaged with 80% or more of the content and reductions in measures of NRS (p=.05), ISCIPBDS (p=0.08), LSF domain (p=.04), BPI (p=0.10) and HADS depression subscale (p=.10).</li> <li>4. 3mo follow-up revealed a moderate linear relationship between module engagement and improvements in sleep quality (p=.06), AMS subcategory of ISCIPBDS (p=0.0), and the depression (p=.03) and anxiety (p=.05)</li> </ul>
	Outcome Measures: The World Health Organization Quality of Life Bref (WHOQOL- BREF), The international spinal cord injury quality of life basic data set, The International Spinal Cord Injury Pain Basic Data Set (ISCIPBDS), The Douleur Neuropathique en 4 Questions (DN4) interview, The Chronic Pain Acceptance Questionnaire-8 (CPAQ-8), The Brief Pain Inventory (BPI) Interference subscale, The	

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
	Hospital Anxiety and Depression Scale (HADS), The Pittsburgh Sleep Quality Index (PSQI), Adverse events.	
Coker et al., (2019) USA RCT PEDro=8 N=81	Population: Control Group (n=40): Mean age=52±15.3 yr; Gender: males=32, females=8; Time since injury=81.5 mo; Level of injury: complete=16, incomplete=24; Severity of injury: AIS A=16, B=3, C=8, D=13. Intervention Group (n=41): Mean age=48±12.8; Gender: males=34, females=7; Time since injury=95 mo; Level of injury: complete=19, incomplete=22; Severity of injury: AIS A=19, B=2, C=7, D=13. Intervention: Participants were randomized to either a control group in which they continued their normal rehabilitation or an intervention group in which they took part in an interactive cognitive behaviour therapy- based learning program for one session per wk, 2 hrs per session for 6 wk with assessments at baseline, post intervention and at 8-wk intervals post intervention. <b>Outcome Measures:</b> Moorong Self-Efficacy Scale (MSES), Generalized Self-Efficacy Scale (GSES), Diener Satisfaction with Life Scale (SWLS), Participation Assessment with Recombined Tools – Objective	<ol> <li>Non-significantly greater increase in MSES for the treatment group compared to the control group from baseline to 6-wk and neither group showed significant difference from baseline to the 30-wk follow-up (p=0.15).</li> <li>The treatment group showed significant improvements for the GSES, PHQ-9 and GAD- 7 from baseline to 6- wk whereas the control group did not.</li> <li>Neither group showed significant changes in SWLS or PART-O from baseline to 6-wk.</li> <li>Despite the significant differences for the treatment group from baseline to 6-wk or from baseline to 30-wk follow-up, there are no significant differences in results between treatment and control.</li> </ol>

Author Year Country Research Design	Methods	Outcome
Total Sample Size		
	(PART-O), Patient Health Questionnaire – 9 (PHQ-9), and General Anxiety Disorder 7-Item (GAD-7).	
Migliorini et al., (2016) Australia RCT PEDro=8 N <sub>Initial</sub> =59 N <sub>Final</sub> =48	Population: Intervention group (n=34): Mean age=47.5±12.2 yr; Gender: males=25, females=9; Time since injury=11.4±11.9 yr; Level of injury: complete paraplegia=5, incomplete paraplegia=8, complete tetraplegia=1, incomplete tetraplegia=18, unknown=2. Waitlist control group (n=25): Mean age=52.8±12.9 yr; Gender: males=17, females=8; Time since injury=19.8±14.0 yr; Level of injury: compete paraplegia=7, incomplete tetraplegia=2, incomplete tetraplegia=2, unknown=1. Intervention: Participants were randomized to either an Electronic Personal Administration of Cognitive Therapy (Epact) group in which the participants completed 10- module skills or a Waitlist Control group with assessments at baseline, 3 mo follow-up and 6 mo follow-up. Outcome Measures: Depression, anxiety, and stress scale-short (DASS21), personal well-being index, helplessness subscale and score above normative threshold of the depression, anxiety and stress scale-short form (DASS21).	<ol> <li>71 individuals accepted the option to try the Epact, but 12 did not complete the intake process and those that completed the intake process and those that did not only differed significantly with regards to stress scores (p=0.05).</li> <li>No significant differences between groups at baseline besides for time since injury (p=0.02) and level of injury distribution.</li> <li>Dropouts from the intervention group did not differ significantly from those that did not drop out in any outcome measure.</li> <li>At post-intervention, the Epact group showed a significant reduction in depression, anxiety and stress and satisfaction with life significantly improved (p&lt;0.05 for all) while the waitlist control group improved significantly with a reduction in depression (p=0.01).</li> </ol>

Author Year Country Research Design PEDro Score Total Sample Size	Methods		Outcome
		5.	Significant reductions in depression, anxiety and stress were maintained from post- intervention to 6 mo follow-up, and even reduced even more, albeit insignificantly.
Dorstyn et al., (2012) Australia RCT PEDro=6 N=40	Population: Age=53.5yr; Gender: males=69%, females=31%; Level of injury: paraplegia=24, tetraplegia=16. Intervention: Individuals with SCI 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)	1. 2. 3.	Small improvement in depression (d=0.32) were seen among individuals that received telecounselling compared to standard treatment group post intervention. 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. Individuals in the standard care group reported increase in clinically significant symptoms of depression over time.
<u>Heutink et al.,</u> (2012)	<b>Population:</b> Mean age=58.8 yr;	1.	No significant
Netherlands	Gender: males=39, females=22: Duration of		difference in HADS depression was seen
RCT	pain=5.4 yr; Type of		between the two
PEDro=6	pain=neuropathic.		groups or over time.
N <sub>Initial</sub> =61 N <sub>Final</sub> =59			

Author Year Country Research Design PEDro Score Total Sample Size	Methods		Outcome
	<b>Intervention:</b> Individuals with SCI 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 10 <sup>th</sup> session.		
	Outcome Measures: Chronic Pain Grade Questionnaire; Hospital Anxiety and Depression Scale (HADS).		
<u>Duchnick et al.,</u> (2009) USA RCT PEDro=4 N=40	<b>Population:</b> 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).	1. 2. 3.	No baseline differences were found. Mood change was not affected by treatment condition. Significant decrease in depression (CES-D) was seen at discharge (p<0.05). However, depression (p<0.05) increased significantly between discharge and follow-up (3 mo).
	Intervention: 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,		

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
	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 psychologists. <b>Outcome Measures:</b> Center for Epidemiologic Studies Depression Scale (CES-D), State Trait Anxiety Inventory (STAI).	
Schulz et al., (2009) USA RCT PEDro=6 N=346	<ul> <li>Population: Mean age=53 yr; Mean time since injury=8 yr.</li> <li>Intervention: 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.</li> <li>Outcome Measures: Center for Epidemiologic Studies Depression Scale (CES-D), health symptoms, self-care problems, social integration.</li> </ul>	<ol> <li>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 versus p=0.031).</li> <li>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.</li> </ol>
<u>Mehta et al.</u> (2020) Canada Pre-Post Level 4	<b>Population:</b> Intervention group (ICBT; n=20): Mean age=54.7±16.2yr; Gender: males=11, females=9; Mean time post injury=12.1±15.9yr; Level of injury: paraplegia=8,	<ol> <li>Depression (p &lt;.001) and anxiety (p=.002) scores decreased significantly after ICBT therapy.</li> </ol>

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
N <sub>Initial</sub> =20 N <sub>Final</sub> =18	tetraplegia=12; Severity of injury: incomplete=14, complete=6; Depression status=mild to moderate depression as assessed by the PHQ-9. <b>Intervention:</b> A group of participants was given internet-based Cognitive behavioural therapy (ICBT), based on chronic conditions course for SCI and case studies or vignettes. The Chronic Conditions Course consisted of five lessons delivered over 8wk. Outcomes were measured at baseline, at post treatment, and at 3mo follow-up.	<ol> <li>Significant improvements were found on SCIQoL subscales of Grief (p&lt;.001), Self -Esteem (p=.04), Resilience (p &lt;.002), and Positive Affect (p&lt;.001) from baseline to post- intervention and follow-up.</li> </ol>
	Outcome Measures: Feasibility, treatment satisfaction questionnaire (TSQ), patient health questionnaire (PHQ-9), generalized anxiety disorder-7 (GAD-7), Spinal Cord Injury Quality of Life (SCI-QOL), International Spinal Cord Injury Basic Pain Data Set (ISCIBPD).	
<u>Li et al., (2020)</u> China Pre-Post N=20	Population: Intervention group (n=9): Mean age=41.7±8.1 yr; Gender: males=9, females=0; Time since injury=8.1±4.1 mo; Level of injury: paraplegia=5, tetraplegia=4; Severity of injury: complete=5, incomplete=4. Comparison group (n=11): Mean age=43.0±15.7 yr;	<ol> <li>Recruitment rate of this study was 88% and the retention rate was 100%, but 2 participants in the COSP group did not attend the minimum number of sessions necessary for analysis.</li> <li>Participants reported that the meeting times and the length of each</li> </ol>

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
	Gender: males=11, females=0; Time since injury=8.2±4.1 mo; Level of injury: paraplegia=7, tetraplegia=4; Severity of injury: complete=5, incomplete=6. Intervention: Participants were assigned to either an 8- wk coping oriented supportive program (COSP) or a comparison group going about their usual business. Outcome Measures: Feasibility, acceptability, brief coping orientations to problems experienced inventory, experienced inventory, Moorong self- efficacy scale, hospital anxiety and depression scale (HADS), quality of life enjoyment and satisfaction questionnaire – short form and six-item social support questionnaire.	<ul> <li>meeting were very appropriate, while one participant mentioned meeting more frequently on a weekly basis.</li> <li>Encouragement and support from peers were reported as motivation enhancers and enjoyed the communication during the meetings.</li> <li>Significantly higher self-efficacy scores in the COSP group compared to the comparison group (p=0.048).</li> <li>Statistically significant effects of the COSP on participant's life enjoyment and satisfaction (p=0.005) and satisfaction of social support (p=0.022).</li> <li>Statistically significant improvements in self- efficacy (p=0.008), depression (p=0.007) and satisfaction with medicine (p=0.046) for the COSP group, but not the comparison group.</li> </ul>
<u>Dear et al.,</u> (2018) Australia Pre-Post N=68	<b>Population:</b> Mean age=48.0±13.0 yr; Gender: males=34, females=34; Time since injury=8.0±10.0 yr; Severity of injury:	<ol> <li>Significant overall effect observed for pain-related disability (p&lt;0.001), anxiety (p&lt;0.001) and depression (p&lt;0.001),</li> </ol>

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
	complete=15, incomplete=44, unsure=9. Intervention: Participants completed five online lessons and homework tasks for pain management with weekly support from a clinical psychologist. Outcome Measures: Pain disability index (PDI), patient health questionnaire 9-item (PHQ-9), generalized anxiety disorder scale 7-item), Wisconsin brief pain questionnaire (WBPQ), pain self-efficacy questionnaire (PSEQ), pain catastrophizing scale (PCS), satisfaction with life scale (SWLS).	<ul> <li>as well as improvements in all three from baseline to post-treatment (p&lt;0.001) and even further improvements at 3-mo follow-up (p&lt;0.015).</li> <li>2. Significant overall time effect observed for pain self-efficacy (p&lt;0.001), pain catastrophizing (p&lt;0.001) and life satisfaction (p&lt;0.001).</li> <li>3. Significant improvements from baseline to post- treatment for pain catastrophizing and life satisfaction (p&lt;0.001) with life satisfaction improving from post- treatment to follow-up (p=0.006) but not pain catastrophizing (p=0.062).</li> </ul>
<u>Verwer et al.,</u> (2016) Netherlands Pre-Post N <sub>Initial</sub> =14 N <sub>Final</sub> =7	<ul> <li>Population: Mean age=44.7 yr; Gender: males=11, females=3; Time since injury=15 mo; Level of injury: paraplegia=10, tetraplegia/unknown=4; Severity of injury: complete=6, incomplete=8.</li> <li>Intervention: Participants engaged in an online self-help program called Psyfit in which they were asked to complete 2 of 6 modules with 4 wk given to complete each module and assesments taken pre-</li> </ul>	<ol> <li>75% of the participants completed the first module and 39% completed the second, 11 participants finished 50% or more of the first module and 7 completed the entire first module and started with the second module and these were considered the study completers.</li> <li>Five of the seven completers reported</li> </ol>

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
	intervention, post-intervention and at 3-mo follow-up. <b>Outcome Measures:</b> Adherence, satisfaction, mental health inventory-5 (MHI-5), center for epidemiological studies depression scale (CES-D), and the Warwick-Edinburgh mental well-being scale.	<ul> <li>that the program was good, and they would recommend it to others.</li> <li>3. The main criticism was that the program was not specified to SCI participants enough, and the other was that the program modules were too long and rigid, making them difficult to want to complete.</li> <li>4. Study completers showed significant improvements in the MHI-5 scores from preto post-intervention (p&lt;0.05) and all scores decreased significantly between post-intervention and 3-mo follow-up (p&lt;0.05), resulting in no significant difference from pre-intervention to 3-mo follow-up (p&gt;0.05).</li> </ul>
<u>Heutink et al.,</u> (2014) Netherlands Follow-Up N=29	Population: Mean age=56.5yr; Gender: males=21, females=8; Level of injury: paraplegia=18, quadriplegia=11; Severity of injury: incomplete=14, complete=15; Mean time post injury=5.4yr; Depression status=symptoms. Intervention: Participants who received treatment in Heutink et al.,(2012) were assessed at 6, 9, and 12mo follow-up.	<ol> <li>HADS-depression scores did not change over time.</li> </ol>

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
	Outcome Measures: Hospital Anxiety & Depression Scale (HADS).	
	<b>Population:</b> Age range=41- 65yr; males=2, females=1; Severity of injury: incomplete=2, complete=1.	<ol> <li>A reduction in DASS-21 depression and stress scale was seen in 2 Individuals: anxiety scale in all three</li> </ol>
<u>Migliorini et al.,</u> (2011) Australia Pre-Post N=3	Intervention: Participants were offered a computer- based Cognitive Behavioural Therapy (CBT) intervention involving 10 modules.	<ul><li>individuals.</li><li>2. Overall quality of life improved in 1 individual and</li></ul>
	Outcome Measures: Depression Anxiety Stress Scale-21 (DASS-21), PWI, SCL EWQ	remained the same in 2 individuals.
	<b>Population:</b> 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	<ol> <li>At 1 yr follow up, the sign test showed no significant change in depression levels HADS in the treatment group from baseline.</li> </ol>
Norrbrink Budh et al., (2006) Sweden PCT N=38	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. Intervention: The intervention group received education.	<ol> <li>However, the treatment group showed systematic decrease in depression as measured by relative change in position (95%)</li> </ol>
	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.	<ul> <li>confidence interval) at 1 yr follow up.</li> <li>3. Depression also decreased systematically in the treatment group compared to the control group at 1 yr follow up: however.</li> </ul>

Author Year Country Research Design PEDro Score Total Sample Size	Methods Outcome Measures: Hospital Anxiety and Depression Scale	Outcome the sign test showed no significant change
<u>Kennedy et al.,</u> (2003) United Kingdom	(HADS). <b>Population:</b> SCI: Age=16-65 yr; Cause of injury: trauma; Chronicity=acute. Depression status=mild (BDI=15) <b>Intervention:</b> 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	<ol> <li>Mood: Depression scores decreased for the intervention group following the intervention (p=0.001).</li> </ol>
Cohort N <sub>Initial</sub> =85; N <sub>Final</sub> =85	and to increase social support. 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.	
<u>Craig et al.,</u> (1999) Australia Case Control N <sub>Initial</sub> =58; N <sub>Final</sub> =58	<b>Population:</b> SCI: Age=16-73 yr; Gender: males=57, females=12; Severity of injury: complete=68%-71%; Chronicity=acute. Depression status=mixed group.	<ul> <li>Percentages are reported for each area measured.</li> <li>1. Re-admission: More controls were readmitted following discharge (p&lt;0.05).</li> </ul>

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
	Intervention: 10 wk in small groups. Each session lasted 1.5-2 hrs replacing normal rehab therapy. Individuals 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). Outcome Measures: Re- admissions, drug usage, relationships, social discrimination, self-reports of adjustment	<ol> <li>Drug usage: Controls were found to have higher self-reported drug usage than the treatment group (cases) (p&lt;0.05).</li> <li>Relationships and Social discrimination: No significant differences were noted between the two groups in relation to the types of relationship each person developed.</li> <li>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).</li> </ol>
<u>King &amp; Kennedy</u> (1999) United Kingdom PCT N <sub>Initial</sub> =38; N <sub>Final</sub> =38	Population: Age=16-65 yr; Chronicity=acute; Depression status=mild Intervention: 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. The following components made up the program: appraisal training, cognitive behavioural coping skills training, and strategies for choosing an adaptive match between appraisals and coping	<ul> <li>Pre-intervention comparisons of groups:</li> <li>1. The intervention group used religion significantly more and humour significantly less as coping strategies (p&lt;0.05) than did controls.</li> <li>2. There were no pre- intervention differences between the groups on range of injury, social support, FIM scores, other coping strategies, depression, or anxiety.</li> </ul>

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
	skills, and obtaining and maintaining social support. <b>Outcome Measures:</b> Functional Impairment Measure (FIM), Social Support Questionnaire (SSQ), Beck Depression Inventory (BDI), State Trait Anxiety Inventory	<ul> <li>Post-intervention comparison of groups:</li> <li>1. Across time there were significant decrease in the depression scores (p&lt;0.05).</li> </ul>
Craig et al., (1998) Australia Cohort N <sub>Initial</sub> =69; N <sub>Final</sub> =58	Population: Treatment: Mean age=31yr; Gender: males=23; females=5; Depression status=mixed group Intervention: 10 wk inpatient program. Small groups (4- 5/group) for 1.5 hr/wk. The major aim was to provide 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. Outcome Measures: State Trait Anxiety Inventory (STAI), Beck Depression Inventory (BDI).	<ol> <li>Significant differences noted for depression overall, (p&lt;0.05).</li> <li>Both the treatment and the control groups appeared to be less depressed 1 and 2 yr after injury.</li> <li>For individuals who scored high on the depression scale before therapy, (9 from each group) there were significant differences after treatment. (p&lt;.01) with the control group reporting higher levels of depressive mood.</li> <li>Depressive mood scores showed significant differences across time (p&lt;0.01) with scores 1 and 2 yr post injury significantly lower than pretreatment scores (p&lt;0.01).</li> </ol>
<u>Craig et al.,</u> (1997) Australia	<b>Population:</b> SCI: Age=16-73 yr; Gender: males=57, females=12; Severity of injury:	<ol> <li>Significantly greater self-esteem for treatment group</li> </ol>

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
PCI N=69	complete=68%-71%; Chronicity=acute. Depression status=mixed group Intervention: 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. Outcome Measures: State Trait Anxiety Inventory (STAI), Beck Depression Inventory (BDI), Rosenberg Self-Esteem scale.	<ul> <li>(p&lt;0.01). Taking this into account, no significant differences between the groups were found immediately after injury or 1 yr later.</li> <li>2. No significant initial differences were found between the groups on anxiety and depression when comparing pre, post and 1 yr scores.</li> <li>3. BDI scores were significantly lower for both conditions 1 yr after injury (p=0.014).</li> <li>4. Those who scored&gt;14 on the depressive mood scale were analyzed using repeated measures ANOVA. 22 people (from both groups) were examined. Significant differences were noted between the groups (p&lt;0.01).</li> <li>5. 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).</li> </ul>
Coping-oriented Supportive Programs		

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
Li et al. (2020) Hong Kong RCT PEDro=5 Level 2 N <sub>Initial</sub> =99 N <sub>Final</sub> =88	Population: Intervention group (Coping-Oriented Supportive Programme (COSP); n=50): Mean age=39±11.7yr; Gender: males=43, females=7; Mean time post injury=6.9±4.2mo; Level of injury: tetraplegia=13, paraplegia=37; Severity of injury: complete=24, incomplete=26; Depression status=mild according to mean HADS-D <i>Control group</i> (Attention group; n=49) Mean age=43±10.7yr; Gender: males=44, females=5; Mean time post injury=8.6±4.2mo; Level of injury: tetraplegia=13, paraplegia=36; Severity of injury: complete=26, incomplete=23; Depression status=mild according to mean HADS-D. Intervention: Two different wards of SCI patients were given either Coping-oriented Supportive Programme (COSP) or attention control training for 1-1.5hr/session, 1x/wk for 8wk. COSP is a psychosocial intervention which is delivered by a registered nurse who has SCI training in both SCI wards, while attention control group were given brief education on personal care. Outcome measures were assessed at baseline, immediately post- intervention, 4wk follow-up, and 12wk follow-up.	<ol> <li>Depressive symptoms and adaptive coping were significantly improved in intervention group (p=.001) compared with the control group at post intervention, but not at follow-ups.</li> <li>Anxiety, maladaptive coping, and social and life satisfaction were improved in intervention group compared to the control group (p&lt;.05) at post-intervention, 4wk follow-up, and 12wk follow-up.</li> <li>Self-efficacy was improved in the intervention group compared with the control group at post- intervention (p=.001) and 4wk follow-up (p=.02).</li> </ol>

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
	<b>Outcome Measures:</b> Brief- COPE scale, Moorong Self- efficacy Scale (MSES), Hospital anxiety and depression scale (HADS), Numerical rating scale for pain, Six-item social support questionnaire (SSQ6), Quality of life enjoyment and satisfaction questionnaire- short form (Q-LES-Q-SF).	
Li et al. (2019) Hong Kong RCT PEDro=4 Level 2 NInitial=22 NFinal=20	Population: Intervention group (Coping oriented supportive program n=9): Mean age=41.67±11yr; Gender: males=100%; Mean time post injury=8.1±4.1mo; Level of injury: tetraplegia=4, paraplegia=5; Severity of injury: complete=5, incomplete=4; Depression status=very mild depression status=very mild depression symptoms according to mean HADS-D <i>Control group</i> (Usual care group; n=11): Mean age=43±15.7yr; Gender: males=100%; Mean time post injury=8.2±4.1mo; Level of injury: tetraplegia=4, paraplegia=7; Severity of injury: complete=5, incomplete=6; Depression status=mild according to the HADS-D. Intervention: Two wards in a hospital were compared, where one received an intervention and the other one was used as a control group with conventional care. The intervention involved culturally	<ol> <li>Within- group analyses showed an improvement in depression HADS-D scoring post intervention in the COSP group (p=.007), but not in the control group. However, the difference was not significant between groups (p=1.16).</li> <li>There was no within and between group differences in the anxiety HADS scores at any time point (p&gt;.5).</li> <li>Between group comparison showed greater self-efficacy (p=.04), and life (p=.005) and social satisfaction (p=0.22) in the COSP group compared with the control group post intervention.</li> </ol>

