

## Original Article

# Impact of spinal cord injury on self-perceived pre- and postmorbid cognitive, emotional and physical functioning

RF Murray<sup>\*1</sup>, A Asghari<sup>1,2</sup>, DD Egorov<sup>1</sup>, SB Rutkowski<sup>3</sup>, PJ Siddall<sup>1</sup>, RJ Soden<sup>3</sup> and R Ruff<sup>4</sup>

<sup>1</sup>University of Sydney Pain Management and Research Centre, Royal North Shore Hospital, Sydney, Australia;

<sup>2</sup>Department of Psychology, Shahed University, Tehran, Iran; <sup>3</sup>Spinal Cord Injuries Unit, Royal North Shore Hospital, Sydney, Australia; <sup>4</sup>Department of Psychiatry, University of California, San Francisco, CA, USA

**Study Design:** Cross-sectional study with repeated measurements.

**Objectives:** To examine the patient's perspective of the impact of spinal cord injury (SCI) on physical, cognitive, emotional function, and quality of life (QOL).

**Setting:** Australia.

**Methods:** A sample of 63 patients with SCI, 32 of whom had recent injuries, and 31 with established injuries were administered the Ruff Neurobehavioral Inventory to examine patients' subjective evaluation of pre- and post-injury functioning. Current happiness levels were also evaluated using the Subjective Happiness Scale. A follow up assessment was performed 6 months later to examine changes over time.

**Results:** A significant difference was found between perception of pre- and postmorbid function on composite Cognitive ( $t=5.99$ ,  $df=62$ ,  $P<0.001$ ), Physical ( $t=11.56$ ,  $df=62$ ,  $P<0.001$ ), and QOL ( $t=7.16$ ,  $df=62$ ,  $P<0.001$ ) scales and on several of the Emotional subscales including anxiety, paranoia and suspicion, and substance abuse ( $P<0.001$ ). A series of hierarchical regression analyses indicate that post-SCI pain was a significant predictor of: cognitive ( $R^2=0.20$ ,  $P<0.001$ ); emotional ( $R^2=0.13$ ,  $P<0.004$ ); and of QOL ( $R^2=0.22$ ,  $P<0.001$ ) functioning. With the exception of a decrease in happiness ( $P<0.01$ ), there were no significant changes in any measures over the 6 month time period.

**Conclusions:** There are significant changes in patients' perceptions of physical and cognitive functioning, and of QOL before and after SCI and some aspects of emotional functioning. Pain has a significant adverse effect on functioning. Happiness decreased slightly in the 6 months between surveys.

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**Keywords:** spinal cord injuries; rehabilitation; psychology; quality of life; pain

## Introduction

Spinal cord injury (SCI) has a major impact on physical, cognitive and emotional function and hence on quality of life (QOL). Adjustments in lifestyle after SCI are rarely described as mild; instead they range from moderate to extremely severe and SCI was reported to be the most expensive hospital diagnosis in the USA in 1996.<sup>1</sup> The physical effects of SCI range from relatively mild, as in incomplete lesions, to disabling, as in complete lesions at the cervical level which create total paralysis and sensory deficits. Loss of mobility is often a dominant concern for those with SCI. Other somatic consequences include loss of sensation, loss of sexual function, loss of control over bladder and bowel

function, muscle spasms, and pressure sores. Sensory loss does not preclude the onset of pain and muscle spasms, and chronic pain is a common problem that rates almost as highly as loss of function in terms of impact on QOL.<sup>2,3</sup>

Cognitive abilities following SCI have traditionally received little attention in research studies but recent research in the field of SCI has highlighted the presence of cognitive deficits in this group. Studies suggest that between 40 and 50% of patients experience varying degrees and patterns of cognitive impairment.<sup>4</sup> These deficits include difficulties with attention, concentration, memory, problem solving, abstract reasoning, and new learning and high-level cognitive skills.<sup>4–6</sup>

In addition to the physical and cognitive effects of SCI, researchers have found that a combination of emotional factors including anxiety affects these

