NEUROPSYCHOLOGICAL FUNCTIONING AND ADJUSTMENT IN SPINAL CORD INJURED PATIENTS

by

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Abstract

The psychological aspect of spinal cord injury (SCI) is a neglected area in healthcare. Until recently psychologists have shown little interest in physical disability. In South Africa very few psychologists have experience of working with patients with SCI. In recent years there has been an increase in the number of individuals with acquired (rather than developmental) disabilities, a trend that is particularly evident in South Africa where there is a high crime rate and a high rate of road traffic accidents.

Neuropsychological aspects and SCI is another area that has received little attention locally, with no studies on this subject in South Africa having been revealed in literature searches. Integration of psychological factors into the management of physical disabilities is critical to successful healthcare delivery.

The aim of this study was to determine the relationship between spinal cord injury (SCI) and cognitive functioning, and the resulting psychological consequences of SCI, with the intention of improving treatment and intervention. Using a prospective design, a total of 112 traumatic spinal cord injured patients were assessed, drawn from major rehabilitation hospitals and centres in Durban, South Africa. A control group was used comprised of patients with amputations. In addition to a semi-structured interview, various questionnaires were administered immediately following their traumatic incident (time point 1) and after a month (time point 2). Cognitive functioning was established using a neuropsychological test battery and the Wechsler Adult Intelligence Scale III. Group differences were explored using ANOVA, χ^2, and t tests. Multivariate analysis was performed to determine changes in psychological functioning over time. Cognitive factors and demographics associated with PTSD were determined using bivariate analysis.

The findings of this study revealed that high levels of anxiety, depression and PTSD were present at the time of admission and a month later. The study also showed that PTSD impacts negatively on cognitive functioning in patients with SCI. Females were found to be at a greater risk of PTSD. Single young males were found to be at greatest risk of sustaining SCI. High rates of road traffic accidents and crimes were contributing factors to SCI and PTSD. The findings of this study highlight the important role of clinical psychology in the acute and rehabilitation phases of physical disability. The thesis also emphasizes the urgent need in South Africa for psychologists to be trained to work with individuals with acquired disabilities and for rehabilitation psychology as a field. The thesis concludes with a proposed intervention model for the psychological management of individuals with SCI.

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Dedication

This dissertation is dedicated to my parents, Gonseel and Parvathy Govender, for believing in me, and especially to my dad whose tireless endeavours helped me to realize my dreams.

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Chapter 1
Introduction

"When a man loses his limb, he loses more; he loses his heart."
(Kessler, 1969, cited in Celikyol, 2002, p. 1047)

Spinal cord injury (SCI) is a complex, debilitating and potentially life-threatening condition which results in multisystem impairment (Boyer, Hitelman, Knolls, Kafkalas, 2003; Duff & Kennedy, 2003) and is one of the most serious physical injuries that can be sustained (Kennedy & Evans, 2001). SCI can result from a traumatic aetiology (e.g., gunshot wound) or non-traumatic aetiology (e.g., infective TB spondylosis). This study focuses on traumatic SCI.

SCI is a significant challenge to an individual and his or her family's psychological as well as financial resources, due to the substantial degree of physiological damage and impairment (Duff & Kennedy, 2003). Research has shown that there is a higher incidence of depression and suicide following SCI compared to the incidence in the general population (Duff & Kennedy, 2003). Rates of current and lifetime PTSD in the SCI population were found to be comparable to those in other traumatized groups (Radnitz et al., 1995 cited in Nielsen, 2003).

There are huge financial implications associated with the caring for a person with a chronic disability such as SCI. According to Kennedy (2007), in many healthcare systems chronic disease has replaced acute disease as a dominant problem and has become the principal cause of disability and the outlay of healthcare expenditure. The majority of healthcare delivery systems have cut down on services and limited access to care for many people with disabilities (Elliot and Warren, 2007). If adequate physical and mental healthcare is not provided for individuals with acquired disabilities, then secondary complications will develop. The long-term consequences of such neglect could lead to even greater financial costs.