Author Year Country Research Design PEDro Score Total Sample Size	Methods		Outcome	
	sensitive psychosocial care program and Coping-Oriented Supportive Program (COSP), 1- 1.5hr/session, 1x/wk for 8wk. Outcome measures were assessed at baseline and post intervention. <b>Outcome Measures:</b> Brief Coping Orientations to Problems Experienced Inventory, Moorong Self- Efficacy Scale, Hospital Anxiety and Depression Scale (HADS), Quality of Life Enjoyment and Satisfaction Questionnaire- Short Form, Six-Item Social Support Questionnaire.			
Acceptance and Commitment Therapy (ACT)				
Han et al. (2023) United States Pre-Post Level 4 N <sub>Initial</sub> =10 N <sub>Final</sub> =10	Population: Mean age=51.2±9.5yr; Gender: males=2, females=8; Mean time post injury= 20.1±15.3yr; Level of injury: cervical=3, thoracic=6, lumbar=1; Severity of injury: not reported; Depression status=moderate as measured by DASS. Intervention: Participants received 8 individual sessions (1h per session) delivered by trained coaches through Zoom videoconferencing, involving 6x1/wk acceptance and commitment therapy (ACT) sessions and 2 psychoeducation sessions over a 1wk period. Outcome measures were assessed at baseline and post- intervention.	1. 2. 3. 4.	Participants showed significant reductions in depression (p=.021), anxiety (p=.032) and stress (p=.036), measured by the DASS- 21. SCI-QOL Grief showed significant reductions (p=.028), and significant increases in SCS-SF (p=.028). EMAS scores improved significantly from pre- to post-intervention (p=.049) The WHOQOL-BREF, SCI-QOL Resilience, MAAS, CFQ-7, AAQ-II measures showed no	

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome		
	Outcome Measures: Depression, Anxiety and Stress Scales (DASS-21), World Health Organization Quality of Life Instruments (WHOQOL-BREF), Spinal Cord Injury Quality of Life (SCI-QOL), Self- Compassion Scale- Short Form (SCS SF) Engagement in Meaningful Activities Survey (EMAS), ACT process measures (Acceptance and Action Questionnaire-II (AAQ-II), Cognitive Fusion Questionnaire (CFQ-7), Mindful Attention Awareness Scale (MAAS), System Usability Scale (SUS)	significant changes after the intervention.		
Mindfulness based Therapy				
Zanca et al. (2022) United States RCT Pedro=8 Level 1b N <sub>initial</sub> =21 N <sub>Final</sub> =19	Population: Intervention group (Clinical Meditation and Imagery; n=11): Mean age=50, 37-66yr (median, range); Gender: males=9, females=2; Mean time post injury=13, 1- 21yr (median, range); Level of injury: Tetraplegia=46%, Paraplegia=54%; Severity of injury: incomplete=64%, complete=27%, unknown=9%; Depression status=normal to moderate as assessed by the PHQ-9 <i>Control group</i> (Health and Function Education; n=10): Mean age=45, 27-72yr (median, range); Gender: males=7, females=3; Mean time post injury=6, 2-18yr (median, range); Level of injury: Tetraplegia 40%,	<ol> <li>No statistically significant differences (p=&gt;.05) in depressive or stress symptoms from baseline were noted between or within the groups.</li> <li>Depressive symptoms showed a direction of change favourable to the clinical meditation and imagery group.</li> <li>Stress symptoms showed a direction of change favourable to the control group.</li> </ol>		
Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome		
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	Paraplegia=60%; Severity of injury: incomplete=40%, complete=20%, unknown=40%; Depression Status=mixed as assessed by the PHQ-9.			
	Intervention: Participants were randomized to receive Clinical Meditation and Imagery (CMI) as intervention or Health and Function Education as control. CMI group participated in a 4wk in- person or virtual mindfulness, mantra meditation, and guided imagery practices in group setting (2hr/session, 1x/wk for 4wk), followed by 4wk of self- directed home-based CMI practice (30min/session, 5x/wk for 4wk). Control group participated in a 4wk in-person or virtual education on topics related to health and function after spinal cord injury in group setting (2hr/session, 1x/wk for 4wk), followed by 4wk of self-directed, home- based education activities (30min/session, 5x/wk for 4wk). Outcomes measures were assessed at 2wk (baseline), 6wk, and 10wk.			
	Outcome Measures: Multidimensional Pain Inventory Life Interference Subscale (MPI-LIS), Numeric Rating Scale (NRS), Survey of Pain Attitudes (SOPA),			

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
	Perceived Stress Scale (PSS), Brief Patient Health Questionnaire (PHQ-9).	
Hearn and Finlay (2018) United Kingdom RCT PEDro=7 N <sub>Initial</sub> =67 N <sub>Final</sub> =43	Population: Mean age=44.4±10.4 yr; Gender: males=31, females=36; Time since injury (yr): 1-2=11, 2- 4=18, 4-8=19, 8-12=6, 12- 15=7, 15+=6; Level of injury: C=25, T=37, L=5; Severity of injury: AIS A=9, B=17, C=19, D=22. Intervention: Participants were randomized to either an 8-wk online mindfulness intervention or an 8-wk internet delivered psychoeducation. Outcome Measures: Depression symptom severity and anxiety (hospital anxiety and depression scale (HADS)), quality of life (QoL)(world health organization quality of life (WHOQOL-BREF), pain perception (numeric rating scale), pain catastrophizing scale (PCS) and mindfulness (five facet mindfulness questionnaire (EEMO)	<ol> <li>Significant differences post-intervention between groups for mindfulness facets of acting with awareness, describing and non- reactivity to inner experience (p&lt;0.05) as well as total FFMQ score (p&lt;0.05).</li> <li>No significant differences between groups for any QoL, pain intensity and mindfulness facets of observing and non- judging post- intervention (p&gt;0.05).</li> <li>Significant between group difference in severity of depression and pain catastrophizing at 3- mo follow-up (p&lt;0.050).</li> </ol>

Several studies examined the effect of group CBT targeting mood among persons with SCI. Three studies found it was effective at reducing depressive symptoms post intervention compared to control groups (P. Kennedy et al., 2003; King & Kennedy, 1999; Y. Li et al., 2019); while three studies found no significant difference in mood (Craig et al., 1997; A. Craig et al., 1998) (Coker et al., (2019) Craig et al., (1997; 1998; 1998) ;(1999) found only a subgroup of participants with Beck Depression Inventory scores greater than 14 experienced a significant reduction in depressive symptoms. Among this subgroup, decreased scores were maintained at 1 and 2 year follow-ups (A. Craig et al., 1998).

In an RCT, Zhao et al. (2021) reported that individuals receiving CBT and medication (anxiolytic and antidepressant drugs as needed) had significant improvement in symptoms of depression and anxiety compared to those receiving traditional rehabilitation. Several studies found significant improvement in depressive symptoms among individuals receiving CBT post intervention (Dorstyn et al., 2011; Duchnick et al., 2009; Feng & Li, 2017; Norrbrink Budh et al., 2006; Perry, Nicholas, & Middleton, 2010). Duchinick et al., (2009) and Dorstyn et al., (2011) found that the effect was not maintained at 3 month follow-up; Perry (2010) found the effect was not maintained at 8 month follow-up.

Four studies examined the effect of CBT targeting pain intervention on mood compared to usual care control group (Blake, Trinder, & Allen, 2018; Heutink et al., 2014; Heutink et al., 2012; Norrbrink Budh et al., 2006; Perry et al., 2010). Only one study which provided online CBT found significant improvement in depressive symptoms between the intervention and control group (Dear et al., 2018).

One study examined the effect of telecounselling CBT programs on mood and adjustment amongst persons with SCI (Dorstyn et al., 2012). Dorstyn et al., (2012) reported symptoms were maintained over the follow-up period. Four studies examined the role of online CBT targeting mood resulting in significant reduction in depressive symptoms post intervention (Migliorini et al., 2016; Migliorini et al., 2011). Burke and colleagues (2019) found no significant difference in depressive symptoms in the intervention group compared to the control group post intervention; however, significant decrease in depressive symptoms were seen in the treatment group at 3 month follow-up. Verwer et al., (2016) found no significant difference in depressive symptoms through a self-directed online CBT program.

Schulz et al., (2009) conducted a CBT trial targeting both persons with SCI and their caregivers. The study found that the dual targeted group both the persons with SCI and caregivers had the greatest reduction in depressive symptoms compared to the group targeting only persons with SCI and information only control group.

Two cluster randomized trials evaluated the efficacy of a coping oriented supportive programme (COSP), a type of CBT, on anxiety in an inpatient SCI rehabilitation unit. Li et al. (2020) found significant improvement in symptoms of anxiety post-treatment and up to 12 weeks follow-up compared to brief education on personal care. Li et al. (2019) found no difference in anxiety outcomes between COSP and traditional rehabilitation.

One small pre-post study examined the effect of Acceptance and commitment therapy (ACT) on depression among Individuals with SCI (Han et al. (2022).

Hearn and Finlay (2018) evaluated the effectiveness of an 8-week online mindfulness program compared to pain psychoeducation among persons with SCI. Participants in the treatment

group found significant reduction in symptoms of depression, anxiety, pain unpleasantness, and catastrophizing compared to the psychoeducation group at post treatment and 3-month follow-up. A small pilot RCT, Zanca et al. ((2022)) found no significant improvement in depressive symptoms post treatment compared to SCI health education.

#### Conclusion

There is level 2 evidence (Craig et al., 1997; A. Craig et al., 1998; A. Craig et al., 1999; A. R. Craig et al., 1998; Paul Kennedy & Rogers, 2000; King & Kennedy, 1999) to support the use group CBT intervention targeting mood to decrease depressive symptoms following SCI among those with elevated depressive symptoms.

There is level 1b evidence from one RCT (Zhao et al. (2021)) that CBT combined with pharmacotherapy was effective in improving symptoms of depression compared to conventional rehabilitation.

There is level 1 evidence (Duchnick et al., 2009; Feng & Li, 2017) that CBT is effective in improving depressive symptoms post intervention.

There is conflicting evidence that CBT intervention results in maintained affective improvement at follow up.

There is level 1b evidence (Schulz et al., 2009) that providing CBT to caregivers and care receivers results in improved depressive symptoms in care receivers.

There is level 1 evidence (Dear et al., 2018; Dorstyn et al., 2011; Migliorini et al., 2011) that telerehabilitation or online based CBT improves symptoms of depression post SCI.

There is conflicting evidence for the effectiveness of coping oriented supportive programs on improving symptoms of anxiety post SCI.

There Is level 4 evidence that acceptance and commitment therapy may reduce symptoms of depression post SCI (Han et al., (2022)).

There is level 1b evidence that online mindfulness programs can help reduce symptoms of depression post SCI (Hearn & Finlay, (2018)).

There Is level 2 evidence that meditation and Imagery Interventions may not reduce symptoms of depression post SCI.

Individual based CBT is effective in reducing symptoms of depression post SCI; however, the results may not be maintained at follow-up.

Cognitive behavioural interventions provided in a group setting appear helpful in reducing post-SCI depression among those with elevated symptoms of depression.

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

Telerehabilitation or online CBT improves symptoms of depression post SCI.

There is conflicting evidence for the effectiveness of coping oriented supportive program on improving symptoms of anxiety post SCI.

Online chronic pain-based mindfulness programs help reduce symptoms of depression among persons with SCI.

Meditation and Imagery Interventions may not reduce symptoms of depression among persons with SCI.

## 3.3.2 Peer Support for Depression following SCI

Peer support involves the provision of assistance, guidance, and mutual aid among individuals who share similar experiences, challenges, or circumstances. Following discharge from hospital with a newly acquired SCI, patients often report feeling emotionally overwhelmed, socially isolated, and lacking in the competence and confidence needed to assume responsibility for their care needs. (Barclay-Goddard et al. (2012)) Peer support through mentoring and peer-led instruction has been shown to improve self-efficacy, due in part to greater effort put forth when individuals learn from others, they perceive to be similar to themselves. (Lorig et al. (2001)) As self-efficacy has been shown to be negatively associated with symptoms of depression and anxiety in individuals with SCI it may be expected to benefit symptoms of peer support on symptoms of depression in individuals with SCI.

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
Mackelprang et al.,(2016) USA RCT PEDro=7 N <sub>Initial</sub> =168 N <sub>Final</sub> =165	Population: Mean age at injury=41.2±15.8 yr; Gender: males=133, females=35; Level and severity of injury: C1-C4 AIS A-C=34, C5-C8 AIS A-C=22, paraplegia AIS A- C=47, AIS D=63. Intervention: Participants were randomized to either peer telephone counselling (TC) group or a usual care (UC) group for a yr after spinal cord injury during rehabilitation. Outcome Measures: Self-reported health care utilization, medical complications, depression severity, current health state, subjective health, and community participation.	<ol> <li>No significant differences between groups for any outcome measures (p&gt;0.05 for all).</li> </ol>
Jones et al. (2021) United States Pre-Post Level 4 N <sub>Initial</sub> =1117 N <sub>Final</sub> =799	Population: Mean age= 20yr-30yr- 3, 31yr-40yr=6, 41yr-55yr=6; Gender: males=7, females=8; Mean time post injury= Not reported; Level of injury: jot reported; Severity of injury: not reported; Depression status=mild as reported by the PHQ-8. Intervention: Participants completed peer-mentoring and peer-led education classes (1hr/class, 4 classes). Outcomes were assessed at 30d, 90d, and 180d post-intervention. Outcome Measures: Unplanned readmissions, General Self-Efficacy (GSE), Patient Health Questionnaire-8 (PHQ-8), Satisfaction with Life Scale (SWLS).	<ol> <li>Higher self-efficacy (GSE) was associated with greater exposure to peer mentoring, and a significant relationship between improvement in GSE and reduced hospital readmissions was observed.</li> <li>There were no significant associations between PHQ-8, SWLS, or peer mentor exposure.</li> </ol>
<u>Hoffmann et al</u> . (2019) Denmark	<b>Population:</b> Mean age=50, 34-58yr; Gender: males=33, females=19; Mean time post injury 0.34, (0.25-	<ol> <li>SF-36 standard data showed significant improvement of depression-related items in five</li> </ol>

Table 3. Peer Support for Depression following SCI

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
Pre-Post Level 4 N=52	0.51) yr (median, IQR); Level of injury: paraplegia=21, tetraplegia=15, unknown=16; Severity of injury: not reported; Depression Status=symptoms. Intervention: Participants attended volunteer-led peer mentor sessions, which were conducted as one-to-one meetings between mentor and mentee. Meetings took place at the rehabilitation center and could occur anytime throughout the rehabilitation period. The appropriate timing of initiating the sessions was based on a joint decision, made by the mentee, the interdisciplinary team, and the project members. There was no time limit for the duration of each meeting. Outcome measures were assessed pre- and post-intervention. Outcome Measures: International SCI QoL Basic Data Set, depression items from the Short Form Health Survey (SF-36), pain frequency and intensity (11-point Numerical Rating Scale).	out of nine items (p<.05). The remaining four items did not improve significantly, although the noted change in all cases was in a positive direction.

One RCT evaluated the effectiveness of a peer led telephone counselling program for persons with SCI compared to usual care. The study found no significant difference in depression severity or quality of life in the treatment group compared to the control group (p>0.05). Two pre-post studies examined the effectiveness of peer mentoring on depression post SCI. Jones et al. (2021) found a significant increase in self-efficacy post intervention; however, no significant reduction in depressive symptoms were seen. Hoffman et al. (2019), provided peer mentorships to adults admitted into inpatient SCI rehabilitation. The study found significant improvement in 5 out of the 9 depression items on the SF-36.

#### Conclusion

There is level 1b evidence that peer led telephone counselling may not be effective in reducing symptoms of depression.

Peer telephone counselling may not be effective in reducing symptoms of depression post SCI.

### 3.3.3. Online Self-Esteem Interventions for Depression following SCI

Online self-esteem interventions are programs designed to help individuals improve their selfesteem through techniques which aim to address factors such negative self-perceptions and the promotion of positive self-image. While these are highly relevant factors following SCI, and are associated with symptoms of depression, only a single study has assessed the impact of such interventions in an SCI population. (van Leeuwen et al. (2012))

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
Robinson-Whelen et al. (2020) United States RCT Pedro=5 Level 2 N <sub>Initial</sub> =23 N <sub>Final</sub> =21	Population: Intervention group (Self-esteem in Second Life Intervention for Women with Disabilities group, n=10): Mean age=50.90±9.95yr; Gender: females=100%; Mean time post injury=15.36±18.70yr; Level of injury: paraplegia=6, tetraplegia=6; Severity of injury: not reported; Depression status=mild as assessed by the PHQ-9. <i>Control group</i> (no treatment, n=11): Mean age=44.13±13.25yr; Gender: females=100%; Mean time post injury=11.61±14.71yr; Level of injury: paraplegia=9, tetraplegia=2; Severity of injury: not reported; Depression	<ol> <li>There were no significant differences between the intervention and control group for the CESD-10 (p=.16) and the PHQ-9 (p=.29).</li> <li>For the within group analyses, changes in depression scores were statistically significant (CESD-10, p=.040; PHQ-9, p=.035) with medium to- large effect sizes. The number of women whose depression scores exceeded the cut-off of 10, indicating risk for clinical depression decreased from four at pre- test to three at post-test on the CESD-10, and decreased</li> </ol>

Table 4. Online Self-Esteem Interventions for Depression following SCI

status=mild as assessed by the		from three at pre-test to
PHQ-9.		one at post-test on the
Intervention: Participants were		PHQ-9.
randomized into the Self-	3.	For the within group
esteem in Second Life		analyses, changes on the
Intervention for Women with		Stress Management
Disabilities (SEE-SCI) group and		subscale of the
control group. The SEE-SCI		psychological health-
group participated in online,		promoting behaviors were
virtual activities to improve self-		minimal and constituted a
efficacy, connectedness, and		small effect size (p=.470).
self-care delivered by female		
facilitators (2-hr x/wk for 7wk).		
The control group received no		
intervention. Outcome		
measures were assessed pre		
and post intervention.		
Outcome Measures: Three		
subscales (Interpersonal		
Support, Spiritual Growth/Self-		
actualization, Stress		
Management) from the Health		
Promoting Lifestyle Profile-II		
(HPLP-II), Medical Outcomes		
Study Social Support Survey		
Emotional-Informational		
Support (MOS-SS-EI),		
Generalized Self-Efficacy Scale		
(GSES), Rosenberg Self-Esteem		
Scale (RSES), Center for		
Epidemiologic Studies		
Depression Scale-10 (CESD-10),		
Patient Health Questionnaire		
(PHQ-9).		

In an RCT, Robinson-Whelen et al. (2022) randomized participants into a self-esteem for women with disabilities intervention (SEE-SCI) group compared to no treatment group. The SEE-SCI group consisted of online virtual activities to improve self-efficacy and social connectedness. The study found no significant reduction in symptoms of depression in the SEE-SCI group compared to the control group.

#### Conclusion

There is level 2 evidence that self-esteem programs do not improve symptoms of depression post SCI.

Self-esteem programs may not be effective in reducing symptoms of depression post SCI.

## 3.3.4. Positive Psychology Exercises for Depression following SCI

Positive psychology interventions aim to promote positive behaviors, emotions, and cognitions that have been found to be associated with better chronic pain adjustment, namely self-compassion, positive affect, and optimism (Muller et al. (2022)).

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
Müller et al. (2022) Switzerland RCT Pedro=6 Level 1b N <sub>Initial</sub> =168 N <sub>Final</sub> =116	Population: Intervention group (positive psychology exercise; n=87): Mean age=55±11.99yr; Gender: males=56, females=31; Mean time post injury=18.5±12.6yr; Level of injury: paraplegia=59, tetraplegia=28; Severity of injury: incomplete=55, complete=32; Depression status=no depression as assessed by the HADS-D. <i>Control group</i> : Mean age=56±12yr; Gender: males=52, females=29; Mean time post injury=16±12.3yr; Level of injury: paraplegia=59, tetraplegia=22; Severity of injury: incomplete=53, complete=28; Depression status=no depression according to mean HADS-D score at baseline. Intervention: Two randomized parallel groups were	<ol> <li>None of the baseline to follow-up Time x Group interactions were statistically significant, indicating no significant between-group differences in changes in any of the outcomes during this time- period (p&gt;.05).</li> </ol>

Table 5. Positive Psychology Exercises for Depression following SCI

investigating chronic pain after	
SCI, where the intervention	
group worked through four	
positive psychology exercises	
over 8wk, while the control	
group wrote about current life	
events mindfully. Outcome	
measures were assessed at	
baseline, 8wk, and 3mo post	
intervention.	
Outcome Measures: Numerical	
rating scale (NRS) for pain	
intensity, Pain catastrophizing	
scale, 10-item Survey of Pain	
Attitude (SOPA) Control	
subscale, disability-modified 12-	
item Pain Interference scale of	
the Brief Pain Inventory (BPI),	
Positive and Negative Affect	
Schedule (PANAS), Depressive	
subscales of Hospital Anxiety	
and Depression Scale (HADS-D),	
World Health Organization	
quality of Life scale (WHOQOL-	
Brief), participants' ratings of	
benefit and satisfaction with	
treatment, assessment of	
adverse events	
	1

In an RCT, Muller et al. (2022) evaluated the effectiveness of a positive psychology program targeting pain compared to mindfulness journaling. The study found no significant reduction in symptoms of depression post treatment compared to the mindfulness journaling group.

#### Conclusion

There is level 1b evidence from one RCT (Muller et al. (2022)) that positive psychology interventions are not effective at improving depressive symptoms compared to mindfulness journaling post SCI.

Positive psychology interventions may not be effective in reducing symptoms of depression post SCI.

## 3.3.5. Eye Movement Desensitization and Reprocessing Therapy for Depression following SCI

Eye Movement Desensitization and Reprocessing (EMDR) therapy is guided by the Adaptive Information processing model. It was initially developed for the treatment of posttraumatic stress disorder (PTSD) (Shapiro (2007)). The aim of the intervention is to focus on a traumatic memory while conducting bilateral stimulation of eye movements. It has been associated with a reduction in the negative emotion associated with trauma memories.

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
Hatefi et al. (2019) Iran RCT Pedro=6 Level 1b N <sub>Initial</sub> =75 N <sub>Final</sub> =68	Population: Intervention group (Eye movement desensitization and reprocessing; n=33): Mean age=48.66±12.66yr; Gender: males=20, females=13; Mean time post injury= 1-2yr=7, 3- 5yr=19, >5yr=7; Level of injury: not reported; Severity of injury: not reported; Depression status=severe as measured by Beck's Depression Inventory. <i>Control group:</i> (n=35); Mean age=49.12±10.13yr; Gender: males=25, females=10; Mean time post injury= 1-2yr=7, 3- 5yr=20, >5yr=8; Level of injury: not reported; Depression status=severe as measured by Beck's Depression Inventory. <b>Intervention:</b> Participants were randomized to receive Eye Movement Desensitization and Reprocessing (EMDR) therapy (45-60min/session, 2 sessions) or to a control group with no treatment. Outcomes measured at baseline and post- intervention.	<ol> <li>The EMDR group experienced a significant reduction in depression and anxiety scores following post- intervention (p&lt;.02 and p&lt;.0001), respectively.</li> <li>There was no significant change in depression or anxiety among participants in the control group.</li> </ol>

Table 6. Eye Movement Desensitization and Reprocessing Therapy for Depression following SCI

Outcome Measures: Beck's	
Depression Inventory, Beck's	
Anxiety Inventory	

Hatefi et al. (2019) conducted an RCT examining the effectiveness of 2 sessions of EMDR compared to no treatment. The study did not report on between group effects. The study reported significant within group effects on symptoms of depression among those that received the intervention.

#### Conclusion

There is limited evidence that EMDR may be effective in reducing symptoms of depression compared to no treatment.

Eye Movement Desensitization and Reprocessing Therapy may be effective in reducing symptoms of depression post SCI.

# 3.4 Combined Psychotherapy and Pharmacotherapy for Treatment of Depression in SCI

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).