\*Correspondence: RF Murray, University of Sydney Pain Management and Research Centre, Royal North Shore Hospital, St. Leonards, New South Wales 2065, Australia

patients.<sup>7</sup> Changes in body image can cause psychological trauma<sup>8</sup> and the use of a halo brace may also distort body image and self concept. Surprisingly, the prevalence and severity of mood disruption following SCI is not as high as many clinicians predict.<sup>10</sup> Many patients who experience emotional distress return to their normal state within the 1st year following injury. Research has shown that by the end of the 1st year following injury, the sequelae of SCI have very little impact on emotional state.<sup>11,12</sup>

Alterations in physical, cognitive and emotional function may all impact on QOL. Subjective components of QOL that affect daily activities, vocation, and psychosocial interactions should be considered in conjunction with physical, cognitive and emotional changes. Although QOL measures in SCI patients have been found to remain high and relatively stable over time,<sup>13</sup> there are a host of factors that may affect QOL following SCI. For example, chronic pain is one of the most frequently recorded reasons for reduced QOL following SCI and may have more impact on QOL scores than the extent of damage associated with SCI.<sup>14–17</sup> Pain severity was one of the few factors that predicted well-being in a large study of 1668 persons with tetraplegia.<sup>18</sup> However, an Australian survey which examined QOL for both SCI and those with traumatic brain injuries did not identify pain as one of the 10 key issues affecting QOL.<sup>19</sup>

Although experts in SCI management are able to predict a patient's ultimate functional capacities based on the level of SCI, pain may also prevent people from attaining the predicted level of functioning.<sup>20</sup> The prevalence of pain in SCI patients has been estimated to be 69%, and nearly one-third of patients rate their pain as severe.<sup>21</sup> Moreover, in a longitudinal study on the prevalence of severity of pain in SCI, Siddall *et al.*<sup>22</sup> found that 91% of those studied reported pain at 2 weeks following injury and 64% still had pain at 6 months following the injury. Despite the high prevalence and impact of pain on QOL, the mechanisms of pain in SCI patients are not well understood. Loeser<sup>23</sup> writes, 'clinical neurophysiology may help define the completeness of the SCI or associated nerve root injuries, but it does not delineate pain types or predict the likelihood of successful treatments with various strategies. Physicians can describe the type of pain in broad categories, but not on the basis of underlying mechanisms.'

In summary, SCI has a major impact on physical, cognitive and emotional function and the presence of pain may be a significant contributor to these changes. Despite these well-documented changes, there is little information available on a person's subjective experience of physical, cognitive and emotional function following SCI and how it compares with their perception of function in each of these domains before injury. A review of the literature on SCI research identified by the Agency for Healthcare Research and Quality website<sup>24</sup> revealed no studies that focused specifically on SCI patients' subjective assessments of life as a whole pre- and post-injury.

The present study had several aims. The first aim was to determine whether there was a significant change in a person's perception of their cognitive, emotional and physical functioning, and QOL before and after injury. This was carried out by comparing the evaluation of their current status with retrospective evaluation of perceived pre-injury functioning using the Ruff Neurobehavioral Inventory (RNBI).<sup>25</sup> We hypothesized that changes in physical functioning would be most clearly demonstrated, as it is the physical sequelae of SCI that are evident and well understood. Although studies have examined effects of SCI on cognitive abilities, mood, and QOL, none have investigated the individual's perception of these variables before and after SCI.

Our second aim was to examine the association between pain intensity following SCI on measures of cognitive, and emotional function as well as QOL. This population frequently experiences pain, which is known to have a significant impact on QOL. However, the effects of pain on cognitive and emotional functioning are not as well understood. In order to examine our hypothesis that the intensity of pain negatively affects variables assessed by the RNBI scales, in our study a series of regression analyses were conducted to examine the effect of pain on the three dimensions of cognitive, emotional, and QOL.

Our third aim was to examine the effect of time on subjective assessments of physical, cognitive, emotional, and QOL and happiness levels. This was carried out in two ways. First, a group with recent injuries was compared with a group with established injuries to examine any differences associated with the duration of injury. Second, assessments in all subjects were repeated 6 months following their initial assessment to examine changes over time.