The psychological aspects of SCI are a neglected area in healthcare. Psychologists, until recently, have shown little interest in physical disability (Wilkinson, 1989). For instance there was little involvement of psychologists in the medical rehabilitation programs in the early twentieth century (Elliott &Warren, 2007). However, there is a need for psychologists to become involved in working with individuals with physical disability. A study by Johnstone, Walsh, Carton and Fish (2008) indicates that in Ireland there is an increase in the number of individuals with acquired (rather than developmental) disabilities. In South Africa there is a similarly rising trend, due to the high crime rate and high incidence of road traffic accidents (RTA). Pandemics such as the HIV/AIDS and the multi- and extreme drug-resistant tuberculosis pandemics have significantly added to this burden. According to Kennedy (2007), there should be an emphasis on psychological factors in the management of physical disabilities as this is critical for successful healthcare delivery.

In South Africa, very few psychologists have experience of working with patients with SCI and few psychology students are trained in this area. Hope (2005) states that in the rehabilitation treatment centres in Johannesburg it is not standard practice for psychologists to work with persons with paraplegia. However, psychotherapeutic interventions are an important part of rehabilitation as they assist in adapting to losses (Hope and Botha, 2005b).

Due to the rise in the number of acquired disabilities such as spinal cord injury (SCI), acquired brain injury, cardio vascular accidents, etc., there is increasing recognition of the need to train psychologists to work with such individuals

(Johnstone, Walsh and Fish, 2008). Only a few clinical psychology internship programmes in South Africa allow for brief placements in spinal units.

Previous studies in South Africa in the area of psychology and SCI were done by Abdinor (2004), Gaitelband (1996), Hope (2005), Marais (1993), McGill (1997), Parker (2005), Thompson (1995) and Van Niekerk (1995). These studies, together with other research in areas such as social work, religion, physiotherapy, etc., are discussed below.

The studies considered various themes such as pain, psychosocial aspects and emotional support, psychological adjustment, subjective experiences of SCI, religion, rehabilitation and sexuality. Colley (1997) examined the psychosocial impact of pain on spinal cord injury patients in a hospital setting. McGill (1997) assessed the bio-psychosocial outcome of patients to their traumatic SCI. In a study on the psycho-social effects of paraplegia on the individual, Mkhize (1993) found that paraplegics had a lower positive sense of social worth compared to people with no apparent disabilities. Mthembu (1994) found that psychosocial aspects are important in the holistic rehabilitation and adaptation of the spinal cord injury patient. In a study of soldiers with SCI, Parker (2005) explored the impact of emotional support offered during rehabilitation on the long term quality of life (QOL) and satisfaction with living (SWL).

Bunde (2008) studied the experiences related to QOL in persons living with SCI in the community following rehabilitation in Tanzania. In an analysis of the experience of the acute phase of traumatic SCI, Gaitelband (1996) emphasized the value of understanding the stages of SCI adjustment and stressed the need for placing adjustment within a personalized and individually meaningful context. Marais (1983) looked at attributions of blame and psychological adjustment among people with spinal cord injury. Van Niekerk (1995) studied depressive symptomatology among South African youth with traumatic SCI. The findings of this study reveal poor adjustment and considerable psychological difficulties following SCI. In a study on the bodily experiences of persons with spinal cord injuries, Henn (1992) emphasized important aspects of life that remained intact, such as ability to love and communicate as well as memories and cognition. Abdinor (2004) conducted a literature review on the effectiveness of cognitive-behaviour therapy in improving psychological adjustment to SCI. In an empirical phenomenological study of the experiences of post-traumatic SCI patients, Thompson (1995) highlighted individual differences in the way that people subjectively experience SCI. Du Preez (1986) compared the phenomenological approach to the natural scientific approach in the study of the experience of traumatic spinal cord injury patients. Hope (2005) explored the subjective experiences of psychotherapeutic interventions and the sense-making process of SCI individuals with violence-related gunshot injury.

Van Velden (1982) examined the pastoral ministry to paraplegics. This study showed that paraplegic's relationship with God plays an important role in the acceptance and adaptation to the disability. Mpanza (1993) looked at rehabilitation for black paraplegics, and Walter (2001) studied the phenomenological experiences of sexuality of males with SCI.

There are few studies on psychological aspects that are current. In addition, quadriplegic patients are neglected in most of the studies. Nor have literature searches revealed any study in South Africa that has looked at neuropsychological functioning and SCI.