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
<u>Perry et al.,</u> (2010) Australia PCT N=36	<b>Population:</b> Mean age=43.8yr; 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.	<ol> <li>A trend towards improvement on the 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.</li> </ol>

Table 7. Combined Psychotherapy and Pharmacotherapy for Treatment of Depression in SCI

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
	Intervention: Individuals with SCI and 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. Outcome Measures: Hospital Anxiety and Depression Scale (HADS).	
<u>Kahan et al.,</u> (2006) USA PCT N=76	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). Intervention: Treatment group received a mixture of outpatient cognitive behavioral psychotherapy and antidepressant medication (individualized), for 30 wk. Outcome Measures: OAHMQ- depression; Life Satisfaction Scale (LSS), The Community Activities Checklist -community activity involvement. Treatment group: @ baseline (T1), 10 weeks (T2) & 30 weeks (T3). Control group: @ 2 points	<ol> <li>Depression Outcomes: The depression rate of the treatment group was improved between all-time points (p≤0.001).</li> <li>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≤0.001). Overall, 71% of SCI subjects' depression improved following treatment.</li> <li>At baseline, treatment and control groups' depression scores were similar, but were significantly different after treatment (p≤0.001). Mean depression scores reduced by 50% &amp; 12% in treatment &amp;</li> </ol>
<u>Kemp et al.,</u> (2004) USA PCT	<b>Population:</b> 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.	<ol> <li>control groups, respectively.</li> <li>Depression Outcomes: A decrease was observed in depression scores from 0-24wk in the treatment group (p&lt;0.001).</li> </ol>

Author Year Country Research Design PEDro Score Total Sample Size	Methods		Outcome
N <sub>Initial</sub> =43 N <sub>Final</sub> =28	Depression status=major depression using Older Adult Health and Mood Questionnaire (OAHMQ). Intervention: 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 mo then was reduced to twice a mo. All were prescribed an antidepressant	2.	Paired t-tests indicated a 24% decline in depression scores from 0-8wk (time 1=15.7, time 2=11.9, p<0.001) and from 8-24 wk (6.7) (p<0.001). 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
	based upon their needs and physician's decision. The average number of therapy sessions completed was 14/17 (range 6-17). <b>Outcome Measures</b> : Older Adult Health and Mood Questionnaire (OAHMQ)Hamilton Depression Rating Scale (HDRS), Community activities checklist, Life Satisfaction Scale (LSS).	4.	depression. A further increase was noted between 8 and 24 wk (time 2=15.5, time 3=22.3, p<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<0.001). Non-treatment group: Scores on the depression measure did not
<u>Judd et al.,</u> (1989) USA	<b>Population:</b> Mean age=31.6 yr; Gender: males=9, females=5; Level of injury: paraplegia=7; tetraplegia=7; Depression status=clinically depressed evaluated using Diagnostic and Statistical Manual of Mental Disorders-III.	1.	change significantly over time. 13 of the 14 individuals had improvement in BDI score at discharge (average BDI at discharge=8).
Pre-Post N=14	Intervention: Individuals received supportive psychotherapy and were prescribed tetracyclic and tricyclic antidepressants during rehabilitation period. Outcome Measures: Beck Depression		

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
<u>Judd et al.,</u> (1986) USA	<b>Population:</b> Mean age=45.6 yr; Gender: males=8, females=1; Level of injury: tetraplegia=5; paraplegia=4. Depression status=clinically depressed evaluated using Diagnostic and Statistical Manual of Mental Disorders -III.	<ol> <li>All individuals showed improvement in depressive and anxiety symptoms.</li> </ol>
Pre-Post N=9	<b>Intervention:</b> Individuals were assessed within 2 wk of admission and prescribed either mianserin or nomifensine along with supportive psychotherapy.	
	<b>Outcome Measures:</b> Hamilton Depression Rating Scale (HDRS).	

Two PCTs reported significant improvement in depressive symptoms in the combined CBT and antidepressant group compared to usual care (Kahan et al., 2006; Kemp et al., 2004). Two prepost studies reported combined supportive psychotherapy and pharmacotherapy resulted in improvement of depressive symptoms amongst persons with SCI (Judd et al., 1986; Judd et al., 1989).

#### Conclusion

There is level 2 evidence (Kahan et al., 2006; Kemp et al., 2004) that combined CBT and antidepressants reduce symptoms of depression post SCI.

There is level 4 evidence (Judd et al., 1986; Judd et al., 1989) indicating the effectiveness of pharmacotherapy combined with supportive psychotherapy for reducing symptoms of depression in SCI.

Combining pharmacotherapy with CBT or supportive psychotherapy results in improved mood post SCI.

## 3.5 Pharmacotherapy for Depression following SCI

Pharmacotherapy is commonly prescribed for the treatment of depression post SCI. Poor tolerance to pharmacotherapy may lead to exacerbation of other secondary issues such as spasticity (Stolp-Smith & Wainberg, 1999). However, research on its efficacy among persons with SCI is limited.

Author Year		
Country		
Research Design	Methods	Outcome
PEDro Score		
Total Sample Size		
Fann et al., (2015) USA RCT PEDro=10 N <sub>Initial</sub> =133 N <sub>Final</sub> =126	Population: Mean age=40yr; Gender: males=99, females=34; Level of injury: paraplegia=70, quadriplegia=62, unknown=1; Severity of injury: incomplete=62, complete=71; Mean time post injury=11yr; Depression status=Major Depressive Disorder. Intervention: Individuals were randomized to receive venlafaxine extended release (150mg/d, n=69) or placebo (control, n=64) for 12wk. Outcomes were assessed pre and post treatment. Outcome Measures: Hamilton Depression Rating Scale (HAM-D), Maier Subscale, Symptom Checklist 20 (SC-20).	<ol> <li>There was no significant difference between groups in improvement on the HAM-D (p=0.42) or SC-20 (p=0.14).</li> <li>On the Maier subscale, there was a significant improvement in the treatment group when compared to the control group (p=0.02).</li> </ol>
Richards et al., (2015) USA RCT PEDro=10 N <sub>Initial</sub> =133 N <sub>Final</sub> =123	<ul> <li>Population: Mean age=40.0±11.0 yr; Gender: males=99, females=34; Time since injury=10.9±10.6 yr; Level of injury: C=62, T=58, L=12; Severity of injury: AIS A=71, B=20, C=12, D=30.</li> <li>Intervention: Participants were randomized to either a venlafaxine XR group or a placebo group using a flexible titration schedule over the course of 12 wk.</li> <li>Outcome Measures: Numeric rating scale 0-10 (NRS) for pain intensity, pain interference items of the brief pain inventory (BPI).</li> </ul>	<ol> <li>No significant difference was seen in mood among those with neuropathic or mixed pain.</li> <li>Significant improvement in mood was reported among those with nociceptive pain.</li> </ol>
<u>Salinas et al.,</u> (2012) Colombia RCT	<b>Population:</b> Mean age=36yr; Gender: males=42, females=4; Level of injury: paraplegia=28,	<ol> <li>There was no significant between groups on the ZSDS at 1mo (p=0.829), 3mo (p=0.421), or 6mo (p=0.551).</li> </ol>

Table 8. Pharmacotherapy for Treatment of Depression in SCI

		r	
PEDro=9	quadriplegia=18; Severity of injury:		
N <sub>Initial</sub> =46 N <sub>Final</sub> =44	incomplete=13, complete=33; Mean		
	time post injury <2wk; Depression		
	status=symptoms.		
	Intervention: Individuals without		
	neuropathic pain were randomized		
	to receive carbamazepine (600mg/d,		
	n=24) or placebo (control, n=22) for		
	1mo. Outcomes were assessed pre		
	and post treatment, and at 3 and		
	6mo follow-up.		
	Outcome Measures: Zung Self-		
	Rating Depression Scale (ZSDS).		
	Population: Mean age=41yr;	1.	There was no significant change in CESD-SF
	Gender: males=36, females=2; Level		scores across time for any medication.
	of injury: paraplegia=18,	2.	I here was no significant difference in CES-D-
	quadriplegia=20; Mean time post		any given time point.
	injury=11yr; Depression		, , , , , , , , , , , , , , , , , , , ,
	status=symptoms.		
Rintala et al., (2007)	Intervention: Individuals with		
USA	chronic neuropathic pain received		
RCT Crossover	amitriptyline (50mg, 3x/d),		
PEDro=6	gabapentin (1200mg, 3x/d), and		
N <sub>Initial</sub> =38 N <sub>Final</sub> =22	diphenhydramine (25mg, 3x/d,		
	control) for 8wk each in a		
	randomized sequence. Outcomes		
	were assessed every 2wk during		
	each drug trial.		
	Outcome Measures: Center for		
	Epidemiologic Studies Depression		
	Scale – Short Form (CES-D-SF).		

Four studies examined the effect of pharmacotherapy alone in the reduction of depressive symptoms post SCI (Fann et al., 2015; Richards et al., 2015; Rintala et al., 2007; Salinas et al., 2012). Richards et al.,(2015) found venlafaxine resulted in significant improvement in pain interference of mood among those with nociceptive pain compared to placebo. No significant effect of venlafaxine was seen among those with neuropathic or mixed pain. The remaining three studies found no significant improvement in depressive symptoms after amitriptyline (Rintala et al., 2007), gabapentin (Rintala et al., 2007), and carbamazepine (Salinas et al., 2012) compared to placebo. Fann et al.,(2015) reported significant decrease in depressive symptoms based on the Maier subscale of the HAM-D among persons receiving venlafaxine compared to placebo.

#### Conclusion

There is limited evidence that carbamazepine, amitriptyline, and gabapentin may not improve symptoms of depression post SCI.

There is level 1b evidence (Fann et al., 2015) that venlafaxine improves depressive symptoms post SCI.

There is level 1b evidence (Richards et al., 2015) that venlafaxine improves pain interference with mood post SCI.

Venlafaxine improves depressive symptoms post SCI.

## 3.6 Physical Interventions for Depression following SCI

#### 3.6.1 Physical Activity 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.

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
Bombardier et al. (2021) United States RCT Pedro=5 Level 2 N <sub>Initial</sub> =15 N <sub>Final</sub> =14	Population: Intervention group (exercise; n=7): Mean age=56±13yr; Gender: males=5, females=2; Mean time post injury= 12±8yr; Level of injury: Cervical=0, thoracic=6, lumbar=1; Severity of injury: AIS A=7; Depression status: mild as assessed by PHQ-9. Control group (Usual care; n=8): Mean age=49±13yr; Gender: males=6, females=2; Mean time post injury= 18±16yr; Level of injury: Cervical=2, thoracic=6, lumbar=0; Severity of injury: AIS	<ol> <li>The exercise intervention group showed a significant difference in improving probable major depression (PHQ-9 score&gt;10) when compared to the control group that only completed their usual care (p=.049).</li> <li>No significant between-group differences were observed in improvement of mild depression symptoms post-intervention (p&gt;.05).</li> </ol>

#### Table 9. Physical Activity for Depression following SCI

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
	A=8; Depression status=mild as assessed by PHQ-9.	
	Intervention: Participants were randomly assigned to the physical activity intervention group and the control group. The intervention group received a multi-component intervention consisting of 16- session physical activity counseling curriculum delivered by a psychologist via telephone calls over 24wk and a free home exercise toolkit. The control group received a letter informing them of their test results and randomization status. They were advised to seek medical care to make lifestyle changes such as diet and exercise to address their cardiometabolic disease or risk factors. Outcome measures were assessed at baseline and at 6mo post- intervention.	
	Outcome Measures: Peak oxygen consumption (VO2 peak), Body mass index (BMI), waist circumference, Insulin sensitivity (ISI), Physical Activity Recall Assessment for Spinal Cord Injury (PARA-SCI), Brief pain inventory intensity and interference scales, Wheelchair User Shoulder Pain index, Patient Health Questionnaire-9 (PHQ-9), World Health Organization Quality of Life Scale (WHOQOL-BRIEF), and participant confidence.	
<u>Akkurt et al.,</u> (2017) Turkey	<b>Population:</b> Mean age: Not reported; Median age: Intervention group=33 yr, Control group=37 yr;	1. No intergroup differences were seen in HADS and CES-D.

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
RCT PEDro=5 N=33	Gender: males=29, females=4; Time since injury=>1 mo, not specified further; Level of injury: C=1, T=22, L=10; Severity of injury: AIS A=19, B=1, C=10, D=3. Intervention: Participants were enrolled in a 12-wk program comparing arm ergometer exercises and general exercises to those that receive only general exercises. Outcome Measures: Psychological status (Center for Epidemiologic Studies Depression Scale and Hospital Anxiety and Depression Scale).	<ol> <li>No statistically significant differences over the assessment period between the intervention and control groups in disability levels, QOL, or metabolic syndrome parameters (p=&gt;0.05 for all).</li> </ol>
Curtis et al., (2017) Canada RCT Crossover PEDro=6 N=22	Population: Yoga group (n=10): Mean age=47.9±19.5 yr; Gender: Not reported; Level of injury: paraplegia=6, tetraplegia=0, ambulatory/unspecified=4; Severity of injury: complete=2, incomplete/disease-related=8. Control group (n=12): Mean age=54.8±10.1 yr; Gender: Not reported; Level of injury: paraplegia=4, tetraplegia=4, ambulatory/unspecified=4; Severity of injury: complete=5, incomplete/disease-related=7. Intervention: Participants were randomized to a 6 wk, twice wkly lyengar yoga group or a 6 wk wait- listed control group, then after the first yoga group completed their sessions, the wait-list control group engaged in the yoga protocol. Outcome Measures: Pain (brief pain inventory (BPI), pain	<ol> <li>Yoga group had significantly lower scores for the HADS (p&lt;0.05) and significantly higher scores for the SCS (p&lt;0.05) at post-intervention than at baseline.</li> <li>Fixed-factor models showed significantly lower HADS scores postintervention compared to preintervention (p&lt;0.05) with time being the main predictor of HADS scores (p&lt;0.05).</li> <li>There was a trend noticed for FFMQ scores from preintervention to postintervention for total scores (p=0.09) and observing scores (p=0.06).</li> <li>Postintervention scores for the SCS and FFMQ were both significantly higher than at preintervention (p&gt;0.05).</li> </ol>

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
	catastrophizing scale (PCS)), psychological (acceptance and action questionnaire (AAQ), hospital anxiety and depression scale (HADS), general self-efficacy scale (GSES), posttraumatic growth inventory (PTGI-SF), Connor- Davidson resilience scale (CD-RISC), self-compassionate scale (SCS)) and mindfulness (five-facet mindfulness questionnaire (FFMQ) measures taken 1-2 wk before and after the program.	
Latimer et al., (2004) Canada RCT PEDro=1 N=23	<b>Population:</b> 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 <b>Intervention:</b> 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. <b>Outcome Measures</b> : 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	<ol> <li>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).</li> <li>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).</li> <li>Exercise was found to buffer the effects of stress on QOL and depression.</li> </ol>
<u>Hicks et al.,</u> (2003) Canada RCT	<b>Population:</b> Age=19-65 yr; Gender: both; Time since injury=1-24 yr.	<ol> <li>Quality of life components: Exercisers reported less stress, fewer depressive symptoms, and greater satisfaction with their</li> </ol>

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
PEDro=8 N <sub>Initial</sub> =43 N <sub>Final</sub> =32	Intervention: Experimental group participated in a progressive exercise training program twice weekly for 9 mo on alternative day's 90-120 min starting with warm up, upper extremity stretching, and 15 to 30 min of aerobic training. As the rate of perceived exertion decreased, the workload increased. Some resistance training took place. <b>Outcome Measures:</b> Changes in depression, cardiovascular function, muscle strength and quality of life.	physical functioning than the controls. (p=0.06). Exercisers reported less pain (p<0.01) and a better Q of L (p<0.05).
Martin Ginis et al., (2003) Canada RCT PEDro=6 N <sub>Initial</sub> =34 N <sub>Final</sub> =34	Population: Mean age=8.6 yr; Gender: 23 males, 11 females; Mean time post-injury: 10.4 yr. Intervention: Intervention group: 5 min of stretching, 15 -30 min of aerobic arm ergometry exercise & 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).	<ol> <li>After 3 months, when compared to controls, exercisers had:</li> <li>↑ QOL (p=0.007)</li> <li>↓ depression (p=0.02)</li> </ol>
Diego et al., (2002) USA RCT PEDro=8 N=20	Population: Mean age=39 yr; Gender: males=15, females=5; Level of injury: tetraplegia; Time since injury=>1 yr. Intervention: One group received a 40 min massage 2x/wk for 5 wk by	<ol> <li>CES-D scores obtained on first day versus last day assessment by group. Repeated measures ANOVA showed a group by day interaction effect (p&lt;0.05).</li> </ol>

Author Year Country Research Design PEDro Score Total Sample Size	Methods		Outcome
	a massage therapist while the other was taught an exercise routine that they performed 2x/wk for 5 wk on their own. <b>Outcome Measures:</b> State Trait Anxiety Inventory (STAI), Center for Epidemiologic Studies Depression Scale (CES-D).	2.	T-tests revealed greater decrease in CES-D depression scores for the massage therapy group (p<0.05).
	<b>Population:</b> Intervention group (n=4): Mean Age=56.4yr; females=9; Mean time post injury=20.25yr; Level of injury: cervical=1, thoracic=3; Severity of injury: incomplete=3, complete=1; Depression status=symptoms.	1.	Moderate to large effect sizes were seen on measures of depression (d = 0.67), anxiety (d=2.39), and satisfaction with social roles and activities (d=0.43) from baseline to post- intervention.
Mehta et al. (2021) Canada Pre-Post Level 4 N=4	Intervention: Online group-based physical activity (PA) program, consisting physical exercises and peer social interaction, 60min/session, 2x/wk for 6wk. The Physical Activity Group Environment Questionnaire and Participant Satisfaction Survey (PSS) were assessed post-intervention. The Quality of Life in Neurological Disorders short-form (NeuroQoL- SF) was assessed at baseline, post- intervention, and at 3mo follow-up. <b>Outcome Measures:</b> Participant Satisfaction Survey (PSS), participant recruitment, engagement, and retention, Physical Activity Group Environment Questionnaire, Quality of Life in Neurological Disorders short-form (NeuroQoL- SF).	2. 3. 4. 5.	The improvements were maintained just for anxiety (d=2.02) and satisfaction with social roles and activities scores (d=0.52) at 3mo follow-up. Participants were highly satisfied with the program in general, the instructions, the instructor's knowledge, effectiveness, and content of the program. Participants were moderately- highly satisfied with the accessibility of the program. Participants were mixed satisfied with the technology of the program.
<u>Crane et al.,</u> (2017) USA	<b>Population:</b> Intervention Group: Mean age=43.8±15.3 yr; Gender:	1.	Significant improvement in state of health as well as a significant

Author Year Country Research Design PEDro Score Total Sample Size	Methods		Outcome
Pre-Post N <sub>Initial</sub> =89 N <sub>Final</sub> =45	males=34, females=11; Level of injury: Paraplegia=11, Tetraplegia (C1-C4)=4, Tetraplegia (C5-C8)=8, Other=22; Severity of injury: AIS A/B=23, C/D=22. Intervention: Participants engaged in a 3-mo physical therapy group exercise class, twice per wk. Outcome Measures: Pre-post intervention interviews about exercise frequency and intensity, perceived health, pain, mood, sleep, and television watching habits.	2.	increase in days per week of moderate to vigorous activity (p<0.05 for both). Total Patient Health Questionnaire-2 depression scores were significantly lower at post-intervention assessment (p<0.05). Participant comments from the interviews reinforced the program's positive influence on their health.
<u>Curtis et al</u> ., (2015) Canada Pre-Post	<b>Population:</b> Mean age=48.4±15 yr; Gender: males=1, females=10; Time since injury=157.4±191.8 mo; Level of injury: complete=3, incomplete=6; unknown=1, not reported=1; Severity of injury: tetraplegia=2, paraplegia=6, unknown=1, not reported=2. <b>Intervention:</b> Participants took part in an 8-wk modified yoga program with assessments taken at baseline and post-intervention.	1.	5 of the 11 participants finished at least 4 sessions and Fisher's exact test revealed that participants who were outpatients were significantly more likely to complete the program than in-patients (p<0.05). No significant differences between baseline and exit scores for any measure (p>0.05).
N=11	Outcome Measures: Pain (Brief Pain inventory (BPI), Pain Catastrophizing Scale (PCS), fatigue (Fatigue Severity Scale (FSS), psychological factors (General Self- Efficacy Scale (GSES), The Positive and Negative Affect Scale (PANAS)) and mindfulness (Toronto Mindfulness Scale (TMS) through self-report.		
<u>Kennedy et al.,</u> (2006) United Kingdom	<b>Population:</b> Gender: males=30, females=5; Age: 18-61 yr, Level of	1.	HADS scores demonstrated significant (p<0.01)

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
Pre-Post N=35	injury: paraplegia=20, tetraplegia=15. Intervention: 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)	improvement in anxiety levels over the duration of the course.
<u>Hicks et al.,</u> (2005) Canada Pre-Post N=14	<ul> <li>Population: Chronic incomplete</li> <li>SCI: N=14; Tetraplegic=11,</li> <li>Paraplegic=3; Gender: males=11,</li> <li>females=3; Age range=20-53 yr;</li> <li>Mean time post injury=7.4 yr; ASIA:</li> <li>B=2, C=12.</li> <li>Intervention: Body weight</li> <li>supported treadmill training</li> <li>(BWSTT) -robotic – up to 45 min,</li> <li>3x/week, 144 sessions (12 mo).</li> <li>Outcome Measures: Center for</li> <li>Epidemiologic Studies Depression</li> <li>Scale (CES-D)</li> </ul>	<ol> <li>Increased life satisfaction and increased physical function satisfaction (p&lt;0.05), after BWSTT.</li> <li>No change in depression or perceived health.</li> </ol>
<u>Warms et al.,</u> (2004) USA Pre-Post N=16	Population: Gender: males=13, females=3; Mean age=43.2 yr; Mean time post injury=14.4 yr. Intervention: "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	<ol> <li>Physical activity: Counts/day increased in 60% of subjects and self-reported activity increased in 69% of subjects, but neither were not significant.</li> <li>Depression: no change.</li> </ol>

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
	at day 4, 7, 11 & 28 (approx. 8 min each). Program lasted for 6 wk and had a final follow up 2 wk post- completion. <b>Outcome Measures:</b> Self Rated Health Scale (SRHS), Center for Epidemiologic Studies Depression Scale (CES-D)	
<u>Guest et al.,</u> (1997) USA Pre-Post N=15	<ul> <li>Population: Traumatic complete paraplegics; N=15; Gender: males=12, females=3; Mean age=28.8 yr; Mean time post injury=3.8 yr.</li> <li>Intervention: Electrically stimulated walking program-32- sessions, using the Parastep® FNS ambulation system.</li> <li>Outcome Measures: Tennessee Self-Concept Scale (TSCS), Beck Depression Inventory (BDI)</li> </ul>	<ol> <li>Physical Self-Concept: decreased after electrically stimulated walking (p&lt;0.05). Those with lower baseline score had the most significant improvements.</li> <li>Depression: decreased after electrically stimulated walking (p&lt;0.05).</li> </ol>
<u>Bradley et al.,</u> (1994) USA Cohort N=37	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 Intervention: Intervention group: 3 mos. Functional Electrical Stimulation (FES) exercise program; Control group: no intervention. Outcome Measures: Multiple Affect Adjective Check List	<ol> <li>Increased in depression &amp; hostility for those who had unrealistic expectations of the FES program (p&lt;0.01 &amp; p&lt;0.05, respectively).</li> </ol>

Several studies (Akkurt et al., 2017; Crane et al., 2017; Hicks et al., 2003; Latimer et al., 2004; Martin Ginis et al., 2003) evaluated the effect of exercise programs which included stretching, aerobic arm ergometry and resistance exercises among those with SCI. The studies found a

significant reduction in depressive symptoms post SCI post-treatment (Crane et al., 2017; Hicks et al., 2003; Latimer et al., 2004; Martin Ginis et al., 2003).