## Methods

### Subjects

A total of 69 patients with SCI were approached to participate in the study. Of these, 63 (91%) agreed to participate and were assessed. Mean age for the entire sample was 43.5 years (SD = 14.2). Other characteristics of the two groups of study participants are shown in Table 1.

A convenience sampling method was used. When the study began all patients who came to the hospital as inpatients or outpatients and who met the following criteria were approached:

1. English-speaking.
2. Between 18 and 65 years of age.
3. No neurological disorder that would affect participation in the study.
4. No history of acquired brain injury.
5. No serious psychological disorder.

Both recently injured patients and people with established injuries were included in the study. Recently

**Table 1** Demographic characteristics of participants ( $n = 63$ )

<i>Duration of injury</i>	<i>New injury</i>	<i>Established Injury</i>	<i>Total</i>
<i>N</i>	32	31	63
<i>Gender</i>			
Male	26	24	50
Female	6	7	13
<i>Type of Injury</i>			
Paraplegia	18	19	37
Tetraplegia	14	12	26
<i>Education</i>			
Tertiary/Postgraduate qualifications	8	6	14
Trade qualification/apprentice Diploma, certificate or other post school study	8	7	15
Completed 12-years-of high school	6	3	10
Left school at age 16 (no HS certificate)	5	4	9
Left school at age 15 or less	1	5	6
Missing	4	3	7
	0	2	2
<i>Work Status at Time of Injury</i>			
Full time or Part time work	24	24	45
Unemployed	0	3	3
Full time student	1	1	
Not working by choice	1	0	1
In a sheltered work program	1		
Unable to work owing to illness	1	0	1
Retired	3	1	4
Other	0	1	1
Missing	1	1	4

injured patients were approached as soon as medical and nursing staff indicated that they were sufficiently medically stable. Patients in the 'recent injury' group were seen at a mean of 7.08 (SD = 7.63) weeks post injury and had a mean age of 41.3 years (SD = 14.7). Those seen at least 1 year after the initial SCI were classified as established injuries. This was an arbitrary classification based upon clinical experience that virtually all SCI patients had completed rehabilitation 1 year after injury. Those with 'established injuries' were seen at a mean of 70 (SD = 47) months post injury and had a mean age of 45.6 years (SD = 13.3).

#### *Outcome measures*

The first outcome measure used was the RNBI.<sup>25</sup> Before the development of the RNBI, no single instrument was available to comprehensively capture the important life domains we wished to examine. The RNBI is the first instrument designed to contrast current problems following central nervous system injury with the individual's assessment of perceived premorbid functioning levels.<sup>25</sup> It is a self-report questionnaire, designed to assess the most important aspects of a person's functioning following a catastrophic event

such as an illness or injury and was designed to capture the individual's evaluation of their cognitive, physical, and emotional function as well as how they view their QOL both before and after injury. The questionnaire contains 243 statements which can be answered: 'False, Not at All True', 'Slightly True', 'Mainly True' or 'Very True'. Lower scores indicate better function.

The psychometric properties of the RNBI have been documented.<sup>25</sup> The internal consistency (ie Cronbach's  $\alpha$ ) of the RNBI Scales ranged from 0.67 to 0.90 and test-retest reliability coefficients ranged from 0.63 to 0.96 and were acceptable as recommended by Nunnally and Bernstein.<sup>26</sup> Validity of the RNBI was also acceptable. The postmorbid emotional scales of the RNBI were significantly correlated ( $P = 0.01$ ) with matching subscales of the Millon Clinical Multiaxial Inventory-III.<sup>27</sup> Similarly, significant correlations were demonstrated for the postmorbid QOL scales in comparisons with both the QOL enjoyment and satisfaction questionnaire<sup>28</sup> and the Mayo-Portland Adaptability Inventory.<sup>29</sup> Given that the RNBI is unique in capturing multiple functions before and after an illness, no published tests were available for validation of the premorbid scales.