Many of the above-mentioned South African studies were conducted almost a decade ago, either just before or just after the country's first democratic elections, which means that the socio-political context to which they relate was radically different from the present day. Some of the challenges now faced in the country include escalating levels of crime, higher accident rates, and changes within the health system. South African roads are now often described as “war zones”, where thousands of people lose their lives (MacRitchie and Seedat, 2006) or suffer injuries that leave them disabled. In addition the health system has since faced many new and difficult challenges, such as the HIV and AIDS pandemic and, more recently, multiple and extreme drug-resistant tuberculosis, not to mention the threat of H1N1 swine flu. The health sector in South Africa has also been particularly badly hit by the country’s “brain drain”, with many experienced doctors, nurses, psychologists and other paramedical staff leaving the country for more lucrative work opportunities overseas or joining the private healthcare sector for better remuneration.

Healthcare in South Africa favours the wealthy. Challenges faced within the health system, such as those described above, chiefly impact on government sector hospitals that serve the poor. Many hospitals and specialized rehabilitation and other units are often without crucial multidisciplinary team members. This has detrimental consequences in the holistic management of patients. Those with poor socio-economic circumstances are highly disadvantaged as they cannot afford private healthcare.

Psychological conditions following SCI have generally been understood as a reaction to the SCI and the realisation that the patient may never be able to walk or use his/her hands again. For many patients, coming to terms with their condition of paraplegia or quadriplegia is a long and difficult journey. Adjusting to and accepting a restricted lifestyle and being confined to a wheelchair is an important aspect of rehabilitation. Patients at the Provincial Spinal Rehabilitation Centre (PSRC) in

KwaZulu-Natal have routinely been diagnosed with conditions such as Major Depressive Disorder, Posttraumatic Stress Disorder and Adjustment Disorder (PSRC hospital records, 2005 to 2009). According to Andrewes (2001), there is evidence to suggest that depression in patients who suffer from basal ganglia related disorders such as Parkinson's disease and Huntington's chorea is organically related or related to biochemical abnormalities of the disease, and may not necessarily be a response to the debilitating nature of the disease. In addition, there is an 'understanding' that in paraplegia and quadriplegia the brain may not be affected and there may be no associated changes in intellect, personality, speech or senses ("British Columbia Paraplegic Association", para. 5). Lezak, Bourdette, Whitman and Hikida (1989, cited in Lezak, 1995) state that cognitive dysfunction in multiple sclerosis patients with predominantly spinal involvement is minimal and mainly limited to attentional problems. However, Dowler, O'Brien, Haaland, Harrington, Fee and Fiedler (1995) demonstrated deficits in information processing speed and no significant deficits in memory, visuospatial and attention/executive functioning skills in patients with SCI.

An exploration and analysis of the relationship between the impact of SCI on the brain and the associated psychological conditions will have profound implications for psychological treatment and rehabilitation.

1.1 Aim

To understand the relationship between SCI and brain functioning and the resulting psychological consequences of SCI with the intention of improving treatment and intervention.

1.2 Objectives

1. To understand the impact of SCI on cognitive functioning.
2. To determine psychological functioning associated with SCI.
3. To determine neuropsychological functioning associated with SCI.
4. To understand the implications for treatment and intervention based on the results of this study.

1.3 Hypotheses

Null Hypothesis 1 (H_{01}): SCI has no impact on cognitive functioning.

Alternate Hypothesis 1 (Ha_1): SCI has an impact on cognitive functioning.

H_{02}: Patients with SCI have no associated psychological conditions.

Ha_2: Patients with SCI have associated psychological conditions.

H_{03}: Patients with SCI have no associated neuropsychological deficits.

Ha_3: Patients with SCI have associated neuropsychological deficits.