In a small RCT, Bombardier et al. (2021) examined the effectiveness of a physical activity counselling program combined with home exercise toolkit on improving symptoms of depression compared to usual care. The study found that those in the intervention group reported significant improvement in depressive symptoms compared to a usual care group.

A Canadian pre-post study Hicks et al., (2005) examined the effect of Body weight supported treadmill training provided three times a week. This study reported an increase in life satisfaction and physical function satisfaction after 1 year of exercise; however, there was no change in reports of depressive symptoms.

Two studies (K. Curtis et al., 2017; K. J. Curtis et al., 2015) evaluated the effectiveness of yoga among persons with SCI. Curtis et al., (2017) found participants receiving twice weekly yoga had a significant decrease in depressive symptoms compared to the waitlist control group. While, a pre-post study found no effect of yoga among those with SCI (K. J. Curtis et al., 2015).

Two studies, (Bradley, 1994; Guest et al., 1997) examined the effects of an electrically stimulated walking program on individuals with SCI. In a cohort study, Bradley (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 (P. 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.

Kennedy et al., (2006) found participation in an integrated sports activity program resulted in a significant decrease in anxiety symptoms compared to baseline. Diego et al.,(2002) found participants in a massage therapy group experienced significant reduction in anxiety compared to those in the home exercise group.

#### Conclusion

There is level 1a evidence (from three randomized controlled trials; (Hicks et al., 2003; Latimer et al., 2004; Martin Ginis et al., 2003) that small group exercise-based programs reduced depressive symptoms post SCI.

There is level 2 evidence from 1 RCT (Bombardier et al. (2021)) that physical activity counselling combined with at home exercise results in reduction of depressive symptoms compared to usual care.

There is level 4 evidence that body weight supported treadmill training (Hicks et al., 2005), or functional electrical stimulation exercise (Bradley, 1994) may not improve symptoms of depression post SCI.

There is level 1b evidence (K. Curtis et al., 2017) that yoga improves depressive symptoms post SCI.

There is level 4 evidence (Guest et al., 1997) that Parastep FNS ambulation training may result in a decrease in depressive symptoms post SCI.

There is level 4 evidence (P. Kennedy et al., 2006) that integrating sports and recreational activities may result in a reduction of depressive symptoms post SCI.

Small group exercise programs improve depressive symptoms in persons with SCI.

Physical activity counselling and home exercise reduce symptoms of depression post SCI

Yoga improves depressive symptoms.

Body weight supported treadmill training may not improve symptoms of depression post SCI.

Parastep FNS ambulation training may improve symptoms of depression.

Increased sport and recreational activities may improve depressive symptoms.

### 3.6.2 Massage for Depression following SCI

Massage therapy provides several health benefits which may contribute to improved mental health outcomes including stress reduction, improved circulation, pain management, and improved sleep. While research pertaining to its efficacy among individuals with SCI is limited, these benefits, along with a lack of associated adverse effects, may make massage a suitable adjunct therapeutic approach. The following studies review the impact of massage therapy on symptoms of depression.

Table 10. Massage for Depression following SCI

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
<u>Chase et al., (</u> 2013) USA RCT Crossover PEDro=6 N=40	Population: Mean age=40.24yr; Gender: males=33, females=7; Level of injury: paraplegia=7, quadriplegia=33; Severity of injury: incomplete=17, complete=23; Mean time post injury=69.35d; Depression status=symptoms. Intervention: Individuals with any form of pain received compression massage (BCM) and light contact touch (LCT) in a randomized sequence during six 20min sessions over 2wk. Outcomes were assessed pre and post each week. Outcome Measures: Patient Health Questionnaire-9 (PHQ-9).	<ol> <li>PHQ-9 score was reduced significantly more in the LCT- BCM group than in the BCM-LCT group during wk1 (p=0.0085), but not during wk 2 (p=0.0747).</li> </ol>
Diego et al., (2002) USA RCT PEDro=8 N=20	<ul> <li>Population: Mean age=39 yr; Gender: males=15, females=5; Level of injury: tetraplegia; Time since injury=&gt;1 yr.</li> <li>Intervention: 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 for 5 wk on their own.</li> <li>Outcome Measures: State Trait Anxiety Inventory (STAI), Center for Epidemiologic Studies Depression Scale (CES-D).</li> </ul>	<ol> <li>CES-D scores obtained on first day versus last day assessment by group. Repeated measures ANOVA showed a group by day interaction effect (p&lt;0.05).</li> <li>t-tests revealed greater decrease in CES-D depression scores for the massage therapy group (p&lt;0.05).</li> </ol>

Two studies found that massage was effective in reducing symptoms of depression post SCI (Chase et al., 2013; Diego et al., 2002). Diego et al., (2002) found that participants who received twice weekly massage for 5 weeks had a greater reduction in depressive symptoms than those that participated in a 5 week exercise program. A second study reported that light contact touch was more effective at reducing symptoms of depression than compression massage (Chase et al., 2013).

#### Conclusion

There is level 1b evidence (Diego et al., 2002) that massage may be effective in reducing symptoms of depression post SCI.

Massage may be effective in reducing symptoms of depression.

## 3.7 Physical Stimulation Interventions for Depression following SCI

Neurostimulatory techniques have the potential to benefit symptoms of depression following SCI by modulating brain activity and promoting neuroplasticity. While this field of study is still evolving, and is particularly limited in the SCI population, several studies have assessed the potential for various therapies to impact depressive symptoms following SCI.

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
Tan et al., (2011) USA RCT PEDro=8 N <sub>Initial</sub> =105 N <sub>Final</sub> =100	Population: Mean age=52yr; Gender: males=90, females=15; Level of injury: paraplegia=66, quadriplegia=37, unknown=2; Severity of injury: incomplete=52, complete=42, unknown=11; Mean time post injury=15yr; Depression status=symptoms. Intervention: Individuals with chronic neuropathic pain were randomized to receive active cranial electrotherapy stimulation (CES, treatment; n=46) or sham CES (control, n=59) 1hr/d for 21d. Outcomes were assessed pre and post treatment. Outcome Measures: Center for Epidemiologic Studies Depression Scale – Short Form (CES-D-SF), State-Trait Anxiety Inventory – Short Form (STAI-SF).	<ol> <li>At baseline, the treatment group had significantly poorer scores on CES-D-SF (p&lt;0.05).</li> <li>There was no significant main effect of time on CES-D-SF.</li> <li>There were no significant time x group interactions on CES-D-SF.</li> </ol>
Defrin et al., (2007) Israel	<b>Population:</b> Mean age=54 yr; Gender: males=7, females=4.	1. Real and sham TMS groups showed a significant decrease in

Table 11. Physical Stimulation for Depression following SCI

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
RCT PEDro=10 N=12	Intervention: Individuals 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. The primary outcome measure was pain, while depression was a secondary outcome measure for the treatment.	<ul> <li>BDI values following the treatment period in comparison to pretreatment BDI values (p&lt;0.01).</li> <li>This reduction was maintained by both groups at follow-up (4.5 wk) (p&lt;0.01).</li> <li>Only individuals 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&lt;0.05).</li> </ul>
	Outcome Measures: Beck Depression Inventory (BDI)	
Fregni et al.,(2006) USA RCT PEDro=8 N <sub>Initial</sub> =17 N <sub>Final</sub> =15	Population: Mean age=35yr; Gender: males=14, females=3; Level of injury: paraplegic=8, quadriplegic=9; Severity of injury: incomplete=6, complete=11; Mean time post injury=3.5yr; Depression status=symptoms. Intervention: Individuals with central pain were randomized to receive active transcranial direct current stimulation (tDCS, treatment; n=11) or sham tDCS (control, n=6) 20min/d for 5d. Outcomes were assessed at baseline, 1-5d pre and post treatment, and 16d follow-up. Outcome Measures: Beck Depression Inventory (BDI), Visual Analogue Scale-Anxiety (VAS-A).	<ol> <li>On BDI, there was no significant effect of time (p=0.82), group (p=0.43), or time x group interaction (p=0.94).</li> </ol>

Three studies evaluated the using of physical stimulation interventions in reducing depressive symptoms post SCI (Defrin et al., 2007; Fregni et al., 2006; Tan et al., 2011). One RCT by Defrin et al., (2007) evaluated the effectiveness of transmagnetic stimulation in reducing pain post-SCI. This study found a significant decrease in depression in individuals treated with

transmagnetic stimulation compared to those in the control group at time of follow-up 2-6 weeks post treatment. No significant effects were seen of transcranial electrical stimulation or transcranial direct current stimulation (Fregni et al., 2006; Tan et al., 2011).

#### Conclusion

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

Repetitive transmagnetic stimulation may improve symptoms of depression post SCI.

## 3.8 Hyperbaric Oxygen for Depression following SCI

Hyperbaric oxygen therapy is a medical treatment involving breathing pure oxygen in a pressurized environment to increase the amount of blood dissolved oxygen and tissue oxygen reserves. While the potential mechanisms of action are not fully understood, HBO may benefit symptoms of depression via increased oxygen delivery to enhance cellular/neuronal function, neuroplasticity, and reductions in inflammation. A single study has assessed the efficacy of HBO for the treatment of depression following SCI.

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome	
Feng et al., (2017) China RCT PEDro=6 N=60	Population: HBO group (n=20): Mean age=36.1±5.2 yr; Gender: males=14, females=6; Level of injury: C=7, T=8, L=5; Severity of injury: AIS A=0, B=12, C=5, D=3. Psychotherapy group (n=20): Mean age=34.8±4.7 yr; Gender: males=15, females=5; Level of injury: C=8, T=6, L=6; Severity of injury: AIS A=0, B=10, C=8, D=2. Conventional rehabilitation group (n=20): Mean age=33.1±4.6 yr; Level of injury: C=7, T=9, L=4; Severity of injury: AIS A=0, B=10, C=7, D=3.	<ol> <li>HAMD score was significantly lower in both the HBO and psychotherapy groups compared to the control group at the end of 8 wk (p&lt;0.05 for both) with no significant difference between HAMD score for HBO and psychotherapy groups from baseline to 8 wk (p&gt;0.05).</li> <li>HAMA score was significantly lower for the HBO group than for the control group (p&lt;0.05) with no significant difference in HAMA score between the HBO and psychotherapy groups (p&gt;0.05).</li> </ol>	

Table 12. Hyperbaric Oxygen for Depression following SCI

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
	Intervention: Participants were randomly allocated to either a hyperbaric oxygen group (HBO), a psychotherapy group or a conventional rehabilitation group for an 8-wk intervention in which all three groups received routine rehabilitation on top of their intervention. Therapy sessions occurred once a day, 6 days a wk for 8 wk. <b>Outcome Measures:</b> Hamilton depression scale (HAMD), Hamilton anxiety scale (HAMA), American spinal injury association score (AISA) and functional independence	

One study evaluated the effectiveness of hyperbaric oxygen in reducing symptoms of depression compared to a psychotherapy group and a conventional rehabilitation group (Feng & Li, 2017). The study found both HBO and psychotherapy groups had significant reduction in symptoms of depression compared to a conventional rehabilitation group.

#### Conclusion

There is level 1b evidence (Feng & Li, 2017) that hyperbaric oxygen may improve depressive symptoms post SCI.

Hyperbaric oxygen may improve depressive symptoms.

## 3.9 Education for Depression following SCI

Education may benefit symptoms of depression by empowering individuals to take an active role in their mental health and learn better coping mechanisms. Several studies have evaluated the effects of educational interventions on symptoms of depression following SCI.

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
Zemper et al., (2003) USA RCT PEDro=4 N <sub>Initial</sub> =67 N <sub>Final</sub> =43	Population: Participants recruited from an outpatient clinic or Center for Independent living. The 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%. Intervention: 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 Disabilities Scale (PADS).	<ol> <li>The intervention group showed statistically significant improvement after intervention in several areas as compared to the control group: SAHP: (p&lt;0.05) HPLP-II: (p&lt;0.001). Nutrition HPLP-II subscale: improvement in nutritional awareness and behaviour (p&lt;0.05) Stress HPLP-II subscale: Increased use of stress management techniques and decreases in perceived stress (p=.001).</li> <li>SCS: fewer and less serious secondary conditions (p&lt;0.001) Depression was less though did not reach significance.</li> </ol>
<u>Federici et al.,</u> (2019) Italy Pre-Post N=11	<b>Population:</b> Mean age: males=50.4±7.3 yr, females=41.5±11.26 yr; Gender: males=5, females=6; Time since injury=30.1±9.4 yr; Level of injury: tetraplegia=3, paraplegia=4, no paraplegia/tetraplegia=4: Severity	<ol> <li>All participants improved significantly on item 5 of the SIS scale "How are your opportunity and your ability to enjoy sexuality yourself?" (p&lt;0.01), SIS scale total score (p&lt;0.05) and BAI scores (p&lt;0.05).</li> </ol>

Table 13. Education for Depression following SCI

Author Year Country Research Design PEDro Score Total Sample Size	Methods		Outcome
	of injury: complete=5, incomplete=2, none=4. Intervention: Participants were 4 couples (one with SCI and one without) and 3 singles with SCI who took part in a sexual health psychoeducational intervention in which 4 couples and 3 singles met every two weeks for 12 meetings of a growth group and reported the results of their love lives and persona lives. <b>Outcome Measures:</b> Sexual interest and satisfaction scale (SIS), Beck depression inventory – II (BDI-II) and Beck anxiety inventory (BAI).	<ol> <li>N</li> <li>Si</li> <li>Si</li> <li>O</li> <li>O</li></ol>	o difference was found for SIS cale's general satisfaction after njury or for BDI (p>0.05). ignificant effect found on item 5 f the SIS scale "How are your pportunity and your ability to njoy sexuality yourself?" for oth individuals and partners p<0.05 for both).
	<b>Population:</b> Gender: mixed group- with more males; Mean time since	1. A tł	n overall difference between ne two groups was found
Dunn et al., (2000) USA PCT N <sub>Initial</sub> =371 N <sub>Final</sub> =371	injury=18.44 yr. Intervention: Follow-up after initial rehabilitation was completed addressing the secondary conditions post-SCI as well as the primary effects of their spinal cord injury. The focus is wellness, health promotion, and illness prevention through a continuum of coordinated care. <b>Outcome Measures:</b> Secondary Conditions Scale (SCS); Check Your Health Questionnaire (CYHQ).	(K 2. N re su F, (K (K (K (K 8. A 0 in d 3. A 0 in d au eu re in d	<ul> <li>b=0.0004).</li> <li>Medical Follow-up group</li> <li>eported a significantly higher</li> <li>ubjective rating than did the No-/U group on 3 variables: Health</li> <li>b=0.0068), Independence</li> <li>b=0.005), Absence of depression</li> <li>b&lt;0.0001). (Fisher's protected</li> <li>east significant diff. test).</li> <li>MANOVA showed a main effect</li> <li>n education on health,</li> <li>ndependence, and absence of</li> <li>epression (p=0.0098). Further</li> <li>nalysis showed that as</li> <li>ducation increased subjects</li> <li>eported greater health, and</li> <li>ndependence and lower</li> <li>epression.</li> </ul>
Three studies evaluated the effect of an education program in reducing symptoms of depression post SCI (Dunn et al., 2000; Federici et al., 2019; Zemper et al., 2003). Two programs involved education regarding wellness and health promotion (Dunn et al., 2000; Zemper et al., 2003). Zemper (2003) found no significant improvement in depressive symptoms; while, Dunn (2000) found that the intervention resulted in decreased depressive symptoms. Federici et al., (2019) provided sexual health psychoeducation over 12 sessions and found no significant improvement in depressive symptoms.

## Conclusion

There is conflicting evidence for the effectiveness of education programs in reducing depressive symptoms post SCI (Dunn et al., 2000; Federici et al., 2019; Zemper et al., 2003).

Education may not improve depressive symptoms post SCI.

# 3.10. Mesenchymal Stem Cells Transplantation for Depression following SCI

Bone marrow mesenchymal stem cells (BMSCs) are highly proliferating and self-renewing cells. Transplantation of BMSCs may be an effective treatment for nerve injury reconstruction or regeneration in patients with SCI. (Assinck et al. (2017))

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
Yang et al. (2020) China RCT Pedro=6 Level 1b N=68	Population: Intervention group (autologous Bone Marrow Mesenchymal Stem Cells (BMSCs) transplantation therapy; n=34): Mean age=35.29±8.04yr; Gender: males=27, females=7; Mean time post injury=Not reported; Level of injury: thoracic: 34; Severity of injury: AIS A= 22; AIS B= 7; AIS C=5; Depression status=moderate-severe as assessed by the Self rating Depression Scale	<ol> <li>The SAS and SDS scores of BMSCs transplantation group after treatment were significantly lower than those of standard occupational therapy group (p&lt;.001).</li> <li>The SAS and SDS scores of BMSCs transplantation group and standard occupational therapy group post treatment were significantly lower than</li> </ol>

Table 14. Mesenchymal Stem Cells Transplantation for Depression following SCI

Control group (standard	those before treatment
occupational therapy n=34).	(n < 0.01)
Mean age=34 67+7 59vr	(p).
Gender: males= $26$ females= $8$ ·	
Mean time post injury=not	
reported: Level of injury:	
thoracic-34: Severity of injury:	
Als $A = 20^{\circ}$ Als $B = 9^{\circ}$ Als $C = 5^{\circ}$	
Depression status=moderate-	
severe as assessed by the Self	
rating Depression Scale	
intervention: Participants were	
Marrow Masanshumal Stam	
Colls (BMSCs) transplantation or	
cells (BIVISCS) transplantation of	
The BMSCs transplantation	
therapy group received 2y Depa	
Magney Massachursel Stars	
Collectroperloat 10d exert in	
Cells transplant 100 apart in	
addition to renabilitation	
services for 1mo. The standard	
occupational therapy group	
received both physiotherapy	
and occupational therapy	
services for 1mo. Outcome	
measures were assessed before	
and after treatment.	
Outcome Measures: American	
Spinal Injury Association (ASIA)	
scores, Motor and sensory	
function using the muscle	
strength grading standard and	
sense of pain and tactile sense,	
Self-rating Anxiety Scale (SAS),	
Self-rating Depression Scale	
(SDS)	

One RCT evaluated the effectiveness of standard rehabilitation or standard rehabilitation with BMSC transplantation among patients admitted to the hospital. The study found that among those that received both standard rehabilitation and BMSC transplantation, there was a significant reduction in depressive symptoms compared to the rehabilitation only group.

Conclusion

There is level 1b evidence from one RCT that mesenchymal stromal cells combined with standard SCI rehabilitation is effective at reducing symptoms of depression compared to SCI rehabilitation alone.

Mesenchymal stromal cells combined with standard SCI rehabilitation may be effective in reducing symptoms of depression post SCI.

## 3.11 Virtual Reality for Depression following SCI

Virtual reality (VR) programs that simulate natural environments may promote positive psychoemotional health outcomes (Kim et al. 2010).

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
Lakhani et al. (2020) Australia RCT Crossover Pedro=3 Level 2 N <sub>Initial</sub> =24 N <sub>Final</sub> =20	Population: Intervention group 1 (VR session first; n=10) Mean age=56.2±20.7yr; Gender: males=100%; Mean time post injury=135.2±63.64d; Level of injury: cervical=5, thoracic/lumbar=5; Severity of injury: AIS A=7, AIS B=1, AIS C=2, AIS D=0; Depression status=mild as assessed by the PHQ-8. Intervention group 2 (usual care first; n=14): Mean age=48±16.21yr; Gender: males=6, females=8; Mean time post injury=127.21±79.51d; Level of injury: cervical=6, thoracic/lumbar=8; Severity of injury: AIS A=3, AIS B=0, AIS C=7, AIS D=4; Depression status=mild as assessed by the PHQ-8. Intervention: The treatment condition and the control	<ol> <li>A t-test confirmed that the Td1 PHQ-8 values were significantly different between groups (p&lt;.05). Difference scores were significantly greater for group 1 participants, and the direction of the change suggests that the psycho- emotional health of group 1 (intervention condition) had improved significantly compared with group 2 (control condition).</li> <li>A second t test confirmed that the Td2 PHQ-8 values were not significantly different between groups (p&gt;.05). While the direction of difference scores suggested that psycho- emotional health improved for the group 2 (intervention condition)</li> </ol>

Table 15. Virtual Reality for Depression following SCI

condition were tested over 2wk.		compared with group 1
The intervention week involved		(control condition), the
participation in up to three		difference was not
20min virtual reality (VR)		significant.
sessions over 3d, where a	3.	The effect size of the
diversity of virtual natural		difference in Td1 and Td2
environments available via the		values between groups was
Oculus Go VR headset were		large and medium,
delivered. The control condition		respectively.
involved regular rehabilitation		
practice over 1wk. Group 1		
participants experienced the		
intervention during week 1 and		
the control during week 2, while		
group 2 experienced the		
opposite. The PHQ-8 was		
completed at 3 time points: T1		
prior to the first condition, T2		
immediately after the first		
condition and prior to the		
second condition, and T3 after		
the second condition. The		
feeling intensity scales were		
completed prior to and		
following each VR session.		
Outcome Measures: Patient		
Health Questionnaire-8 (PHQ-		
8), three feeling intensity scales		
(adapted versions of the		
Depression Intensity Scale		
Circles).		
,		

In a crossover RCT, Lakhani randomized individuals into two groups. Group 1 received rehabilitation with virtual natural environments on the Oculus Go VR headset in the first week followed by regular rehabilitation. Group 2 received regular rehabilitation for the first week followed by combined VR and rehabilitation. The study found that after the first week, those in Group 1 had significantly lower levels of depressive symptoms compared to Group 2. This difference was no longer significant at the end of week 2 when all participants had received VR intervention.

### Conclusion

There is level 2 evidence that the use of virtual natural environment with traditional rehabilitation results in reduction of depressive symptoms compared to rehabilitation alone.

Virtual reality programs may be effective in reducing symptoms of depression post SCI.

# 3.12. Targeted Job Information Interventions for Depression following SCI

Access to return to work programs may be helpful in obtaining employment for those post SCI. These programs include information on general work skills and job specific skills. Engaging in employment skills programs can help to improve individuals' self-confidence (Dorstyn et al. 2023).