The pain measure used was the pain subscale of the RNBI Physical Composite Scale. Both the pre- and postmorbid subscales for pain are comprised of six questions. During the development of the RNBI, the six final questions were selected from over 40 pain questions based on preliminary studies. Thereafter, the final pain subscales were examined in additional validation studies that included a sample of chronic pain patients without SCI as well as a SCI group without chronic pain. Both the pre- and postmorbid pain subscales demonstrated a high sensitivity and specificity for capturing pain symptoms.<sup>25</sup>

The second outcome measure used was the subjective happiness scale (SHS).<sup>30</sup> This instrument was developed as a subjective approach to the assessment of happiness. The scale comprises four items designed to measure global subjective happiness. Possible scores range from 1.0 to 7.0, with higher scores reflecting greater happiness. It was developed and validated in 14 studies with a total of 2732 participants. Data were collected in the USA and Russia. Internal consistency was found to be good with  $\alpha$  ranging from 0.79 to 0.94 ( $M = 0.86$ ). Test-retest reliability ranged from 0.55 to 0.90 ( $M = 0.72$ ). Tests assessing convergent validity demonstrated correlations ranging from 0.52 to 0.72 ( $M = 0.62$ ) with other measures of well-being and happiness. The mean score on the SHS for adult Americans was 5.62 (SD = 0.96).<sup>30</sup> We chose this measure for its discriminative ability, because questions are not health-related but focus simply on the individual's assessment of his/her own happiness.

#### *Assessment of patients*

All participants were informed of the purpose of the study, and were asked whether they would be willing to complete the RNBI questionnaire and the SHS on two occasions: at first contact and again 6 months

later. At the first time point, the RNBI was used to collect data on current cognitive, emotional, physical function, and QOL as well as perceived function in each of these domains before injury. In addition, the SHS was administered to evaluate current levels of happiness.

Subjects were then re-evaluated using both instruments 6 months following the first interview to examine changes over time. Informed consent was obtained and participants who were unable to write because of paralysis, were assisted by the first author. All members of this group indicated that they would receive assistance from their carers to complete the follow up questionnaire. The questionnaires were mailed to all participants with a return envelope 6 months after they had completed the initial survey. No reward for returning the questionnaire was offered. Of the 63 patients, 36 (60%) participants completed the second questionnaire 6 months following their initial evaluation.

#### Statistical analysis

Statistical analysis was completed using SPSS Version 10.0.<sup>31</sup> Before data were analyzed, the validity scales of the RNBI were examined as recommended by Ruff and Hibbard.<sup>25</sup> The RNBI calculates separate validity scales for pre- and postmorbid sections of the test. These scales determine overly positive- or negative-response patterns as well as inconsistencies across answers. All validity scales were found to be within acceptable ranges.

## Results

Although patients were initially divided into two groups based on duration of injury, preliminary analysis examined an association between time at injury and cognitive, emotional, physical function, and QOL and found no significant relationship between this variable and these four dimensions. Thus, post- and premorbid RNBI composite scales differences for the entire sample were examined. To control for familywise type I error rate, a Bonferroni adjustment was used ( $0.05/21 = 0.0023$ ).<sup>32</sup>

Preinjury scores on the RNBI cognitive, physical, and QOL composite scales were significantly lower than post-injury scores ( $P < 0.001$ ) (Table 2). This indicates that subjects perceived that their post-injury function was worse in all of these dimensions. In contrast, no significant difference was found on emotional composite scales. However, when emotional subscales were examined individually, it was revealed that there were significant differences in the scores in the anxiety, paranoia and suspicion, and substance abuse subscales. There was a significant increase in the anxiety subscale ( $P < 0.001$ ) indicating worsening of anxiety post-injury and a significant decrease in the substance abuse ( $P < 0.001$ ) and paranoia and suspicion ( $P < 0.001$ ) subscales indicating an improvement in both these dimensions. There were no significant changes in the Emotional subscales measuring anger, depression, and post-traumatic stress.