1.4 Outline of Chapters

The format for the rest of the dissertation is as follows: Chapter 2 is a review of pertinent literature on spinal cord injury. The physiological and psychological impact of trauma is discussed in detail. Neuropsychological aspects are explicated. The organization of the nervous system is explained. This includes the spinal cord structure and function. The higher functions such as memory, language, emotion, spatial behaviour, attention and consciousness are detailed. Rehabilitation psychology, which is "the application of psychological knowledge and understanding on behalf of individuals with disabilities and society through such activities as research, clinical practise, teaching, public education, development of social policy and advocacy" (Scherer et al., 2000 cited in Kennedy, 2007, p. 4), is examined. The socio-political circumstances related to spinal cord injury in South Africa are explored. Disability, legislation and constitutional issues in a developing country are critically analyzed. Disparity on healthcare in South Africa is elucidated.

Chapter 3 considers theoretical underpinnings related to neuropsychological functioning and adjustment to spinal cord injury. According to Wright (1960, cited in Elliot and Warren, 2007) disability and rehabilitation are best expressed in terms of the Lewinian equation, $b = f(p \times e)$, in which behaviour is a function of the person and the environment. Models that highlight these aspects of adaptation, together with a bio-psychosocial and cultural approach to health and illness and its crucial relevance to spinal cord injury, are further discussed. Cognitive behavioural theory is explored, with emphasis on Beck's Theory of Depression and the Rational-emotive therapy developed by Ellis. Models that provide an understanding of individual and interpersonal health behaviour are explored. The mechanism through which social networks and social support affect physical, mental and social health (Baranowski, Perry and Parcel, 2002) is explained using the conceptual model of the relationship of social networks and social support to health. The transactional model of stress and coping, a framework for evaluating the process of coping with stressful events (Wenzel, Glanz & Lerman, 2002), is examined.

The theory of neocortical control of movement and the pathways from the motor cortex to the spinal cord are highlighted. The hierarchical model of cortical function and the role of the cerebellum in movement are discussed. Executive functioning is explained using the supervisory attentional system model and also the

Grafman model. The theoretical framework for attention is examined. Baddeley and Hitch's model of working memory and the active memory model is discussed. Memory is further explored by examining the consolidation system and the role of brain structures such as the hippocampus, thalamus and mamillary bodies. The Wernicke-Lichtheim-Geschwind model of language is examined in detail. The organisation of perception in terms of hierarchical and parallel modular systems is explained. Models of the amygdala as the central processor of emotion are discussed.

Chapter 4 outlines the methodology of the study. The quantitative research approach is elaborated as a means for testing objective theories by examining the relationship among variables (Creswell, 2009) from a postpositivist worldview. There is further elucidation of the design of the study, the instruments used and its reliability and validity. The SCI group and the control group as well as the procedure of the research are discussed along with the statistical methods utilized.

Chapter 5 gives the results of the study with the presentation and analysis of data. Chapter 6 is an interpretation and discussion of the results. Chapter 7 concludes the thesis with an indication of the limitations of the study; suggestions for further research, and recommendations for training and the psychological management of individuals with spinal cord injury.

Chapter 2

Review of Literature

> In 1995, Christopher Reeve, a well-known actor who portrayed Superman in film, was thrown from his horse at the third jump of a riding competition. Reeve's spinal cord was severed at the C1–C2 level, near the upper end of the vertebral column. The injury left his brain and the remainder of his spinal cord functioning but his brain and spinal cord were no longer connected. Reeve's body below the neck was completely paralyzed (Kolb & Wishaw, 2003, p. 197).

It was once thought that there was no way to treat spinal cord injuries such as that suffered by Christopher Reeve, but an understanding of spinal cord function has led to improvements in treatments that enable patients to lead long and active lives (Kolb & Wishaw, 2003). More recently with new research, extensively contributing to the field, this has resulted in improved treatment for those with spinal cord injuries. However, there are huge discrepancies in this regard. While this trend is evident in high income countries, low income countries still struggle with a lack of basic resources and provide very limited care for those with SCI. According to Mothabeng (2007), some of the greatest challenges faced in the African continent include huge populations, limited number of therapists, huge demands for rehabilitation services and limited resources. South Africa, being a medium income country, also lacks state healthcare resources and provides limited treatment for individuals with spinal cord injury. Needless to say, the private health sector is able to provide more substantial and longer treatment to the few that can financially afford it.