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
Dorstyn et al. (2019) Australia RCT Pedro=5 Level 2 NInitial=48 NFinal=36	Population: Intervention group (Work and SCI; n=25): Mean age=43±10.9yr; Gender: males=12, females=13; Mean time post injury= 12.5±12.4yr; Level of injury: paraplegia=15, tetraplegia=10; Severity of injury: incomplete=13, complete=10, unknown=2; Depression status: 'mixed'. <i>Control group</i> (Waitlist; n=23): Mean age=40.7±11yr; Gender: males=15, females=8; Mean time post injury= 10.7±13.2yr; Level of injury: paraplegia=13, tetraplegia=9, not reported=1; Severity of injury: incomplete=9, complete=14; Depression status=mixed. Intervention: Participants were randomly assigned to the 4wk Work and SCI intervention or to a waitlist control group. The Work and SCI involved one introductory and six stand-alone	<ol> <li>Intention to Treat analyses found no significant main or interaction effects for the primary or secondary outcomes (p&gt;.05).</li> <li>'Work and SCI' participants did, however, report small improvements in optimism from T1 to T2 (g=.24 [CI: .04, .44] p=.02) in comparison to controls (g = 04 [CI:29, .21] p=.75). This equated to a significant group x time interaction effect (LOT-R F(1, 33)=3.98, p .05; g=0.36, CI: .04, .68, p=.03). However, there was wide variability on this measure, with six intervention participants reporting negligible or no change in pre-post levels of optimism.</li> </ol>

Table 16. Targeted Job Information Interventions for Depression following SCI

online learning modules	
covering requisite job search	
and career planning skills.	
Outcomes measures were	
assessed at baseline, and 4wk	
post intervention.	
Outcome Measures: 25-item	
Job Procurement Self-Efficacy	
Scale (JSES), Life Orientation	
Test-Revised (LOT-R), Patient	
Health Questionnaire (PHQ-9),	
job search activity engagement,	
engagement with the	
intervention program.	
	online learning modules covering requisite job search and career planning skills. Outcomes measures were assessed at baseline, and 4wk post intervention. <b>Outcome Measures:</b> 25-item Job Procurement Self-Efficacy Scale (JSES), Life Orientation Test-Revised (LOT-R), Patient Health Questionnaire (PHQ-9), job search activity engagement, engagement with the intervention program.

In an RCT, participants were randomized to a return-to-work intervention group or a wait list control group. The study found no significant difference between the two groups on outcomes of depression post intervention.

#### Conclusion

There is level 2 evidence that return-to-work interventions may not improve symptoms of depression post SCI.

Return to work interventions may not be effective in reducing symptoms of depression post SCI.

## 3.13. Multidisciplinary Interventions for Depression following SCI

Several studies have evaluated multidisciplinary interventions for depression following SCI consisting of various combinations of behavioural and/or physical interventions in both externally guided and self-managed interventions.

Author Year	Methods	Outcome
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Country Research Design PEDro Score Total Sample Size		
Mu	ltidisciplinary telehealth consultat	ion
	<b>Population:</b> <i>Intervention group</i> (mobile health rehabilitation + standard care; n=19): Mean age=37.9±13.4yr; Gender: males=13, females=6; Mean time post injury=9.9±8yr; Level of injury: Paraplegia=11, tetraplegia=8; Severity of injury: Complete=9, incomplete=10; Depression status: mild as assessed by the BDI-II.	<ol> <li>From all the psychosocial scales, none of them showed significant changes from baseline to 9mo (p&gt;.05).</li> </ol>
	<i>Control group</i> (Usual care; n=19)	
<u>Kryger et al.</u> (2019) United States RCT Pedro=6	Mean age=44±15.3yr; Gender: males=12, females=7; Mean time post injury=13.5±11yr; Level of injury: Paraplegia=10, tetraplegia=9; Severity of injury: Complete=12, incomplete=7; Depression status=mild as assessed by the BDI-II.	
Level 1b N <sub>Initial</sub> =38 N <sub>Final</sub> =33	Intervention: Participants were randomly assigned to receive Interactive mobile Health rehabilitation using the iMHere system in addition to usual care, or usual care only. The iMHere app included several modules: 1) medication management, 2) urinary and bowel program reminders, with a system for reporting concerning symptoms, 3) skincare tracking with photo capabilities to monitor for pressure injuries and skin breakdown, 4) mood tracking with validated surveys, and 5) messaging, to communicate with a clinician. Outcome measures were	

	assessed at baseline, 3mo, 6mo, and 9mo post-intervention. <b>Outcome Measures:</b> Number of UTIs, number of pressure injuries, number of emergency department visits (for any reason, or for UTIs or pressure injuries), number of hospitalizations (for any reason, or for UTIs or pressure injuries), Canadian occupational performance measure (COPM), Adolescent self-management and Independence scale, Beck Depression Inventory-II (BDI-II), Patient Assessment of Chronic Illness care, World Health Organization Quality of Life measure Brief (WHOQOL-Brief), Craig Handicap Assessment and Reporting Technique Short Form using the physical domain only.	
Khong et al. (2022) United States Cohort Level 2 N <sub>Initial</sub> =83 N <sub>Final</sub> =75	Population: Intervention group (Tele-SCI engagers; n=62): Mean age=41.24±17.08yr; Gender: males=46, females=16; Mean time post injury= 89, 74.8- 109.3d (median, IQR); Level of injury: Cervical=43, thoracic=15, lumbar=4; Severity of injury: Complete=27, other=35; Depression status=normal to mild as assessed by PHQ-9 <i>Control group</i> (Tele-SCI non- engagers; n=21): Mean age=41.43±13.71yr; Gender: males=19, females=2; Mean time post injury= 78, 69-120.3d (median, IQR); Level of injury: Cervical=15, thoracic=6, lumbar=0; Severity of injury: Complete=13, other=8; Depression status: normal to mild as assessed by PHQ-9	<ol> <li>There were no significant between-group differences in the measures of life satisfaction (LSIA), reintegration (RNLI,) and depression (PHQ-9) (all p&gt;.1) at any time point.</li> <li>Psychological concern was the seventh common concern discussed during the FaceTime tele-SCI visits among engagers with the frequency of 39 times (5.5%).</li> </ol>

	Internetion, Deutisinguite	[ ]
	Intervention: Participants received a 9.7-inch Apple iPad, 6-month data plan, hand stylus, and adaptive equipment and received training. Participants had the option of engaging in tele-SCI consultations and visits with a SCI physiatrist using video-chat application FaceTime during the 6mo study duration. Outcome measures were assessed at baseline, and monthly (1x/mo) during the 6mo study duration.	
	Outcome Measures: Life Satisfaction Index-A (LSIA), Patient Health Questionnaire-9 (PHQ-9), Reintegration into Normal Living Index (RNLI), Program Satisfaction Survey (PSS), number of ED visits, hospitalizations, in-office physician visits, tele-SCI encounters, and inquiries seeking clinical advice from any medical professional by phone or email (e.g., urinary tract infections [UTI] advice from primary care physician or daily activities from an occupational or physical therapist) were assessed.	
Dhakal et al. (2022) United Kingdom Pre-Post Level 4 N=97 SCI=82	Population: Mean age=38.4±12.2yr; Gender: males=77, females=20; Mean time post injury=not reported; Level of injury: paraplegia=64, tetraplegia=18; Severity of injury: not reported; Depression status=mixed. Intervention: Consultations with a multidisciplinary team (MDT) completed via a tele- rehabilitation system (1-2x/wk) until goal achievement. The MDT discussed the ongoing	<ol> <li>The scores for severity of depression, anxiety, and stress for participants with SCI or ABI significantly decreased after intervention (p&lt;.01).</li> <li>The EQ-5D index score significantly increased post- intervention (p&lt;.001).</li> <li>There was a significant mean difference (P&lt;.001) between the pre-and post- intervention MBI, and the visual analogue scale</li> </ol>

	physical, cognitive, psychological, and vocational problems encountered by participants during the consultations and offered advice and referrals accordingly. Outcome measures were assessed at baseline, and 4wk post-intervention.		included as an item of the EQ-5D-5L with effect sizes - 0.4 and -0.7 respectively.
	Barthel Index (MBI), Depression Anxiety Stress Scale (DASS), EuroQoL 5 (EQ-5D-5L).		
Multidi	sciplinary Self-Management Interv	enti	ons
Liu et al. (2022) China RCT Pedro=6 Level 1b N <sub>Initial</sub> =102 N <sub>Final</sub> =98	Population: Intervention group (App-based self-management; n=49): Mean age=40.37±12.18yr; Gender: males=41, females=8; Mean time post injury= <2yr; Level of injury: Cervical=14, thoracic=24, lumbar and below=11; Severity of injury: AIS A=25, AIS B=5, AIS C=9, AIS D=7, AIS E=3; Depression status=mild according to mean BDI-II score. Control group (Telephone follow-up; n=49): Mean age=43.06±12.06yr; Gender: males=40, females=9; Mean time post injury= <2yr; Level of injury: Cervical=15, thoracic=22, lumbar and below=12; Severity of injury: AIS A=23, AIS B=3, AIS C=9, AIS D=9, AIS E=6; Depression status=mild according to mean BDI-II score. Intervention: Participants were randomly given either telephone follow-ups after discharge as control, or an APP- based self-management as intervention. The control group were given calls at 12wk post-	1.	BDI-II scores progressively increased in the control group from baseline to 24wk (p=.002), indicating the higher level of depression over the study period. The depression score started to decrease in the intervention group from 12wk, and the depression level was significantly lower in the intervention group compare with the control at 24wk (p=.007).
	intervention. The control group were given calls at 12wk post- discharge to check in on skin		

	care, managing defecation, self- care, and function training. The intervention group were given five sessions of intervention including health education by a nurse, interaction with medical staff, and referral to specialists via APP at 2wk, 4wk, 6wk, 8wk, and 12wk post-discharge. Outcome measures were assessed at 12wk and 24wk post discharge. <b>Outcome Measures:</b> Beck Depression Inventory-2 (BDI-II).	
Li & Fu (2020) Canada PCT Level 2 N=124	Population: Intervention group (health management + aerobic exercise, n=68): Mean age=45.36±6.33yr; Gender: males=37, females=31; Mean time post injury=<5yr (n=15), 5+yr (n=53); Level of injury: not reported; Severity of injury: incomplete=57, complete=11; Depression status=moderate depression as assessed by Beck Depression Inventory (BDI). <i>Control group Control group</i> (aerobic exercise, n=56): Mean age=43.87±5.92yr; Gender: males=29, females=27; Mean time post injury=<5yr (n=14), 5+yr (n=42); Level of injury: not reported; Severity of injury: incomplete=43, complete=13; Depression status=moderate depression as assessed by Beck Depression Inventory (BDI). Intervention: A management plan was developed based on the patient's condition and self- care ability publicized to family and patients. It was also combined with aerobic exercise program mainly containing upper limb tension training, weights, and wheelchair	<ol> <li>The WHOQOL-BREF outcome scores were significantly improved in intervention groups compared with the control group in physiological domain, psychological domain, and total QOL (p&lt;.05). However, no statistical differences were observed in social relationship and environmental domains (p&gt;.05) between groups.</li> <li>Anxiety and depression scores reduced notably in both groups (p&lt;.05), and the scores in the intervention group were significantly lower than the control after treatment (p&lt;.05).</li> </ol>

	exercises 30min/d, 5x/wk for 4wk. The control group underwent routine aerobic exercise only. Outcomes measures were assessed at baseline, and post intervention. <b>Outcome Measures:</b> Barthel Index (BI), World Health Organization Quality of Life (WHOQOL-BREF), Hamilton Anxiety Scale (HAMA), Beck Depression Inventory (BDI), Rehabilitation assessment indicators, Cardiopulmonary indicators.	
	Systematic Nursing Interventions	
Xia et al. (2022) China PCT Level 2 N=90	Population: Intervention group (Systematic nursing; n=45): Mean age=36.75±3.32yr; Gender: males=23, females=22; Mean time post injury=not reported; Level of injury: not reported; Depression status= severe according to mean total HADS. <i>Control group</i> (Rehabilitation training plan; n=45): Mean age=36.69±3.29yr; Gender: males=21, females=24; Mean time post injury=not reported; Level of injury: not reported; Severity of injury: not reported; Depression status=severe according to mean total HADS. Intervention: Two groups of patients were given either usual care with a diet plan as control, or the systematic care model as the intervention. The systematic care model involved a nurse educating the patient and family about the SCI and recovery, doing psychological interventions to ease patient	<ol> <li>HADS scores significantly decreased in both groups after the intervention (p&lt;.05), and the scores were markedly lower in the intervention group than the control group (p&lt;.05).</li> <li>QOL scores significantly increased in both groups after the intervention (p&lt;.05), and the scores were markedly higher in the intervention group than the control group (p&lt;.05).</li> <li>The intervention group showed better self-efficacy levels (GSES) than the control group after intervention (p&lt;.05).</li> </ol>

discomfort, and creating care plans and diet instruction pre and post operation.	
Outcome Measures: Generic quality of life inventory (GQOLI- 74), and Hospital anxiety and depression scale (HADS), Incidence of complications, Rehabilitation outcomes including Functional Independence Measure (FIM), General Self-efficacy Scale (GSES), and Modified Barthel Index (MBI).	

One RCT, examined the effectiveness of a multidisciplinary telehealth consultation and mobile application monitoring on those post SCI. The study found no significant improvement on psychosocial outcomes compared to the control group (Kryger et al. (2019)). Two pre-post trials examined the use of teleconsultations among those post SCI. Dhakal et al. (2022) found significant improvement in symptoms of depression post intervention, while Khong et al. (2022) found no effect.

#### Conclusion

There is level 1b evidence that multidisciplinary telehealth consultations do not reduce symptoms of depression post SCI.

Multidisciplinary telehealth consultations may not be effective in reducing symptoms of depression post SCI.

## 4.0 Anxiety

Anxiety significantly contributes to disability among persons with SCI with up to 45% of individuals experiencing excessing worry, fear or panic (Le & Dorstyn, 2016). The effects of anxiety are often triggered among those with traumatic injuries. However, those with non-traumatic origins also experience anxiety related to their secondary conditions.

## 4.1 Prevalence of Anxiety Post-SCI

Prevalence rates of anxiety among those with SCI vary due to differing definitions and outcome measures utilized. Additionally, outcome measures may inflate prevalence estimates due to overlap of somatic symptoms related to secondary complications experienced by those with SCI including blood pressure, motor weakness, and respiratory function (Julian, 2011). However, some use of self-report measures to estimate prevalence may lead to underreporting due to socially desirable responding by individuals (Hunt, Auriemma, & Cashaw, 2003). A meta-analysis found that 27% of individuals reported clinically significant symptoms of anxiety (Le & Dorstyn, 2016). Anxiety estimates were found to be similar among hospital and community samples (27 versus 29%) (Le & Dorstyn, 2016). Longitudinal studies demonstrate levels do not diminish over time of up to 2 years post injury (AR Craig, Hancock, & Dickson, 1994).

## 4.2 Interventions for Management of Anxiety following SCI

Interventions for anxiety following spinal cord injury (SCI) present their own unique set of challenges and considerations. Conducting intervention studies in this population can be complex due to the diverse nature of SCI-related anxiety. Individuals with SCI may experience anxiety stemming from various factors such as physical limitations, psychological adjustment, and changes in social roles. This heterogeneity makes it crucial to develop tailored interventions that address the specific anxiety concerns of each individual. However, similar to depression interventions, the availability of a large number of participants for research purposes can be limited at individual sites, requiring collaboration among multiple centers to obtain an adequate sample size. Ethical considerations also arise, as providing comprehensive care to all individuals with SCI is paramount, making it challenging to establish control conditions that involve withholding treatment. Furthermore, the assessment of anxiety in the SCI population often relies on self-report measures, including standardized tools. (Kisala et al. (2015)) While these measures offer convenience and cost-effectiveness, further evaluation is needed to determine their validity and applicability in the context of SCI-related anxiety. Overall, interventions for anxiety following SCI demand careful attention to the diverse nature of anxiety presentations, collaboration among research sites, ethical considerations, and the refinement of assessment measures to ensure accurate diagnosis and effective treatment.

able 10. Systematic new	ws and meta Analysis. An meatherne	
Authors Year Country Date of Studies Included	Method	Conclusions
AMSTAR Score Total Sample Size		

Table 18. Systematic Reviews and Meta-Analysis: All Treatments

Davari et al. (2020) Iran reviews of published articles up to December 2018 AMSTAR=9 N=9	Method: A systematic review and meta-analysis of English RCTs on humans including any age group; comparing Pregabalin to Gabapentin or placebo; and measuring neuropathic pain as an outcome. Databases: PubMed, Cochrane Library, Embase, Scopus, the Web of Science. Level of evidence: Poor methodological quality RCTs: using Cochrane Collaboration's tool. Questions/measures/hypothesis: to examine the safety and efficacy of pregabalin (PGB) and gabapentin (GBP) in the treatment of neuropathic pain due to SCI.	1.	Anxiety and depression symptoms were improved by Pregabalin use when compared to placebo (p<.05).
Hearn & Cross (2020) United Kingdom Review of published articles from 1996 to 2019. AMSTAR=8 N=5	Method: Comprehensive literature search of English studies with adults (18yr+) living with SCI, regardless of etiology, who had mindfulness training as a part of their intervention. Databases: PsycINFO, PsycARTICLES, MEDLINE. Level of evidence: Three of the papers were of poor/low quality, while two were moderate quality according to the Cochrane Collaboration Risk of Bias tool. Questions/measures/hypothesis: To synthesize and critically appraise available quantitative and qualitative evidence on the effects of Mindfulness-Based Interventions (MBIs) on pain and pain-related outcomes, depression, anxiety, and QoL in people with SCI; to make specific recommendations for future research based on current knowledge.	1. 2. 3.	One study reported no change in depressive symptoms, while the other four studies reported significant improvements in depression symptoms (p<.05). Four studies examined anxiety but only one reported significant decrease in anxiety symptoms (p<.05), and another study showed no change. The other studies did not use statistical analysis to determine the impact of their interventions. Two studies examined changes in QoL, both of which reported no significant changes in QoL following MBIs.
<u>Yu et al.</u> (2020)	<b>Method:</b> Reviewed RCTs that compared noninvasive brain stimulation (NIBS) with sham	1.	Noninvasive brain stimulation showed no beneficial effect over

China Published up to January 31, 2019 AMSTAR=7 N=11	stimulation for neuropathic pain (NP), depression, and anxiety levels for SCI patients, and conducted a meta- analysis. <b>Databases:</b> Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE, Embase, PsycINFO, Physiotherapy Evidence Database (PEDro). <b>Level of evidence:</b> 10 RCTs with level 1a evidence (PEDro=>6), and one RCT with level 1b evidence (PEDro=5). <b>Questions/measures/hypothesis:</b> The aim of meta-analysis was to examine the effectiveness of NIBS in the treatment of NP, and depression and anxiety symptoms among individuals with SCI.		sham stimulation on the improvement of depression (p>.05) but had significant effect on improvement of anxiety symptoms (p<.05).
Onakpoya et al. (2019) United Kingdom Database inception to January 2018 AMSTAR=8 N=26	<ul> <li>Method: A meta-analysis of RCTs of adults who received pregabalin to manage neuropathic pain.</li> <li>Databases: MEDLINE, Embase, Cochrane Central Register of Controlled Trials (CENTRAL)</li> <li>Level of evidence: 26 RCTs with moderate to high risk of biases measured by Cochrane Risk of Bias criteria.</li> <li>Questions/measures/hypothesis:</li> <li>The objective of this rapid review was to evaluate the evidence for benefits and harms of pregabalin in the treatment of neuropathic pain in adults, using evidence from published randomized clinical trials (RCTs).</li> </ul>	1. 2. 3.	Out of the four studies that looked at anxiety and depression symptoms, there were no significant differences in the HADS-anxiety scores between groups (p=.14) or in HADS- depression scores between groups (p=.54). Moderate quality evidence showed that pregabalin significantly reduced sleep interference scores (p<0.00001). Four studies assessed QOL, using EuroQoL-5, showed conflicting results for the effect of pregabalin on QOL improvement after SCI.
<u>Yu et al.</u> (2019) China	<b>Method:</b> Comprehensive literature search of RCTs of SCI participants with SCI-induced neuropathic pain. Meta Analysis was conducted.	1.	Pregabalin administration elevated the mental status of patients with SCI-

Review of published	Databases: Pubmed, EMBASE,		induced neuropathic
articles from 1946-May	Cochrane Library.		pain.
2018 (Pubmed), 1974- May 2018 (EMBASE) and May 2018 (Cochrane Library) AMSTAR=7 N=5	Level of evidence: 3 RCTs, Moderate quality (III Grade): one crossover clinical trial and one open-label trial Questions/measures/hypothesis: To show the efficacy of pregabalin and confirm the safety of using pregabalin for the treatment of SCI-related neuropathic pain.	2.	Decreased Hospital Anxiety and Depression Scale (HADS) anxiety and depression scores were found in pregabalin and placebo groups at the endpoints. HADS anxiety and depression scores of the pregabalin group was significantly lower than those of the placebo group HADS anxiety (p=.05) and HADS depression (n= 002).

## 4.3. Psychological Interventions

## 4.3.1 Cognitive Behavioural Interventions

Acceptance and commitment therapy (ACT) is a mindfulness-based intervention to help improve symptoms of depression and anxiety. It includes CBT based processes such as mindfulness and acceptance that result in behaviour change and psychological flexibility (Hayes et al.(2012)).