**Table 2** Paired samples *t*-test for pre- and postmorbid functioning on composite cognitive, emotional, physical, and quality of life scales and on their subscales

Variable	Pre		Post		df	t	Level of significance
	M	(SD)	M	(SD)			
Cognitive	29.92	(6.54)	37.06	(10.73)	62	5.99	0.001
Attention	7.53	(2.30)	9.82	(3.74)	62	4.85	0.001
Executive functioning	8.17	(2.60)	10.33	(3.43)	62	5.22	0.001
Learning and memory	7.43	(2.77)	9.30	(3.35)	62	3.86	0.001
Speech and language	6.70	(1.14)	7.76	(2.37)	62	3.76	0.001
Emotional	49.25	(9.08)	49.27	(10.24)	62	0.01	0.989
Anger	8.09	(2.33)	9.18	(3.17)	62	2.57	0.013
Anxiety	7.20	(1.61)	8.74	(3.28)	62	4.45	0.001
Depression	9.31	(2.93)	8.90	(2.99)	62	-0.92	0.363
Paranoia and suspicion	8.36	(2.20)	6.79	(1.30)	62	-5.32	0.001
PTSD	8.55	(2.80)	9.71	(3.84)	62	2.08	0.041
Substance abuse	7.90	(2.70)	6.44	(1.22)	62	-4.74	0.001
Physical	22.86	(5.14)	39.78	(10.97)	62	11.56	0.001
Neurological status	8.25	(2.62)	12.95	(3.16)	62	8.91	0.001
Pain	6.84	(1.93)	12.76	(5.14)	62	9.49	0.001
Somatic complaints	7.77	(2.40)	14.34	(4.57)	62	10.53	0.001
Quality of life	31.03	(6.53)	41.05	(9.20)	62	7.16	0.001
Abuse	6.56	(2.32)	6.32	(0.98)	62	-0.736	0.464
Activities of daily living	6.74	(2.13)	12.20	(4.65)	62	7.52	0.001
Psychosocial integration	7.83	(2.13)	11.32	(2.96)	62	8.59	0.001
Vocation	9.68	(3.37)	11.11	(3.81)	62	2.34	0.023

To control for the risk of Type I errors, a Bonferroni adjustment was used ( $0.05/21 = 0.0023$ ). Only *t*-values at or below the 0.0023  $\alpha$ -level were considered significant

We examined participants' current levels of subjective happiness only. Mean happiness levels were 5.61 (SD=1.50). The maximum achievable score on the SHS is 7.0.

To examine the hypothesis that for all subjects intensity of pain would predict scores on some postmorbid composite scales, regression analyses were performed with scores on the pain subscale as the predictor variable and cognitive, emotional and QOL composite scales as separate criterion variables. To control for familywise type I error rate, a Bonferroni adjustment was used ( $0.05/4=0.013$ ).<sup>32</sup> Regression analyses indicated that intensity of pain was a significant predictor of scores on all three scales (Table 3).

#### Six month follow up

To analyze differences between participant responses on the initial survey (Time 1) and at 6-month follow up (Time 2) a series of paired samples *t*-tests was performed for all RNBI composite scales obtained at each time point. Paired samples *t*-tests were also performed for SHS scores. To control for familywise type I error rate, a Bonferroni adjustment was used ( $0.05/5=0.01$ ).<sup>32</sup> Results indicated no significant differences between Time 1 and Time 2 assessments in either group on any of the RNBI composite scales. There was, however, a small but significant ( $P<0.01$ ) decrease in happiness levels for the entire group from Time 1 to Time 2 (Table 4).

### Discussion

This study showed that SCI patients' perception of their lives before and after their injury changed significantly in almost all areas examined. Although the emotional composite scale showed no significant change, there were significant changes in several subscales of this dimension. Our findings are consistent with the results of some previous studies that have evaluated function in these same areas at various time points following SCI.<sup>2,4-6,9-12,16</sup> In addition, this study provides information on the person's current functional status and a

**Table 3** Postmorbid cognitive, emotional, and physical functioning, and QOL as predicted by pain in regression analysis

Criterion variables predicted by post pain intensity	$R^2$	Adj $R^2$	F	B	t	Level of significance
Cognitive	0.20	0.19	15.21	0.45	3.9	<0.001
Emotional	0.13	0.12	9.2	0.36	3.04	0.004
QOL	0.22	0.21	17.60	0.47	4.12	<0.001

Abbreviation: QOL, Quality of life

To control for the risk of Type I errors, a Bonferroni adjustment was used ( $0.05/4=0.013$ ). Only *t*-values at or below the 0.013  $\alpha$ -level were considered significant

comparison with their perception of function in these same domains before injury, a comparison that has not been made in previous studies.