Author Year Country Research Design PEDro Score Total Sample Size	Methods		Outcome
	CBT		
Burke et al., (2019) Ireland RCT PEDro=6 N <sub>Initial</sub> =69 N <sub>Final</sub> =68	<b>Population:</b> <i>Intervention Group</i> (Internet delivered cognitive behavioural pain management program (CBT-PMP); n=35): Mean age=50±12.3yr; Gender: males=25, females=10; Mean time post injury=16±11.8yr; Level of injury: cervical=10, thoracic-13, lumbar=7, unknown=8; Severity of injury: AIS A=1, AIS C=2, AIS D=3,	1.	No significant difference between intervention and control groups for WHOQOL-BREF and ISCI- QOLBDS (p>.05). No significant group X time interaction for the HADS questionnaire,

Table 19. Cognitive Behavioural Interventions

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
	unknown=29; Anxiety status=normal as assessed by the HADS. <i>Control group</i> (usual care; n=34): Mean age=52±13.8yr; Gender: males=27, females=7; Mean time post injury=16±12.6yr; Level of injury: cervical=7, thoracic=17, lumbar=7, unknown=3; Severity of injury: AIS A=3, AIS B=2, AIS C=1, AIS D=2, Unknown=26; Anxiety status=borderline abnormal as by the HADS. <b>Intervention:</b> Participants were randomized to receive internet delivered cognitive behavioural therapy pain management program (CBT-PMP) SPIRE (1 module and assignment/wk for 6wk) or the control group (continued to manage pain as per usual). Outcomes measures were assessed at baseline, post-intervention 6wk, and 3mo post-program completion. <b>Outcome Measures:</b> The World Health Organization Quality of Life BREF (WHOQOL- BREF), The international spinal cord injury quality of life basic data set, The International Spinal Cord Injury Pain Basic Data Set (ISCIPBDS), The Douleur Neuropathique en 4 Questions (DN4) interview, The Chronic Pain Acceptance Questionnaire-8 (CPAQ-8), The Brief Pain Inventory (BPI) Interference subscale, The Hospital Anxiety and Depression Scale (HADS), The Pittsburgh Sleep Quality Index (PSQI), Adverse events.	<ul> <li>PSQI for sleep or CPAQ for pain acceptance (p&gt;.05 for all).</li> <li>Post-intervention there was a moderate linear relationship observed between number of module where users engaged with 80% or more of the content and reductions in measures of NRS (p=.05), ISCIPBDS (p=0.08), LSF domain (p=.04), BPI (p=0.10) and HADS depression subscale (p=.10).</li> <li>3mo follow-up revealed a moderate linear relationship between module engagement and improvements in sleep quality (p=.06), AMS subcategory of ISCIPBDS (p=0.0), and the depression (p=.03) and anxiety (p=.05) subscales of HADS</li> </ul>
<u>Coker et al.,</u> (2019) USA RCT PEDro=8 N=81	<b>Population:</b> Control Group (n=40): Mean age=52±15.3 yr; Gender: males=32, females=8; Time since injury=81.5 mo; Level of injury: complete=16, incomplete=24; Severity of injury: AIS A=16, B=3, C=8, D=13. Intervention Group (n=41): Mean age=48±12.8; Gender: males=34, females=7; Time since injury=95 mo; Level of injury:	<ol> <li>Non-significantly greater increase in MSES for the treatment group compared to the control group from baseline to 6-wk and neither group showed significant difference from baseline to the 30-wk follow-up (p=0.15).</li> </ol>

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
	complete=19, incomplete=22; Severity of injury: AIS A=19, B=2, C=7, D=13. Intervention: Participants were randomized to either a control group in which they continued their normal rehabilitation or an intervention group in which they took part in an interactive cognitive behaviour therapy- based learning program for one session per wk, 2 hrs per session for 6 wk with assessments at baseline, post intervention and at 8-wk intervals post intervention. <b>Outcome Measures:</b> Moorong Self-Efficacy Scale (MSES), Generalized Self-Efficacy Scale (GSES), Diener Satisfaction with Life Scale (SWLS), Participation Assessment with Recombined Tools – Objective (PART-O), Patient Health Questionnaire – 9 (PHQ-9), and General Anxiety Disorder 7-Item (GAD-7).	<ol> <li>The treatment group showed significant improvements for the GSES, PHQ-9 and GAD-7 from baseline to 6-wk whereas the control group did not.</li> <li>Neither group showed significant changes in SWLS or PART-O from baseline to 6-wk.</li> <li>Despite the significant differences for the treatment group from baseline to 6-wk or from baseline to 30-wk follow-up, there are no significant differences in results between treatment and control.</li> </ol>
<u>Migliorini et al.,</u> (2016) Australia RCT PEDro=8 N <sub>Initial</sub> =59 N <sub>Final</sub> =48	<ul> <li>Population: Intervention group (n=34): Mean age=47.5±12.2 yr; Gender: males=25, females=9; Time since injury=11.4±11.9 yr; Level of injury: complete paraplegia=5, incomplete paraplegia=8, complete tetraplegia=1, incomplete tetraplegia=18, unknown=2. Waitlist control group (n=25): Mean age=52.8±12.9 yr; Gender: males=17, females=8; Time since injury=19.8±14.0 yr; Level of injury: compete paraplegia=7, incomplete paraplegia=13, complete tetraplegia=2, incomplete tetraplegia=2, unknown=1.</li> <li>Intervention: Participants were randomized to either an Electronic Personal Administration of Cognitive Therapy (ePACT) group in which the participants completed 10-module skills or a Waitlist Control group with assessments at baseline, 3 mo follow-up and 6 mo follow-up.</li> </ul>	<ol> <li>71 individuals accepted the option to try the ePACT, but 12 did not complete the intake process and those that completed the intake process and those that did not only differed significantly with regards to stress scores (p=0.05).</li> <li>No significant differences between groups at baseline besides for time since injury (p=0.02) and level of injury distribution.</li> <li>Dropouts from the intervention group did not differ significantly from those that did not drop out in any outcome measure.</li> </ol>

Author Year Country Research Design PEDro Score Total Sample Size	Methods		Outcome
	<b>Outcome Measures:</b> Depression, anxiety, and stress scale-short (DASS21), personal well- being index, helplessness subscale and score above normative threshold of the depression, anxiety and stress scale-short form (DASS21).	4.	At post-intervention, the ePACT group showed a significant reduction in depression, anxiety and stress and satisfaction with life significantly improved (p<0.05 for all) while the waitlist control group improved significantly with a reduction in depression (p=0.01).
		5.	Significant reductions in depression, anxiety and stress were maintained from post-intervention to 6 mo follow-up, and even reduced even more, albeit insignificantly.
<u>Dorstyn et al.,</u> (2012)	<b>Population:</b> Age=53.5yr; Gender: males=28, females=12; Level of injury: paraplegia=24, quadriplegia=16; Anxiety status=symptoms. <b>Intervention:</b> Individuals were randomly assigned to receive biweekly tele-counselling for 20min over 12wk (n=20, treatment) or standard inpatient care (n=20, control). <b>Outcome Measures:</b> Depression Anxiety Stress Scale-21 (DASS-21).	1.	Small improvements in DASS-21 depression (d=0.32), anxiety (d=0.24) and stress levels (d=0.27) were found in the treatment group compared to the control group post intervention.
Australia RCT PEDro=6 N <sub>Initial</sub> =40 N <sub>Final</sub> =39		2.	Of the 8 individuals in the treatment group that reported mild, moderate, or severe levels of depression and/or anxiety, 4 reported no symptoms post intervention. Individuals in the control group reported increases in clinically

Author Year			
Country Research Design	Methods		Outcome
PEDro Score	includus .		outcome
Total Sample Size			
			depression and/or anxiety over time.
Heutink et al., (2012) Netherlands RCT PEDro=6 N <sub>Initial</sub> =61 N <sub>Final</sub> =59	Population: Mean age=58.8yr; Gender: males=39, females=22; Level of injury: paraplegia=42, quadriplegia=19; Severity of injury: incomplete=39, complete=22; Anxiety status=symptoms. Intervention: Individuals with chronic neuropathic pain were randomly assigned to receive a multidisciplinary Cognitive Behavioural Therapy (CBT, n=31) program or waitlist group (n=30). The intervention consisted of 10 sessions over 10wk and a follow-up session 3wk later. Outcome Measures: Hospital Anxiety and Depression Scale (HADS).	1.	Individuals in the CBT group found significant improvement in HADS- anxiety (p<0.027) and participation (p<0.008) compared to the waitlist group.
Duchnick et al., (2009) RCT PEDro=4 N <sub>Initial</sub> =41 N <sub>Final</sub> =35	Population: Mean age=52.6yr; Gender: males=40, females=1; Level of injury: paraplegia=19, quadriplegia=22; Severity of injury: incomplete=31, complete=10; Mean time post injury=53.2d; Anxiety status=symptoms. Intervention: Participants were randomly allocated to either coping effectiveness training (CET, n=20) or supportive group therapy (SGT, n=20). CET focused on stress appraisal, problem solving, communication skills, behavioral strategies, cognitive strategies, and social support. SGT emphasized sharing experiences and information related to SCI, emotional and cognitive reactions, and support from peers and therapist. Each inpatient group met 1x/wk for 60min. Outcomes were assessed pre and post treatment, and at 3mo follow- up. Outcome Measures: Center for Epidemiologic Studies Depression Scale (CES-D), State Trait Anxiety Inventory (STAI).	1. 2. 3.	Significant decreases in STAI scores were seen at discharge in both groups (p<0.05). STAI (p<0.001) scores increased significantly between discharge and follow-up in both groups. STAI was not affected by group.
Zhao et al. (2021) China	<b>Population:</b> <i>Intervention Group</i> (psychological intervention; n=36): Mean age=49.39±13.88yr; Gender: males=26, females=10; Mean time post injury=not	1.	There were significant differences in the SAS and SDS scores between the intervention group

Author Year		
Country		
Research Design	Research Design Methods	
PEDro Score		
Total Sample Size		
RCT	reported; Level of injury: Tetraplegia=100%;	(psychological
PEDro=4	Severity of injury: AIS A=7, AIS B=23, AIS C=6;	intervention group) and
Level 2	Anxiety status=mild-moderate as assessed by	(conventional systemic
N-72	Control group (conventional systemic	treatment group) at 3
11-72	treatment: $n=36$ ): Mean age=45 03+14 04vr:	months $(p < 01)$ . 6
	Gender: males=29. females=7: Mean time	months (p<.01), 1yr
	post injury=not reported: Level of injury:	(p<.01), and 2yr (p<.01)
	Tetraplegia 100%: Severity of injury: AIS A=8.	post-surgery.
	AIS B=20. AIS C=8: Anxiety status=mild-	
	moderate as assessed by the Zung Self Rating	
	Anxiety Scale.	
	Intervention: Participants were randomly	
	divided into psychological intervention or	
	Conventional systemic treatment group.	
	Psychological intervention group: received a	
	mix of cognitive behavioural psychotherapy,	
	supportive psychotherapy, and medication in	
	addition to conventional treatment.	
	Conventional systemic treatment group:	
	received general symptomatic treatment,	
	surgical treatment, routine postoperative	
	nursing, routine postoperative neurological	
	exercise, postoperative respiratory exercise	
	and the company of family members or	
	nursing workers. Outcome measures were	
	assessed presurgery, 3mo after surgery, 6mo	
	after surgery, 1yr after surgery and 2yr after	
	surgery.	
	<b>Outcome Measures:</b> Zung Self-Rating Anxiety	
	(SDS) Medical Outcomes Study 26-item Short	
	Form Health Survey (SE-36) American Sninal	
	Injury Association (ASIA), Japanese	
	Orthopedic Assessment (JOA).	
Mehta et al. (2020)	<b>Population:</b> <i>Intervention aroup</i> (ICBT: n=20):	2. Depression (p <.001)
Canada	Mean age=54.7±16.2yr; Gender: males=11,	and anxiety (p=.002)
Calldud	females=9; Mean time post	scores decreased
Pre-Post	injury=12.1±15.9yr; Level of injury:	significantly after ICBT
Level 4	paraplegia=8, tetraplegia=12; Severity of	therapy.

Author Year Country Research Design PEDro Score Total Sample Size	Methods		Outcome
N <sub>Initial</sub> =20 N <sub>Final</sub> =18	<ul> <li>injury: incomplete=14, complete=6; Anxiety status=mild to moderate anxiety assessed by the GAD-7.</li> <li>Intervention: A group of participants was given internet-based Cognitive behavioural therapy (ICBT), based on chronic conditions course for SCI and case studies or vignettes.</li> <li>The Chronic Conditions Course consisted of five lessons delivered over 8wk. Outcomes were measured at baseline, at post treatment, and at 3mo follow-up.</li> <li>Outcome Measures: Feasibility, treatment satisfaction questionnaire (TSQ), patient</li> </ul>	2.	Significant improvements were found on SCIQoL subscales of Grief (p<.001), Self -Esteem (p=.04), Resilience (p <.002), and Positive Affect (p<.001) from baseline to post- intervention and follow- up.
	health questionnaire (PHQ-9), generalized anxiety disorder-7 (GAD-7), Spinal Cord Injury Quality of Life (SCI-QOL), International Spinal Cord Injury Basic Pain Data Set (ISCIBPD).		
Dear et al., (2018) Australia Pre-Post N=68	<ul> <li>Population: Mean age=48.0±13.0 yr; Gender: males=34, females=34; Time since injury=8.0±10.0 yr; Severity of injury: complete=15, incomplete=44, unsure=9.</li> <li>Intervention: Participants completed five online lessons and homework tasks for pain management with weekly support from a clinical psychologist.</li> <li>Outcome Measures: Pain disability index (PDI), patient health questionnaire 9-item (PHQ-9), generalized anxiety disorder scale 7- item), Wisconsin brief pain questionnaire (WBPQ), pain self-efficacy questionnaire (PSEQ), pain catastrophizing scale (PCS), satisfaction with life scale (SWLS).</li> </ul>	1. 2. 3.	Significant overall effect observed for pain- related disability (p<0.001), anxiety (p<0.001) and depression (p<0.001), as well as improvements in all three from baseline to post-treatment (p<0.001) and even further improvements at 3-mo follow-up (p<0.015). Significant overall time effect observed for pain self-efficacy (p<0.001), pain catastrophizing (p<0.001) and life satisfaction (p<0.001). Significant improvements from baseline to post- treatment for pain catastrophizing and life

Author Year Country Research Design PEDro Score Total Sample Size	Methods		Outcome
			satisfaction (p<0.001) with life satisfaction improving from post- treatment to follow-up (p=0.006) but not pain catastrophizing (p=0.062).
<u>Heutink et al</u> . (2014) Netherlands Follow-Up N=29	Population: Mean age=56.5yr; Gender: males=21, females=8; Level of injury: paraplegia=18, quadriplegia=11; Severity of injury: incomplete=14, complete=15; Mean time post injury=5.4yr; Anxiety status=symptoms. Intervention: Participants who received treatment in Heutink et al., (2012) were assessed at 6, 9, and 12mo follow-up. Outcome Measures: Hospital Anxiety & Depression Scale (HADS).	1.	HADS-anxiety scores significantly decreased across from pre- to post- treatment, to 6mo, and to12mo (p<0.05).
<u>Dorstyn et al.,</u> (2011) Australia PCT N <sub>Initial</sub> =24 N <sub>Final</sub> =19	<ul> <li>Population: Mean age=48.5yr; Gender: males=20, females=4; Level of injury: paraplegia=14, quadriplegia=10; Severity of injury: incomplete=5, complete=19; Anxiety status=symptoms.</li> <li>Intervention: Participants with moderate to severe DASS-21 scores received Cognitive Behavioural Therapy (CBT, treatment, n=11) and those with subclinical scores received standard care (control, n=13). CBT was delivered via 7-22 sessions, each for 30- 60mins. The treatment group was also prescribed low dose amitriptyline. Outcomes were assessed pre and post treatment, and at 3mo follow-up.</li> <li>Outcome Measures: Depression Anxiety Stress Scale-21 (DASS-21).</li> </ul>	1. 2. 3.	DASS-21 total scores did not change significantly over time in the treatment group. DASS-21 total scores, anxiety sub scores and stress sub scores decreased post treatment and increased at follow-up. DASS-21 scores did not change significantly over time in the control group.
<u>Migliorini et al.,</u> (2011) Australia Pre-Post N=3	<b>Population:</b> Age range=41-65yr; males=2, females=1; Severity of injury: incomplete=2, complete=1; Anxiety status=symptoms. <b>Intervention:</b> Participants were offered a computer-based Cognitive Behavioural Therapy (CBT) intervention involving 10 modules.	1.	DASS-21 anxiety score decreased in all 3 individuals.

Author Year			
Country			
Research Design	Methods		Outcome
PEDro Score			
Total Sample Size			
	Outcome Measures: Depression Anxiety Stress Scale-21 (DASS-21), Symptoms Checklist-90 (SCL-90), Personal Wellbeing Index (PWI), Emotional Wellbeing Questionnaire (EWQ).		
<u>Perry et al</u> . (2010) Australia PCT N <sub>Initial</sub> =36 N <sub>Final</sub> =30	<ul> <li>Population: Mean age=44yr; Gender: males=28, females=8; Level of injury: paraplegia=20, quadriplegia=13, Severity of injury: incomplete=23, complete=13; Mean time post injury=70.5mo; Anxiety status=symptoms.</li> <li>Intervention: Individuals with chronic neuropathic pain received either a multidisciplinary cognitive behavioural pain management program (treatment, n=19) or standard care (control, n=17). Treatment involved 10 sessions and pharmacotherapy over 6mo. Outcomes were assessed pre and post treatment, and at 1mo and 9mo follow- up.</li> <li>Outcome Measures: Hospital Anxiety and Depression Scale (HADS).</li> </ul>	1.	HADS-anxiety scores significantly improved over time in the treatment group when compared to the control group (p=0.007).
<u>Norrbrink Budh et al</u> . (2006) PCT N=38	Population: Mean age=52yr; Gender: males=14, females=24; Level of injury: paraplegic=19, quadriplegic=19; Severity of injury: incomplete=28, complete=10; Mean time post injury=12yr; Anxiety status=symptoms. Intervention: Individuals with neuropathic pain received cognitive behavioural therapy, education, relaxation, and body awareness training (treatment, n=27) while matched controls received no treatment for neuropathic pain (n=11). Treatment was delivered 5hr/wk for 10wk. Outcomes were assessed pre and post treatment, and at 3mo, 6mo, and 12mo follow-up. Outcome Measures: Hospital Anxiety and Depression Scale (HADS)	1.	At 12mo, there was no significant change in anxiety scores on the HADS in the treatment group from baseline. However, the treatment group showed systematic decrease in anxiety on the HADS as measured by relative change in position (95% CI) at 12mo.
Kennedy et al., (2003)	<b>Population:</b> Mean age=38.4yr; Gender:	1	Post CFT the treatment
United Kingdom	males=69, females=16; Level of injury:	L .	group showed a
РСТ	paraplegia=39, quadriplegia=46; Severity of		significant reduction in
N=85	injury: incomplete=36, complete=49; Mean		

Author Year		
Country	Mathada	Outeerree
Research Design	Research Design Wiethods	
Total Sample Size		
	time post injury=20wk; Anxiety status=symptoms. Intervention: Participants received coping effectiveness training (CET, treatment, n=45) or no treatment (control, n=40). CET was delivered in 60-75min sessions for 2x/wk over 3.5wk and involved problem solving, mindfulness, coping, and improving social supports. Outcomes were assessed pre and post treatment, and at a 6wk follow-up. Outcome Measures: Beck Depression Inventory (BDI), State Trait Anxiety Inventory (STAI), Coping Strategies Scale (CSS), Self- Perception Scale (SPS).	STAI scores (p=0.001) compared to controls.
<u>King &amp; Kennedy</u> (1999) United Kingdom PCT N=38	<ul> <li>Population: Mean age=33yr; Gender: males=29, females=9; Level of injury: paraplegia=19, quadriplegia=19; Severity of injury: incomplete=11, complete=27; Mean time post injury=19yr; Anxiety status=symptoms.</li> <li>Intervention: Participants received coping effectiveness training (treatment, n=19), while matched controls received standard care (n=19). Treatment was delivered in 60- 75min sessions 2x/wk with 6-9 other participants. Sessions included a mixture of didactic presentations, practical exercises, and group discussions. Outcomes were assessed pre and post treatment, and at 6wk follow-up.</li> <li>Outcome Measures: Beck Depression Inventory (BDI), State Trait Anxiety Inventory (STAI), COPE Inventory.</li> </ul>	1. There were significantly greater reductions in HADS- anxiety (p<0.05) in the treatment group than in controls.
<u>Craig et al.,</u> (1997) Australia PCT N=69	<b>Population:</b> Mean age=31yr; Gender: males=57, females=12; Level of injury: paraplegia=34, quadriplegia=35; Severity of injury: incomplete=21, complete=48; Time post injury=acute; Anxiety status=symptoms. <b>Intervention:</b> Participants received standard care (control, n=41) or small group cognitive behavioural therapy (CBT, treatment, n=28). CBT was provided for 1.5hr/wk over 10wk	1. STAI and RSES scores did not improve significantly at 1yr.

Author Year Country			2
Research Design	Methods		Outcome
PEDro Score			
Total Sample Size	and included muscle relaxation visualization		
	techniques self-hypnosis cognitive		
	restructuring social skills training and		
	sexuality sessions. Outcomes were assessed		
	pre and post treatment, and at 1yr follow-up.		
	Outcome Measures: Beck Depression		
	Inventory (BDI), State Trait Anxiety Inventory		
	(STAI), Rosenberg Self-Esteem scale (RSES).		
	Population: Mean age=31yr; Gender:	1.	Those with high STAI
	males=57, females=12; Level of injury:		scores showed a
	paraplegia=34, quadriplegia=35; Severity of		significant improvement
<u>Craig et al.,</u> (1998)	injury: incomplete=21, complete=48; Time		on STAI over time
Australia	post injury=acute; Anxiety status=symptoms.		(p<0.01).
Follow-Up	Intervention: Participants from Craig et al.,		
N=58	(1997) were assessed at 2yr follow-up.		
	Outcome Measures: Beck Depression		
	Inventory (BDI, State Trait Anxiety Inventory		
	(STAI), Coning Oriented Supportive Program		
	Population: Intervention group (Coping-	1.	Depressive symptoms
	Oriented Supportive Programme (COSP);		and adaptive coping
	n=50): Mean age=39±11.7yr; Gender:		were significantly
	iniun-6.9±4.2mo: Lovel of inium:		group (p= 001)
	tetranlegia-13 naranlegia-37: Severity of		compared with the
	injury: complete=24 incomplete=26: Anxiety		control group at post
	status=mild according to mean HADS-A		intervention, but not at
<u>Li et al.</u> (2020)	Control group (Attention group: p=40) Moon		follow-ups.
Hong Kong	2ge=42+10 Zyr: Gender: males=44	2	Anviety maladantive
РСТ	females=5: Mean time nost	۷.	coning and social and
Lovel 2	injury=8.6+4.2mo: Level of injury:		life satisfaction were
Level 2	tetraplegia=13. paraplegia=36: Severity of		improved in intervention
PEDro=5	injury: complete=26, incomplete=23; Anxiety		group compared to the
N <sub>Initial</sub> =99 N <sub>Final</sub> =88	status=mild according to mean HADS-A.		control group (p<.05) at
	Intervention: Two different words of SCI		post-intervention, 4wk
	natients were given either Coning-oriented		follow-up, and 12wk
	Supportive Programme (COSP) or attention		follow-up.
	control training for 1-1.5hr/session. 1x/wk for	3.	Self-efficacy was
	8wk. COSP is a psychosocial intervention		improved in the
	which is delivered by a registered nurse who		intervention group
	has SCI training in both SCI wards, while		compared with the

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
	attention control group were given brief education on personal care. Outcome measures were assessed at baseline, immediately post-intervention, 4wk follow- up, and 12wk follow-up.	control group at post- intervention (p=.001) and 4wk follow-up (p=.02).
	<b>Outcome Measures:</b> Brief-COPE scale, Moorong Self-efficacy Scale (MSES), Hospital anxiety and depression scale (HADS), Numerical rating scale for pain, Six-item social support questionnaire (SSQ6), Quality of life enjoyment and satisfaction questionnaire- short form (Q-LES-Q-SF).	
Li et al. (2019) Hong Kong RCT PEDro=4 Level 2 N <sub>Initial</sub> =22 N <sub>Final</sub> =20	<ul> <li>Population: Intervention group (Coping oriented supportive program n=9): Mean age=41.67±11yr; Gender: males=100%; Mean time post injury=8.1±4.1mo; Level of injury: tetraplegia=4, paraplegia=5; Severity of injury: complete=5, incomplete=4; Anxiety status=very mild anxiety symptoms according to mean HADS-A</li> <li>Control group (Usual care group; n=11): Mean age=43±15.7yr; Gender: males=100%; Mean time post injury=8.2±4.1mo; Level of injury: tetraplegia=4, paraplegia=7; Severity of injury: complete=5, incomplete=6; Anxiety status=very mild according to the HADS-A.</li> <li>Intervention: Two wards in a hospital were compared, where one received an intervention and the other one was used as a control group with conventional care. The intervention involved culturally sensitive psychosocial care program and Coping-Oriented Supportive Program (COSP), 1-1.5hr/session, 1x/wk for 8wk. Outcome measures were assessed at baseline and post intervention.</li> <li>Outcome Measures: Brief Coping Orientations to Problems Experienced Inventory, Moorong Self-Efficacy Scale, Iteration involved cultural for the compared in the problems Experienced Inventory, Moorong Self-Efficacy Scale, Iteration in the problem intervention involved cultural for the compared intervention.</li> </ul>	<ol> <li>Within- group analyses showed an improvement in depression HADS-D scoring post intervention in the COSP group (p=.007), but not in the control group. However, the difference was not significant between groups (p=1.16).</li> <li>There was no within and between group differences in the anxiety HADS scores at any time point (p&gt;.5).</li> <li>Between group comparison showed greater self-efficacy (p=.04), and life (p=.005) and social satisfaction (p=0.22) in the COSP group compared with the control group post intervention.</li> </ol>

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
	(HADS), Quality of Life Enjoyment and Satisfaction Questionnaire-Short Form, Six- Item Social Support Questionnaire.	
	Acceptance and Commitment Therapy	
	<b>Population:</b> Mean age=51.2±9.5yr; Gender: males=2, females=8; Mean time post injury= 20.1±15.3yr; Level of injury: cervical=3, thoracic=6, lumbar=1; Severity of injury: not reported; Anxiety status=moderate as measured by DASS.	<ol> <li>Participants showed significant reductions in depression (p=.021), anxiety (p=.032) and stress (p=.036), measured by the DASS-</li> </ol>
<u>Han et al. (2022)</u> United States Pre-Post Level 4 N <sub>Initial</sub> =10 N <sub>Final</sub> =10	Intervention: Participants received 8 individual sessions (1h per session) delivered by trained coaches through Zoom videoconferencing, involving 6x1/wk acceptance and commitment therapy (ACT) sessions and 2 psychoeducation sessions over a 1wk period. Outcome measures were assessed at baseline and post-intervention. <b>Outcome Measures:</b> Depression, Anxiety and Stress Scales (DASS-21), World Health Organization Quality of Life Instruments (WHOQOL-BREF), Spinal Cord Injury Quality of Life (SCI-QOL), Self-Compassion Scale- Short Form (SCS SF) Engagement in Meaningful Activities Survey (EMAS), ACT	<ol> <li>21.</li> <li>2. SCI-QOL Grief showed significant reductions (p=.028), and significant increases in SCS-SF (p=.028).</li> <li>3. EMAS scores improved significantly from pre- to post-intervention (p=.049)</li> <li>4. The WHOQOL-BREF, SCI-QOL Resilience, MAAS, CFQ-7, AAQ-II measures showed no significant changes after the</li> </ol>
process measures (Acceptance and Action Questionnaire-II (AAQ-II), Cognitive Fusior Questionnaire (CFQ-7), Mindful Attention Awareness Scale (MAAS), System Usability Scale (SUS)	Questionnaire-II (AAQ-II), Cognitive Fusion Questionnaire (CFQ-7), Mindful Attention Awareness Scale (MAAS), System Usability Scale (SUS)	intervention.

Several studies examined the effect of in person group CBT related programs compared to standard care on improvement of anxiety symptoms for persons with SCI (Craig et al., 1997; P. Kennedy et al., 2003; King & Kennedy, 1999; Y. Li et al., 2019). Three of these studies found significant improvement in anxiety symptoms among those in the CBT group compared to the standard care group (P. Kennedy et al., 2003; King & Kennedy, 1999; Y. Li et al., 2019). Li et al., 2019). Coker et al., (2019) found no significant effect of group based CBT on anxiety symptoms. Craig et al., (1997) found no improvement in anxiety symptoms among the participants overall;

however, a subgroup of participants with high levels of anxiety experienced significant improvement in their anxiety symptoms (A. R. Craig et al., 1998).

One study examined the effect of telerehabilitation based CBT for managing anxiety symptoms. Dorstyn et al. (2012), in an RCT, reported small effects of telecounselling in improving anxiety symptoms compared to standard care. Migliorini et al., (2011) reported improvement in anxiety scores after an online CBT program for persons with SCI. Burke and colleagues (2019) found no significant difference in anxiety symptoms in the intervention group compared to the control group post intervention; however, significant decreases in anxiety symptoms were seen in the treatment group at 3 month follow-up

Four studies examined the effect of a CBT program among persons with SCI and chronic pain (Blake et al., 2018; Heutink et al., 2014; Heutink et al., 2012; Norrbrink Budh et al., 2006; Perry et al., 2010) Blake et al., (2018) provided a guided 8 week online CBT program and found significant improvement in anxiety symptoms post intervention. In an RCT, Heutnick et al., (2012) significant improvement in anxiety symptoms in the intervention group compared to the wait list control group; these results were maintained at 1 year follow up (Heutink et al., 2014). Perry et al., (2010) also found a multidisciplinary CBT program resulted in improvements in anxiety over time. However, Norrbrink Budh et al., (2006) found no significant reduction in anxiety symptoms among those in the CBT group compared to the no treatment group.

Duchnick et al. (2009) evaluated the effectiveness of a CBT training intervention compared to a supportive group program. The study reported a significant decrease in anxiety scores among both groups and no group effect.

Dorstyn et al. (2011) compared CBT combined with low dose amitriptyline to a standard care group and found those in the combined CBT and amitriptyline group had a significantly greater reduction in anxiety symptoms compared to the standard care group. However, this was not maintained at follow-up.

Two cluster randomized trials evaluated the efficacy of a coping oriented supportive programme (COSP) on anxiety in an inpatient SCI rehabilitation unit. Li et al. (2020) found significant improvement in symptoms of anxiety post-treatment as well as at 4-week and 12-week follow-up compared to brief education on personal care, while Li et al. (2019) found no difference in anxiety outcomes between COSP and traditional rehabilitation.

#### Conclusion

There is level 2 evidence from (Craig et al., 1997; A. Craig et al., 1998; A. Craig et al., 1999; A. R. Craig et al., 1998; P. Kennedy et al., 2003; King & Kennedy, 1999), that in person CBT may improve anxiety symptoms compared to standard treatment among those with elevated symptoms.

There is level 1b evidence (Dear et al., 2018; Dorstyn et al., 2011) Miglorini et al., 2016), that telerehabilitation based CBT improves symptoms of anxiety among persons with SCI.

There is level 1 evidence (Duchnick et al., 2009; Feng & Li, 2017) that CBT is effective in improving anxiety symptoms post intervention.

There is conflicting level 2 evidence (Li et al., 2019; 2020) for the effectiveness of coping oriented supportive programme on improving symptoms of anxiety post SCI.

There is level 4 evidence (Han et al. 2022) that guided videoconferencing ACT may reduce symptoms of anxiety post SCI.



## 4.3.2. Eye Movement Desensitization and Reprocessing Therapy for Anxiety following SCI

Eye Movement Desensitization and Reprocessing (EMDR) therapy is guided by the Adaptive Information processing model. It was initially developed for the treatment of posttraumatic stress disorder (PTSD) (Shapiro 2007). The aim of the intervention is to focus on a traumatic memory while conducting bilateral stimulation of eye movements. It has been associated with a reduction in the negative emotion associated with trauma memories.

Table 20	Evo Movement	Doconcitization of	and Donrococcina	Thorapy for /	Noviaty fallowing CCL
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Author Year		
Country	Methods	Outcome
Research Design		

PEDro Score		
Total Sample Size		
<u>Hatefi et al.</u> (2019) Iran	Population: Intervention group (Eye movement desensitization and reprocessing; n=33): Mean age=48.66±12.66yr; Gender: males=20, females=13; Mean time post injury= 1-2yr=7, 3- 5yr=19, >5yr=7; Level of injury: not reported; Severity of injury: not reported; Anxiety status=severe as reported by Beck's Anxiety Inventory. <i>Control group:</i> (n=35); Mean age=49.12±10.13yr; Gender: males=25, females=10; Mean time post injury= 1-2yr=7, 3-	<ol> <li>The EMDR group experienced a significant reduction in depression and anxiety scores following post-intervention (p&lt;.02 and p&lt;.0001), respectively.</li> <li>There was no significant change in depression or anxiety among participants in the control group.</li> </ol>
RCT Pedro=6	5yr=20, >5yr=8; Level of injury: not reported; Severity of injury:	
Level 1b N <sub>Initial</sub> =75 N <sub>Final</sub> =68	not reported; Anxiety status=severe as reported by Beck's Anxiety Inventory.	
	Intervention: Participants were randomized to receive Eye Movement Desensitization and Reprocessing (EMDR) therapy (45-60min/session, 2 sessions) or to a control group with no treatment. Outcomes measured at baseline and post- intervention.	
	Outcome Measures: Beck's Depression Inventory, Beck's Anxiety Inventory	

Hatefi et al. (2019) conducted an RCT examining the effectiveness of 2 sessions of EMDR compared to no treatment. The study did not report on between group effects. The study reported significant within group effects on symptoms of anxiety among those that received the intervention.

#### Conclusion

There is limited evidence that EMDR may be effective in reducing symptoms of anxiety compared to no treatment.

Eye Movement Desensitization and Reprocessing Therapy may improve anxiety post SCI.

## 4.4. Physical Interventions for Anxiety following SCI

## 4.4.1. Physical Activity for Anxiety 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.

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
<u>Akkurt et al.,</u> (2017) Turkey RCT PEDro=5 N=33	<ul> <li>Population: Mean age: Not reported; Median age: Intervention group=33 yr, Control group=37 yr; Gender: males=29, females=4; Time since injury=&gt;1 mo, not specified further; Level of injury: C=1, T=22, L=10; Severity of injury: AIS A=19, B=1, C=10, D=3.</li> <li>Intervention: Participants were enrolled in a 12-wk program comparing arm ergometer exercises and general exercises to those that receive only general exercises.</li> <li>Outcome Measures: Psychological status (Center for Epidemiologic Studies Depression Scale and Hospital Anxiety and Depression Scale).</li> </ul>	<ol> <li>No intergroup differences were seen in HADS.</li> <li>No statistically significant differences over the assessment period between the intervention and control groups in disability levels, QOL, or metabolic syndrome parameters (p=&gt;0.05 for all).</li> </ol>
<u>Curtis et al.,</u> (2017) Canada RCT Crossover PEDro=6	<b>Population:</b> Yoga group (n=10): Mean age=47.9±19.5 yr; Gender: Not reported; Level of injury: paraplegia=6, tetraplegia=0, ambulatory/unspecified=4; Severity	<ol> <li>Yoga group had significantly lower scores for the HADS (p&lt;0.05) and significantly higher scores for the SCS (p&lt;0.05) at</li> </ol>

Table 21. Physical Activity for Anxiety following SCI

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
N=22	of injury: complete=2, incomplete/disease-related=8. Control group (n=12): Mean age=54.8±10.1 yr; Gender: Not reported; Level of injury: paraplegia=4, tetraplegia=4, ambulatory/unspecified=4; Severity of injury: complete=5, incomplete/disease-related=7. Intervention: Participants were randomized to a 6 wk, twice wkly lyengar yoga group or a 6 wk wait- listed control group, then after the first yoga group completed their sessions, the wait-list control group engaged in the yoga protocol. Outcome Measures: Pain (brief pain inventory (BPI), pain catastrophizing scale (PCS)), psychological (acceptance and action questionnaire (AAQ), hospital anxiety and depression scale (HADS), general self-efficacy scale (GSES), posttraumatic growth inventory (PTGI-SF), Connor- Davidson resilience scale (SCS) and mindfulness (five-facet mindfulness questionnaire (FFMQ) measures taken 1-2 wk before and after the program.	<ul> <li>post-intervention than at baseline.</li> <li>2. Fixed-factor models showed significantly lower HADS scores postintervention compared to preintervention (p&lt;0.05) with time being the main predictor of HADS scores (p&lt;0.05).</li> <li>3. There was a trend noticed for FFMQ scores from preintervention to postintervention for total scores (p=0.09) and observing scores (p=0.06).</li> <li>4. Postintervention scores for the SCS and FFMQ were both significantly higher than at preintervention (p&gt;0.05).</li> </ul>
<u>Mehta et al. (2021)</u> Canada Pre-Post Level 4 N=4	Population: Intervention group (n=4): Mean Age=56.4yr; females=9; Mean time post injury=20.25yr; Level of injury: cervical=1, thoracic=3; Severity of injury: incomplete=3, complete=1; Anxiety status=symptoms. Intervention: Online group-based	<ol> <li>Moderate to large effect sizes were seen on measures of depression (d = 0.67), anxiety (d=2.39), and satisfaction with social roles and activities (d=0.43) from baseline to post- intervention.</li> <li>The improvements were</li> </ol>

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
	consisting physical exercises and peer social interaction, 60min/session, 2x/wk for 6wk. The Physical Activity Group Environment Questionnaire and Participant Satisfaction Survey (PSS) were assessed post-intervention. The Quality of Life in Neurological Disorders short-form (NeuroQoL- SF) was assessed at baseline, post- intervention, and at 3mo follow-up. <b>Outcome Measures:</b> Participant Satisfaction Survey (PSS), participant recruitment, engagement, and retention, Physical Activity Group Environment Questionnaire, Quality of Life in Neurological Disorders short-form (NeuroQoL- SF).	<ul> <li>(d=2.02) and satisfaction with social roles and activities scores (d=0.52) at 3mo follow-up.</li> <li>Participants were highly satisfied with the program in general, the instructions, the instructor's knowledge, effectiveness, and content of the program.</li> <li>Participants were moderately-highly satisfied with the accessibility of the program.</li> <li>Participants were mixed satisfied with the technology of the program.</li> </ul>
<u>Kennedy et al.,</u> (2006) United Kingdom Pre-Post N=35	<ul> <li>Population: Gender: males=30, females=5; Age: 18-61 yr, Level of injury: paraplegia=20, tetraplegia=15.</li> <li>Intervention: 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</li> <li>Outcome Measures: Life Satisfaction Questionnaire (LSQ), Hospital Anxiety and Depression Scale (HADS)</li> </ul>	<ol> <li>HADS scores demonstrated significant (p&lt;0.01) improvement in anxiety levels over the duration of the course.</li> </ol>

Three studies evaluated physical activity in improving anxiety symptoms post SCI. Akkurt et al., (2017) found no significant difference in levels of anxiety among those in the arm ergometer plus standard exercise group compared to standard exercise alone. Curtis et al.,(2017) found participation in a yoga program resulted in decreased symptoms of anxiety post intervention. Kennedy et al.,(2006) found increasing level of physical activities such as skiing, horseback riding, resulted in improvement in anxiety levels post intervention.

### Conclusion

There is level 1b evidence (K. Curtis et al., 2017) that yoga may decrease symptoms of anxiety post SCI.

There is level 4 evidence (P. Kennedy et al., 2006) that increased physical activity through various outlets may improve anxiety symptoms.

Physical activity may improve anxiety post SCI.

## 4.4.2. Physical Stimulation for Anxiety following SCI

Similar to depression, the field of study assessing neurostimulation for anxiety following SCI is relatively limited. While further research will be required to better understand the efficacy, safety and mechanisms of action, several studies have assessed the impact various neurostimulatory techniques on anxiety symptoms post-SCI.

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
Tan et al., (2011) USA RCT PEDro=8 N <sub>Initial</sub> =105 N <sub>Final</sub> =100	Population: Mean age=52yr; Gender: males=90, females=15; Level of injury: paraplegia=66, quadriplegia=37, unknown=2; Severity of injury: incomplete=52, complete=42, unknown=11; Mean time post injury=15yr; Anxiety status=symptoms. Intervention: Individuals with chronic neuropathic pain were randomized to receive active (treatment, n=46) or sham (control, n=59) cranial electrotherapy	<ol> <li>At baseline, the treatment group had significantly poorer scores on STAI-SF (p&lt;0.05).</li> <li>There was no significant main effect of time on STAI-SF in either group.</li> <li>There were no significant time x group interactions on STAI-SF.</li> </ol>

Table 22. Physical Stimulation for Anxiety Following SCI
Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
	stimulation (CES) 1hr/d for 21d. Outcomes were assessed pre and post treatment. <b>Outcome Measures:</b> Center for Epidemiologic Studies Depression Scale – Short Form (CES-D-SF), State-Trait Anxiety Inventory – Short Form (STAI-SF).	
<u>Soler et al</u> . (2010) Spain RCT PEDro=8 N=39	<b>Population:</b> Mean age=45yr; Gender: males=31, females=9; Level of injury: paraplegia=30, quadriplegia=10; Severity of injury: incomplete=8, complete=32; Mean time post injury=9yr; Anxiety status=symptoms. <b>Intervention:</b> Individuals with chronic neuropathic pain were randomized to receive transcranial direct current stimulation (tDCS, n=10), visual illusion (VI, n=10), tDCS with VI (n=10), or sham tDCS (placebo, n=10) during 10 sessions over 2wk. Outcomes were assessed pre and post treatment, and 2, 4, and 12wk follow-up. <b>Outcome Measures:</b> Numerical Rating Scale for Anxiety (NRS-A).	<ol> <li>NRS-A score significantly decreased in the tDCS, tDCS+VI, and VI groups (p&lt;0.019), but not the placebo group.</li> <li>NRS-A score improvements were only maintained in the tDCS+VI group at all follow-ups (p&lt;0.04).</li> </ol>
Fregni et al., (2006) USA RCT PEDro=8 N <sub>Initial</sub> =17 N <sub>Final</sub> =15	<b>Population:</b> Mean age=35yr; Gender: males=14, females=3; Level of injury: paraplegic=8, quadriplegic=9; Severity of injury: incomplete=6, complete=11; Mean time post injury=3.5yr; Anxiety status=symptoms. <b>Intervention:</b> Individuals with central pain were randomized to receive active (treatment, n=11) or sham (control, n=6) transcranial direct current stimulation (tDCS) 20min/d for 5d. Outcomes were assessed at baseline, 1-5d pre and post treatment, and 16d follow-up.	<ol> <li>On VAS-A, there was a significant effect of time (p=0.001), but not group (p=0.42) or time x group (p=0.99).</li> </ol>

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
	<b>Outcome Measures:</b> Beck Depression Inventory (BDI), Visual Analogue Scale-Anxiety (VAS-A).	
<u>Diego et al.,</u> (2002) USA RCT PEDro=8 N=20	Population: Mean age=39yr; Gender: males=15, females=5; Level of injury: quadriplegia; Time post injury>1yr; Anxiety status=symptoms. Intervention: Participants were randomized to receive massage therapy (treatment, n=10) or perform a home exercise routine (control, n=10) 2x/wk for 5wk. Outcome Measures: Center for Epidemiologic Studies Depression Scale (CES-D), State Trait Anxiety Inventory (STAI).	<ol> <li>The treatment group showed a significantly greater decrease in STAI (p&lt;0.01) scores after treatment than controls.</li> </ol>

In an RCT, Tan et al., (2011) found no significant difference in anxiety symptoms between participants in the cranial electrotherapy stimulation (CES) compared to sham group. Two studies examined the effect of transcranial direct current stimulation (tDCS) on anxiety after SCI (Fregni et al., 2006; Soler et al., 2010). Soler et al., (2010) found significant reduction in symptoms among those in the tDCS compared to the sham group. Participants in the TDCS combined with visual illusion group had the greatest decrease in anxiety symptoms. Fregni et al., (2006) found no significant effects of tDCS on anxiety compared to sham group.

#### Conclusion

There is level 2 evidence from 1 RCT, that cranial electrotherapy stimulation may not be effective at reducing symptoms of anxiety after SCI.

There is conflicting evidence from 2 RCTs that transcranial direct current stimulation alone may reduce symptoms of anxiety after SCI.

There is level 2 evidence that combined transcranial direct current stimulation and visual illusion walking may help reduce symptoms of anxiety after SCI

There is level 2 evidence from 1 RCT, that massage may reduce symptoms of anxiety after SCI compared to home exercise.

There is level 4 evidence from 1 pre-post study, that participation in sports activity may reduce symptoms of anxiety after SCI.

Cranial electrotherapy stimulation may not be effective in reducing anxiety symptoms post SCI.

Combined transcranial direct current stimulation and visual illusion walking may reduce symptoms of anxiety post SCI.

Massage may help reduce symptoms of anxiety post SCI.

Participation in sports may reduce symptoms of anxiety post SCI.

# 4.5 Hyperbaric Oxygen for Anxiety following SCI

Similar to depression, studies assessing the impact of HBO on anxiety following SCI are limited and the mechanisms of action are not well understood. A single study has assessed the impact of HBO on symptoms of anxiety following SCI.

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
<u>Feng et al</u> . (2017) China RCT PEDro=6 N=60	<b>Population:</b> HBO group (n=20): Mean age=36.1±5.2 yr; Gender: males=14, females=6; Level of injury: C=7, T=8, L=5; Severity of injury: AIS A=0, B=12, C=5, D=3. Psychotherapy group (n=20): Mean age=34.8±4.7 yr; Gender: males=15, females=5; Level of injury: C=8, T=6, L=6; Severity of injury: AIS A=0, B=10, C=8, D=2. Conventional rehabilitation group (n=20): Mean age=33.1±4.6 yr; Level of injury: C=7, T=9, L=4;	<ol> <li>HAMD score was significantly lower in both the HBO and psychotherapy groups compared to the control group at the end of 8 wk (p&lt;0.05 for both) with no significant difference between HAMD score for HBO and psychotherapy groups from baseline to 8 wk (p&gt;0.05).</li> <li>HAMA score was significantly lower for the HBO group than for the control group (p&lt;0.05) with no significant difference in HAMA</li> </ol>

Table 23. Hyperbaric Oxygen for Anxiety following SCI

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
	Severity of injury: AIS A=0, B=10, C=7, D=3.	score between the HBO and psychotherapy groups (p>0.05).
	<b>Intervention:</b> Participants were randomly allocated to either a hyperbaric oxygen group (HBO), a psychotherapy group or a conventional rehabilitation group for an 8-wk intervention in which all three groups received routine rehabilitation on top of their intervention. Therapy sessions occurred once a day, 6 days a wk for 8 wk.	
	Outcome Measures: Hamilton depression scale (HAMD), Hamilton anxiety scale (HAMA), American spinal injury association score (ASIA) and functional	

In a randomized controlled trial, Feng et al.,(2017) evaluated the effectiveness of hyperbaric oxygen compared to psychotherapy or standard rehabilitation on anxiety symptoms. The study found a significant difference in levels of anxiety among those that received HBO compared to the standard rehabilitation group. No significant difference was seen between HBO and psychotherapy.

#### Conclusion

There is level 1b evidence that hyperbaric oxygen may improve symptoms of anxiety post SCI.

Hyperbaric oxygen may improve symptoms of anxiety post SCI.

# 4.6 Sexual Health Education for Anxiety following SCI

Sexual health education for individuals with spinal cord injury (SCI) aims to address the challenges faced in regaining confidence and experiencing intimacy. SCI can lead to changes in genital sensation and sexual function, affecting both men and women. (Chhabra 2015; Hammond et al. 2009) Sexual adjustment to SCI involves body image, self-esteem, and the need to redefine concepts of sexuality and pleasure. The promotion of sexual health education aims to foster a positive and comprehensive understanding of sexuality, which may help individuals with SCI navigate anxiety and improve their overall well-being. A single study has assessed the impact of sexual health education for anxiety following SCI.

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
Federici et al., (2019) Italy Pre-Post N=11	Population: Mean age: males=50.4±7.3 yr, females=41.5±11.26 yr; Gender: males=5, females=6; Time since injury=30.1±9.4 yr; Level of injury: tetraplegia=3, paraplegia=4, no paraplegia/tetraplegia=4; Severity of injury: complete=5, incomplete=2, none=4. Intervention: Participants were 4 couples (one with SCI and one without) and 3 singles with SCI who took part in a sexual health psychoeducational intervention in which 4 couples and 3 singles met every two weeks for 12 meetings of a growth group and reported the results of their love lives and persona lives. Outcome Measures: Sexual interest and satisfaction scale (SIS), Beck depression inventory – II (BDI- II) and Beck anxiety inventory (BAI).	<ol> <li>All participants improved significantly on item 5 of the SIS scale "How are your opportunity and your ability to enjoy sexuality yourself?" (p&lt;0.01), SIS scale total score (p&lt;0.05) and BAI scores (p&lt;0.05).</li> <li>No difference was found for SIS scale's general satisfaction after injury, BDI, or BAI (p&gt;0.05).</li> <li>Significant effect found on item 5 of the SIS scale "How are your opportunity and your ability to enjoy sexuality yourself?" for both individuals and partners (p&lt;0.05 for both).</li> </ol>

#### Table 24. Sexual Health Education for Anxiety following SCI

#### Discussion

Federici and colleagues (2019) provided participants with a sexual health psychoeducation program over 12 session. The program found no significant improvements in level of anxiety post intervention.