Our study shows an important difference among the emotional subscales. As past research has indicated, mood changes in the form of depression do not tend to persist long-term. Indeed, our finding that levels of depression (using the RNBI) were not significantly different from a person's perceived level of depression before injury confirm these findings. This is further supported by our findings using the SHS, which for our patient group reached levels that were close to norms for the USA population.

In contrast with the findings on depression, which showed no significant difference between current and perceived pre-injury levels, the anxiety subscale was significantly elevated. This increase in anxiety is probably related to uncertainty regarding the future, loss of perceived life control, and, for those who experience chronic pain, concern regarding the future level and intensity of pain.

SCI patients perceived a significant lowering of cognitive and physical functioning following the injury. The physical change is not unexpected and needs little further comment. Patient perceptions of their cognitive abilities are reflected in statements such as 'I learn things more slowly,' 'I have difficulty naming objects,' and 'I have trouble remembering things.' Perceptions may not be based in real declines in functioning. However, cognitive changes have been found in previous studies of people with SCI using psychometric test measures.<sup>4-6</sup>

Factors contributing to these cognitive deficits are varied. Some may have sustained a traumatic brain injury at the time of their accidents. Others may have secondary trauma as a result of factors such as cerebral edema, hypoxia and anoxia. Radanov and Dvorak<sup>33</sup> have reported cerebral dysfunction after whiplash, yet, in long-term follow up, they found few deficits not attributable to pain, medications or emotional distress. Any of these factors may also be operating in

**Table 4** Paired samples *t*-test for postmorbid functioning at Time 1 and Time 2 (6-month follow up) on composite cognitive, emotional, physical, and QOL scales, on selected subscales and on happiness scales

Variable	Time 1		Time 2		df	t	Level of significance
	M	(SD)	M	(SD)			
Cognitive	38.25	(1.45)	39.22	14.64	31	-0.52	0.60
Emotional	50.50	(11.39)	52.61	(14.16)	27	-0.86	0.39
Physical	42.58	(10.52)	41.45	(12.61)	30	0.68	0.50
QOL	43.81	(9.99)	45.16	(10.23)	31	-0.85	0.40
Happiness	5.55	(1.14)	5.24	(1.34)	35	2.59	0.01

Only *t*-values at or below the 0.01  $\alpha$  level were considered significant

To control for the risk of Type I errors, a Bonferroni adjustment was used ( $0.05/4=0.013$ ). Only *t*-values at or below the 0.013  $\alpha$ -level were considered significant

this population. It is known that medications used to treat chronic pain may indeed affect perceived cognition.<sup>34,35</sup> However, no studies were found that examined the effects of analgesic medication specifically on the SCI population.

Bonekat, Anderson and Squires<sup>36</sup> reviewed four cases of obstructive sleep apnea in SCI patients and found decreased cognitive abilities, probably related to sleep hypoxia. A previous history of alcohol or substance abuse may have led to impairment in cognitive functioning and chronic alcoholics are likely to show cognitive deficits.<sup>37</sup> However, studies on moderate alcohol abuse indicate that neuropsychological deficits are likely to be minimal, accounting for only one percent of the variance when other contributing factors are considered.<sup>38</sup> Thus, in the SCI population, unless there is a known history of chronic alcohol abuse, it is unlikely that moderate alcohol use is an important contributing factor to decreased cognitive abilities. As the RNBI indicated a significant decrease in perceived levels of substance abuse following injury, it is unlikely that substance abuse contributed to decreased cognitive abilities for these patients. Thus, the reasons for patients' perceived decline in cognitive functioning for this population are unclear and warrant further evaluation to determine whether perceived deterioration in cognitive abilities is consistent with neuropsychological screening measures.