Conclusion

There is level 4 evidence that sexual health may not improve anxiety post SCI.

Sexual health education may not improve symptoms of anxiety post SCI.

### 4.7 Mesenchymal Stem Cells Transplantation Therapy for Anxiety following SCI

Bone marrow mesenchymal stem cells (BMSCs) are highly proliferating and self-renewing cells. Transplantation of BMSCs may be an effective treatment for nerve injury reconstruction or regeneration in patients with SCI. (Assinck et al. 2017)

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
Yang et al. (2020) China RCT Pedro=6 Level 1b N=68	Population: Intervention group (autologous Bone Marrow Mesenchymal Stem Cells (BMSCs) transplantation therapy; n=34): Mean age=35.29±8.04yr; Gender: males=27, females=7; Mean time post injury=Not reported; Level of injury: thoracic: 34; Severity of injury: AIS A= 22; AIS B= 7; AIS C=5; Anxiety status=severe as assessed by the Self-rating Anxiety Scale. <i>Control group</i> (standard occupational therapy, n=34): Mean age=34.67±7.59yr; Gender: males=26, females=8; Mean time post injury=not reported; Level of injury: thoracic=34; Severity of injury: AIS A= 20; AIS B= 9; AIS C=5; Anxiety status=severe as	<ol> <li>The SAS and SDS scores of BMSCs transplantation group after treatment were significantly lower than those of standard occupational therapy group (p&lt;.001).</li> <li>The SAS and SDS scores of BMSCs transplantation group and standard occupational therapy group post treatment were significantly lower than those before treatment (p&lt;.001).</li> </ol>

Table 25. Mesenchymal Stem Cells Transplantation Therapy for Anxiety following SCI

assessed by the Self-rating	
Anxiety Scale.	
Intervention: Participants were	
randomized to receive Bone	
Marrow Mesenchymal Stem	
Cells (BMSCs) transplantation or	
standard occupational therapy.	
The BMSCs transplantation	
therapy group received 2x Bone	
Marrow Mesenchymal Stem	
Cells transplant 10d apart in	
addition to rehabilitation	
services for 1mo. The standard	
occupational therapy group	
received both physiotherapy	
and occupational therapy	
services for 1mo. Outcome	
measures were assessed before	
and after treatment.	
Outcome Measures: American	
Spinal Injury Association (ASIA)	
scores, Motor and sensory	
function using the muscle	
strength grading standard and	
sense of pain and tactile sense,	
Self-rating Anxiety Scale (SAS),	
Self-rating Depression Scale	
(SDS).	
	assessed by the Self-rating Anxiety Scale. Intervention: Participants were randomized to receive Bone Marrow Mesenchymal Stem Cells (BMSCs) transplantation or standard occupational therapy. The BMSCs transplantation therapy group received 2x Bone Marrow Mesenchymal Stem Cells transplant 10d apart in addition to rehabilitation services for 1mo. The standard occupational therapy group received both physiotherapy and occupational therapy services for 1mo. Outcome measures were assessed before and after treatment. Outcome Measures: American Spinal Injury Association (ASIA) scores, Motor and sensory function using the muscle strength grading standard and sense of pain and tactile sense, Self-rating Depression Scale (SDS).

One RCT evaluated the effectiveness of standard rehabilitation or standard rehabilitation with BMSC transplantation among patients admitted to the hospital. The study found that among those that received both standard rehabilitation and BMSC transplantation, there was a significant reduction in anxiety symptoms compared to the rehabilitation only group.

#### Conclusion

There is level 1b evidence from one RCT that mesenchymal stromal cells combined with standard SCI rehabilitation is effective at reducing symptoms of anxiety compared to SCI rehabilitation alone.

Mesenchymal stromal cells transplantation therapy may improve symptoms of anxiety post SCI.

# 4.8. Music Therapy for Anxiety following SCI

The use of music therapy can reduce anxiety by refocusing a person's attention and alter perceptions of anxiety by replacing stressful environmental stimuli with novel auditory stimuli in the attention channels in the brain. (Thaut et al. 1993)

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
Wood et al. (2021) United States Pre-Post Level 4 NInitial=20 NFinal=12	Population: Intervention group (Music Therapy, n=13): Mean age=18-40yr=3, 41-50yr=3, 51- 60yr=2, 61-70yr=2, >15yr=3; Gender: males=7, females=6; Mean time post injury=Acute; Level of injury: cervical=7, thoracic=5, lumbar=1; Severity of injury=not reported; Anxiety status=mild as reported by the GAD-7 at hospital admission. Intervention: Participants received 2x personalized Music Assisted Relaxation (MAR) exercises during a music therapy session by a Board- Certified Music Therapist for 20min within 3d. VAS scores for pain, anxiety and relaxation were assessed before and after the intervention. GAD-7 and PSS-10 were completed at hospital admission and dismissal. Outcome Measures: Visual Analog Scale (VAS) score for pain, anxiety and relaxation, Perceived Stress Scale-10 (PSS), Generalized Anxiety Disorder (GAD-7).	<ol> <li>Anxiety and relaxation scores improved significantly after the Music therapy intervention (p&lt;.05).</li> <li>Perceived Stress Scale-10 (PSS, mean difference=7.29) and generalized anxiety disorder (GAD-7, mean difference=3.29) scores decreased from hospital admission to dismissal.</li> </ol>

Table 26. Music Therapy for Anxiety following SCI

Discussion

In a pre-post-trial, Wood et al. (2021) provided personalized music assisted relaxation two times within 3 days for 20 mins each. The study found significant improvement in anxiety post treatment.

#### Conclusion

There is level 4 evidence that music therapy reduces anxiety post SCI.

Music therapy may improve symptoms of anxiety post SCI.

### 4.9. Multidisciplinary Interventions following SCI

Several studies have assessed multidisciplinary interventions for anxiety following SCI including telerehabilitation, self-management strategies and systematic nursing interventions.

Author Year Country Research Design PEDro Score Total Sample Size	Methods	Outcome
Mu	Itidisciplinary Telehealth Consultat	tion
Dhakal et al. (2022) United Kingdom Pre-Post Level 4 N=97 SCI=82	Population: Mean age=38.4±12.2yr; Gender: males=77, females=20; Mean time post injury=not reported; Level of injury: paraplegia=64, tetraplegia=18; Severity of injury: not reported; Anxiety status=mixed. Intervention: Consultations with a multidisciplinary team (MDT) completed via a tele- rehabilitation system (1-2x/wk) until goal achievement. The MDT discussed the ongoing physical, cognitive, psychological, and vocational problems encountered by	<ol> <li>The scores for severity of depression, anxiety, and stress for participants with SCI or ABI significantly decreased after intervention (p&lt;.01).</li> <li>The EQ-5D index score significantly increased post- intervention (p&lt;.001).</li> <li>There was a significant mean difference (P&lt;.001) between the pre-and post- intervention MBI, and the visual analogue scale included as an item of the</li> </ol>

Table 27. Mobile Health Interventions for Anxiety following SCI

	participants during the consultations and offered advice and referrals accordingly. Outcome measures were assessed at baseline, and 4wk post-intervention. <b>Outcome Measures:</b> Modified Barthel Index (MBI), Depression Anxiety Stress Scale (DASS), EuroQoL 5 (EQ-5D-5L)	EQ-5D-5L with effect sizes - 0.4 and -0.7 respectively.
Multidi	sciplinary self-Management Interv	entions
Li & Fu (2020) Canada PCT Level 2 N=124	Population: Intervention group (health management + aerobic exercise, n=68): Mean age=45.36±6.33yr; Gender: males=37, females=31; Mean time post injury=<5yr (n=15), 5+yr (n=53); Level of injury: not reported; Severity of injury: incomplete=57, complete=11; Anxiety status=moderate to severe as assessed by HAM-A scores. <i>Control group</i> (aerobic exercise, n=56): Mean age=43.87±5.92yr; Gender: males=29, females=27; Mean time post injury=<5yr (n=14), 5+yr (n=42); Level of injury: not reported; Severity of injury: incomplete=43, complete=13; Depression status=moderate depression as assessed by Beck Depression Inventory (BDI). Intervention: A management plan was developed based on the patient's condition and self- care ability publicized to family and patients. It was also combined with aerobic exercise program mainly containing upper limb tension training, weights, and wheelchair exercises 30min/d, 5x/wk for 4wk. The control group	<ol> <li>The WHOQOL-BREF outcome scores were significantly improved in intervention groups compared with the control group in physiological domain, psychological domain, and total QOL (p&lt;.05). However, no statistical differences were observed in social relationship and environmental domains (p&gt;.05) between groups.</li> <li>Anxiety and depression scores reduced notably in both groups (p&lt;.05), and the scores in the intervention group were significantly lower than the control after treatment (p&lt;.05).</li> </ol>

	exercise only. Outcomes measures were assessed at baseline, and post intervention. <b>Outcome Measures:</b> Barthel Index (BI), World Health Organization Quality of Life (WHOQOL-BREF), Hamilton Anxiety Scale (HAMA), Beck Depression Inventory (BDI), Rehabilitation assessment indicators, Cardiopulmonary indicators.		
Xia et al. (2022) China PCT Level 2 N=90	Population: Intervention group (Systematic nursing; n=45): Mean age=36.75±3.32yr; Gender: males=23, females=22; Mean time post injury=not reported; Level of injury: not reported; Severity of injury: not reported; Anxiety status= Severe according to mean total HADS <i>Control group</i> (Rehabilitation training plan; n=45): Mean age=36.69±3.29yr; Gender: males=21, females=24; Mean time post injury=not reported; Level of injury: not reported; Severity of injury: not reported; Anxiety status= severe according to mean total HADS.	2.	HADS scores significantly decreased in both groups after the intervention (p<.05), and the scores were markedly lower in the intervention group than the control group (p<.05). QOL scores significantly increased in both groups after the intervention (p<.05), and the scores were markedly higher in the intervention group than the control group (p<.05). The intervention group showed better self-efficacy levels (GSES) than the control group after intervention (p<.05).
	<b>Intervention:</b> Two groups of patients were given either usual care with a diet plan as control, or the systematic care model as the intervention. The systematic care model involved a nurse educating the patient and family about the SCI and recovery, doing psychological interventions to ease patient discomfort, and creating care		

plans and diet instruction pre and post operation.	
Outcome Measures: Generic quality of life inventory (GQOLI- 74), and Hospital anxiety and depression scale (HADS), Incidence of complications, Rehabilitation outcomes including Functional Independence Measure (FIM), General Self-efficacy Scale (GSES), and Modified Barthel Index (MBI).	

In a pre-post study, Dhakal et al. (2022) found multidisciplinary telehealth consultations resulted in significant improvement in symptoms of anxiety.

#### Conclusion

There is limited level 4 evidence that providing multidisciplinary telehealth consultations reduces anxiety post SCI.

Multidisciplinary telehealth consultations may improve symptoms of anxiety post SCI.

# 5.0 Final Comments

This chapter has summarized research highlighting several promising approaches to the management of post-SCI mental health. 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 evidence-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 review of SCI rehabilitation (Sipski & Richards, 2006).

### 6.0 Summary

There is level 2 evidence (Craig et al., 1997; A. Craig et al., 1998; A. Craig et al., 1999; A. R. Craig et al., 1998; Paul Kennedy & Rogers, 2000; King & Kennedy, 1999) to support the use group CBT intervention targeting mood to decrease depressive symptoms following SCI among those with elevated depressive symptoms.

There is level 1b evidence from one RCT (Zhao et al. 2021) that CBT combined with pharmacotherapy was effective in improving symptoms of depression compared to conventional rehabilitation.

There is level 1 evidence (Duchnick et al., 2009; Feng & Li, 2017) that CBT is effective in improving depressive symptoms post intervention.

There is conflicting evidence that CBT intervention results in maintained affective improvement at follow up.

There is level 1b evidence (Schulz et al., 2009) that providing CBT to caregivers and care receivers results in improved depressive symptoms in care receivers.

There is level 1 evidence (Dear et al., 2018; Dorstyn et al., 2011; Migliorini et al., 2011) that telerehabilitation or online based CBT improves symptoms of depression post SCI.

There is conflicting evidence for the effectiveness of coping oriented supportive programs on improving symptoms of anxiety post SCI.

There Is level 4 evidence that acceptance and commitment therapy may reduce symptoms of depression post SCI (Han et al., 2022).

There is level 1b evidence that online mindfulness programs can help reduce symptoms of depression post SCI (Hearn & Finlay, 2018).

There Is level 2 evidence that meditation and Imagery Interventions may not reduce symptoms of depression post SCI.

There is level 1b evidence that peer led telephone counselling may not be effective in reducing symptoms of depression.

There is level 2 evidence that self-esteem programs do not improve symptoms of depression post SCI.

There is level 1b evidence from one RCT (Muller et al. 2020) that positive psychology interventions are not effective at improving depressive symptoms compared to mindfulness journaling post SCI.

There is limited evidence that EMDR may be effective in reducing symptoms of depression compared to no treatment.

There is level 2 evidence (Kahan et al., 2006; Kemp et al., 2004) that combined CBT and antidepressants reduce symptoms of depression post SCI.

There is level 4 evidence (Judd et al., 1986; Judd et al., 1989) indicating the effectiveness of pharmacotherapy combined with supportive psychotherapy for reducing symptoms of depression in SCI.

There is limited evidence that carbamazepine, amitriptyline, and gabapentin may not improve symptoms of depression post SCI.

There is level 1b evidence (Fann et al., 2015) that venlafaxine improves depressive symptoms post SCI.

There is level 1b evidence (Richards et al., 2015) that venlafaxine improves pain interference with mood post SCI.

There is level 1a evidence (from three randomized controlled trials; (Hicks et al., 2003; Latimer et al., 2004; Martin Ginis et al., 2003) that small group exercise-based programs reduced depressive symptoms post SCI.

There is level 2 evidence from 1 RCT (Bombardier et al. 2019) that physical activity counselling combined with at home exercise results in reduction of depressive symptoms compared to usual care.

There is level 4 evidence that body weight supported treadmill training (Hicks et al., 2005), or functional electrical stimulation exercise (Bradley, 1994) may not improve symptoms of depression post SCI.

There is level 1b evidence (K. Curtis et al., 2017) that yoga improves depressive symptoms post SCI.

There is level 4 evidence (Guest et al., 1997) that Parastep FNS ambulation training may result in a decrease in depressive symptoms post SCI.

There is level 4 evidence (P. Kennedy et al., 2006) that integrating sports and recreational activities may result in a reduction of depressive symptoms post SCI.

There is level 1b evidence (Diego et al., 2002) that massage may be effective in reducing symptoms of depression post SCI.

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

There is level 1b evidence (Feng & Li, 2017) that hyperbaric oxygen may improve depressive symptoms post SCI.

There is conflicting evidence for the effectiveness of education programs in reducing depressive symptoms post SCI (Dunn et al., 2000; Federici et al., 2019; Zemper et al., 2003).

There is level 1b evidence from one RCT that mesenchymal stromal cells combined with standard SCI rehabilitation is effective at reducing symptoms of depression compared to SCI rehabilitation alone.

There is level 2 evidence that the use of virtual natural environment with traditional rehabilitation results in reduction of depressive symptoms compared to rehabilitation alone.

There is level 2 evidence that return-to-work interventions may not improve symptoms of depression post SCI.

There is level 1b evidence that multidisciplinary telehealth consultations do not reduce symptoms of depression post SCI.

There is level 2 evidence from (Craig et al., 1997; A. Craig et al., 1998; A. Craig et al., 1999; A. R. Craig et al., 1998; P. Kennedy et al., 2003; King & Kennedy, 1999), that in person CBT may improve anxiety symptoms compared to standard treatment among those with elevated symptoms.

There is level 1b evidence (Dear et al., 2018; Dorstyn et al., 2011) Miglorini et al., (Migliorini et al., 2016)), that telerehabilitation based CBT improves symptoms of anxiety among persons with SCI.

There is level 1 evidence (Duchnick et al., 2009; Feng & Li, 2017) that CBT is effective in improving anxiety symptoms post intervention.

There is conflicting level 2 evidence (Li et al., (2019); (2020)) for the effectiveness of coping oriented supportive programme on improving symptoms of anxiety post SCI.

There is level 4 evidence (Han et al. (2022)) that guided videoconferencing ACT may reduce symptoms of anxiety post SCI.

There is limited evidence that EMDR may be effective in reducing symptoms of anxiety compared to no treatment.

There is level 1b evidence (K. Curtis et al., 2017) that yoga may decrease symptoms of anxiety post SCI.

There is level 4 evidence (P. Kennedy et al., 2006) that increased physical activity through various outlets may improve anxiety symptoms.

There is level 2 evidence from 1 RCT, that cranial electrotherapy stimulation may not be effective at reducing symptoms of anxiety after SCI.

There is conflicting evidence from 2 RCTs that transcranial direct current stimulation alone may reduce symptoms of anxiety after SCI.

There is level 2 evidence that combined transcranial direct current stimulation and visual illusion walking may help reduce symptoms of anxiety after SCI

There is level 2 evidence from 1 RCT, that massage may reduce symptoms of anxiety after SCI compared to home exercise.

There is level 4 evidence from 1 pre-post study, that participation in sports activity may reduce symptoms of anxiety after SCI.

There is level 1b evidence that hyperbaric oxygen may improve symptoms of anxiety post SCI. There is level 4 evidence that sexual health may not improve anxiety post SCI.

There is level 1b evidence from one RCT that mesenchymal stromal cells combined with standard SCI rehabilitation is effective at reducing symptoms of anxiety compared to SCI rehabilitation alone.

There is level 4 evidence that music therapy reduces anxiety post SCI.

There is limited level 4 evidence that providing multidisciplinary telehealth consultations reduces anxiety post SCI.

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# Abbreviations

AAQ-II	Acceptance and Action Questionnaire-II
ABI	acquired brain injury
ACT	acceptance and commitment therapy
ASIA	American Spinal Injury Association
BCM	body compression massage
BI	Barthel Index
BPI	Brief Pain Inventory
BMSC	bone marrow mesenchymal stem cells
BWSTT	body weight supported treadmill training
CBT	cognitive behavioural therapy
CBT-PMP	Cognitive Behavioural Pain Management Program
CD-RISC	Connor Davidson Resilience Scale
CENTRAL	Cochrane Central Register of Controlled Trials
CES	cranial electrotherapy etimulation
CES-D	Center for Epidemiologic Studies Depression Scale
CET	Coping Effectiveness Training
CFQ-7	Cognitive Fusion Questionnaire-7
CINAHL	Cumulative Index to Nursing and Allied Health Literature
CMI	clinical meditation and imagery
COPE	Coping Orientation to Problems Experienced
COSP	Coping Oriented Supportive Program
CPAQ-8	Chronic Pain Acceptance Questionnaire-8
CSS	Coping Strategies Scale
CYHQ	Check Your Health Questionnaire
DASS21	Depression, Anxiety and Stress Scale - Short
DN4	Douleur Neuropathique en 4 Questions
ePACT	electronic personal administration of cognitive therapy
EMAS	Engagement in Meaningful Activities Survey
EMDR	eye movement desensitization and reprocessing
EWQ	Emotional Wellbeing Questionnaire
FES	functional electrical stimulation
FIM	Functional Impairment Measure
FSS	Fatigue Severity Scale
FFMQ	Five Facet Mindfulness Questionnaire
GAD-7	Generalized Anxiety Disorder-7
GBP	gabapentin
GSES	Generalized Self-Efficacy Scale
gqoli-74	Generic Quality of Life Inventory-74
HADS	Hospital Anxiety and Depression Scale
НВО	hyperbaric oxygen
HDRS	Hamilton Depression Rating Scale
HLPL-II	Health Promoting Lifestyle Profile-II
ICBT	internet-based cognitive behavioural therapy
ISCIPBDS	International Spinal Cord Injury Pain Basic Data Set
JOA	Japanese Orthopedic Assessment
JSES	Job Procurement Self-Efficacy Scale
LCT	light contact touch massage

LOT-R	Life-Orientation Test Revised
LSIA	Life Satisfaction Index-A
LSS	Life Satisfaction Scale
LSQ	Life Satisfaction Questionnaire
MAAS	Mindful Attention Awareness Scale
MAACLR	Mutiple Affect Adjective Check List
MAR	music assisted relaxation
MBI	mindfulness-based intervention
MDT	multidisciplinary team
MHI-5	Mental Health Inventory-5
MPI-LIS	Multi-Dimensional Pain Inventory Life Interference Subscale
MSES	Moorong Self-Efficacy Scale
Neuro-QOL-SF	Quality of Life in Neurological Disorders Short Form
NIBS	Non-Invasive Brain Stimulation
NP	neuropathic pain
NRS	Numeric Rating Scale
OAHMO	Older Adult Health and Mood Questionnaire
PADS	Physical Activities with Disabilities Scale
PANAS	Positive and Negative Affect Schedule
PARA-SCI	Physical Activity Recall Assessment for Spinal Cord Injury
PART-O	Participation Assessment with Recombined Tools – Objective
PCS	Pain Catastrophizing Scale
PDI	Pain Disability Index
PEDro	Physiotherapy Evidence Database
PGB	pregabalin
PHO-9	Patient Health Questionnaire-9
PSEO	Pain Self-Efficacy Questionnaire
PSS	Perceived Stress Scale
PSOL	Pittsburgh Sleen Quality Index
PTGI-SF	Post-Traumatic Growth Inventory Short Form
001	quality of life
0-1 FS-0-SF	Quality of Life Enjoyment and Satisfaction Questionnaire Short Form
RCT	randomized controlled trial
RNII	Reintegration into Normal Living Index
RSES	Rosenberg Self-Esteem Scale
rTMS	Repetitive Transmagnetic Stimulation
SAHP	Self-Rated Abilities for Health Practices Scale
SAS	7ung Self-Rating Anxiety Scale
SCI	spinal cord injury
	Spinal Cord Injury Quality of Life
SCS	Secondary Conditions Scale
SCS-SF	Self-Compassion Scale – Short Form
SDS	7ung Self-Bating Depression Scale
SE-36	Short Form Health Survey
SGT	supportive group therapy
SIS	Sexual Interest and Satisfaction Scale
	Survey of Pain Attitudes
SPS	Self-Percention Scale
SRHS	Self-Rated Health Scale
SSO	Social Support Questionnaire
SJQ	State Trait Anxiety Inventory
511	State matrimety inventory

SUS	System Usability Scale
SWLS	Diener Satisfaction with Life Scale
ТС	telephone counselling
tDCS	Transcranial Direct Current Stimulation
TMS	Toronto Mindfulness Scale
TSQ	Treatment Satisfaction Questionnaire
UTI	urinary tract infection
VAS-A	Visual Analogue Scale – Anxiety
VR	virtual reality
WBPQ	Wisconsin Brief Pain Questionnaire
WHOQOL-BREI	F World Health Organization Quality of Life BREF