Patients' perceived deterioration in QOL was also expected and consistent with previous findings showing the detrimental impact of both SCI and pain on multiple QOL domains.<sup>39</sup> Factors that have been found to affect adjustment to SCI include depressed mood,<sup>40,41</sup> anxiety, sadness, and a perception of excessive fatigue.<sup>42,43</sup> In this group, depression (including feelings of sadness) was not found to be an important factor, although anxious symptoms increased. In this population factors that are likely to be important include dependence on others, interference with normal activities of daily living, pain, and loss of meaningful work and recreational activities. Turk and Rudy<sup>44</sup> found all the latter factors were likely to reduce perceived QOL. Feelings of poor internal control and decreased self efficacy are also likely to result in negative affect.

Gething *et al.*,<sup>19</sup> in a 4-year research project conducted with an Australian sample, found that SCI had a substantial impact on QOL. Their study also reported low levels of internal control, a factor that is important to subjective QOL, as dependence on others may compound deterioration in life quality. Gething *et al.*<sup>19</sup> also found that the most important priority for the group studied was 'benefits, services and equipment,' an indication that the perception of low-internal control was probably at least partially associated with unmet needs.

The second part of our study was to determine the impact of pain on perceived cognitive, emotional and physical functioning, and on QOL. We found pain severity to be a significant predictor of functioning on all measures. This is consistent with previous studies that

have demonstrated the major impact of pain on physical functioning<sup>14-16</sup> and the association between pain and mood dysfunction.<sup>16</sup> In this SCI population the effect of pain on cognitive function may be owing to a combination of factors that are secondary to the presence of pain, such as sleep disturbance and increased use of medications. The combined effect of pain, with its impact on all areas of function is then likely to have a significant impact on perceived QOL. Summers *et al.*<sup>43</sup> have recommended the application of psychological management strategies to pain related to SCI. Physical exercise is also important, both for the management of pain and for the psychological benefits that flow from increased physical activity.<sup>45</sup> Research suggests that individuals with SCI can be 'immunized' against anxiety and depression if cognitive behavior therapy is provided early on in their rehabilitation following injury.<sup>19</sup>

The third part of our study examined changes in function over time with a comparison between a newly injured group and a similar group with established injuries and by performing two assessments separated by a 6-month period. The findings in the present study indicate that cognitive, emotional, physical, and QOL dimensions are stable over time. We had expected that changes would occur within the recently injured group, and it was surprising to find that there was no change on any of the RNBI measures for either group of patients. However, we found a small but significant decrease in subjective happiness overall. It may be that these changes were not substantial enough to be detected in a group of the size in our study.

From a theoretical perspective, these results contribute to a better understanding of SCI patients' subjective feelings about life after injury, and how this changed life compares to their perception of their previous lives. Firstly, people perceive a worsening of physical and cognitive functions, and QOL but not overall mood. Secondly, we found that pain had an adverse impact on all aspects of functioning examined. This finding indicates the importance of physical strategies aimed at reducing pain as well as psychological strategies aimed at reducing and managing pain, as severe emotional distress and pain have a strong interaction. Thirdly, we found that there were no significant changes in physical, cognitive, emotional functioning or in QOL over the 6-month period either for newly injured patients or those with established injuries.

This study does have limitations. Firstly the sample size was relatively small, with a total of 63 participants and a follow up group of 36 participants. This made it difficult to analyze subgroups of patients according to time as injury and level of injury. A second limitation was the lack of a control group so that SCI patients could be compared with healthy controls on the same questionnaires. This limitation is particularly important, as the RNBI was normed on a USA sample, and Australian norms are not available. However, this limitation does not apply for the pre- vs postmorbid comparisons. Despite these limitations, this study is the

first to examine SCI patients' perceptions of life before and after injury, to compare the responses of newly-injured patients with those with established injuries regarding perceived function before and after injury, and to examine the relationship of pain to these aspects of function.

## Conclusion

This study examined SCI patients' subjective assessment of their pre- and postmorbid functioning and found adverse changes in most of the domains examined. Furthermore, the presence of pain was associated with reduced function in the domains examined. However, despite patients' perceived losses, their assessment of subjective happiness was close to that of the USA population although it declined slightly over time. Although there were differences in some of the emotional measures such as anxiety, there was no difference in the perceived levels of depression before and after injury.

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