Spinal cord injury is one of the leading causes of acquired disability in the adult population (Hess, Marwitz & Kreutzer, 2003). In South Africa, traumatic SCI is mainly the result of road traffic accidents and crime related activities. A report released by the South African Police Service on the national serious crime figures for the period 1 April 2009 to 31 March 2010 indicated that a total of 2 121 887 (approximately 2,1 million) serious crime cases were registered in the Republic of South Africa (South African Police Service, 2009/2010). Further, a profile of fatal injuries in South Africa conducted in 2007 by the National Injury Mortality Surveillance System (NIMSS) found that fatal injuries, especially as a consequence of motor vehicle collisions and violence was the major public health priority (Donson, 2008). Previously, the need for psychological intervention following SCI was not appreciated since patients were not expected to survive, but with modern medical intervention patients with SCI undergo rehabilitation with the goal of becoming independent and returning back to society as contributing members. Clinical psychology, neuropsychology and rehabilitation psychology play a fundamental role in this adjustment process. In Ireland, Rehabilitation psychology services form an integral part of rehabilitation at the National Rehabilitation Hospital as the need for psychological services for individuals with disabilities has been recognized (Johnstone, Walsh, Carton & Fish, 2008). Moreover, in South African Psychology, there appears to be a shift in clinical psychology to more medically applied and behavioural medicine related intervention. However, although psychologists working in behavioural medicine do focus on health related problems, there has been less interest in SCI and rehabilitation.

This chapter is divided into four parts. The first part deals with spinal cord injury (SCI), the second discusses psychological functioning and adjustment, the third outlines cognitive functioning, SCI, neuropsychology and rehabilitation psychology, and the fourth is a review of disability legislation and healthcare in South Africa.

2.1 Spinal Cord Injury

2.1.1 The Spinal Cord

2.1.1.1 Structure

The spinal cord is a long cylindrical structure containing neurons that convey sensory and motor information to and from the brain (see Figure 1). The vertebral column, which is made up of a series of interlocking vertebra, extends from the brain to the lower back area, encases and protects the spinal cord (Duff & Kennedy, 2003; Kolb & Wishaw, 2003).

Figure 1: The spinal column

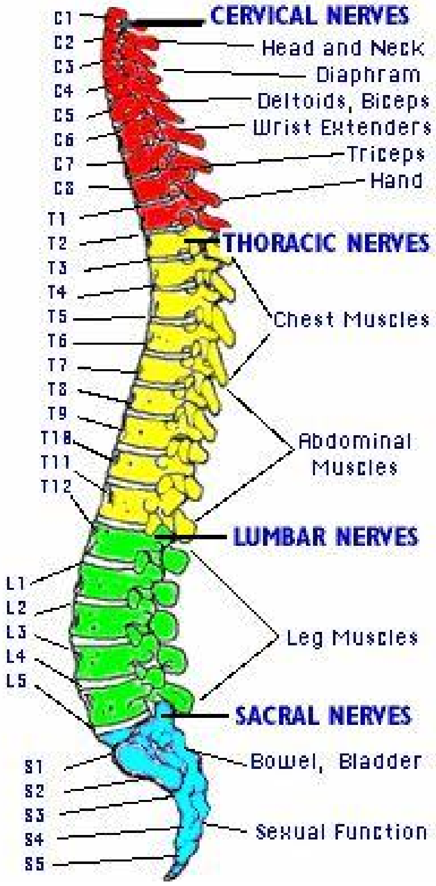

Figure 1: Diagram illustrating the spinal cord, spinal nerves and their function. Source: http://www.spinalinjury.net/html/_spinal_cord_101.html Accessed on 12/01/2010.

The spinal cord is made up of 30 segments, called dermatomes (meaning "skin cuts"): 8 cervical (C), 12 thoracic (T), 5 lumbar (L) and 5 sacral (S) (Kolb & Wishaw, 2003). Nerve fibres connect the segments to the body dermatome of the same number, including the organs and musculature that lie within the dermatome (Kolb & Wishaw, 2003). The spinal cord had 31 pairs of nerves that connect it to different parts of the body (WHO, 1996). The cervical segments control the forelimbs, the thoracic segments control the trunk and the lumbar segments control the hind limbs (Kolb & Wishaw, 2003).

Figure 2: Cross section of the spinal cord

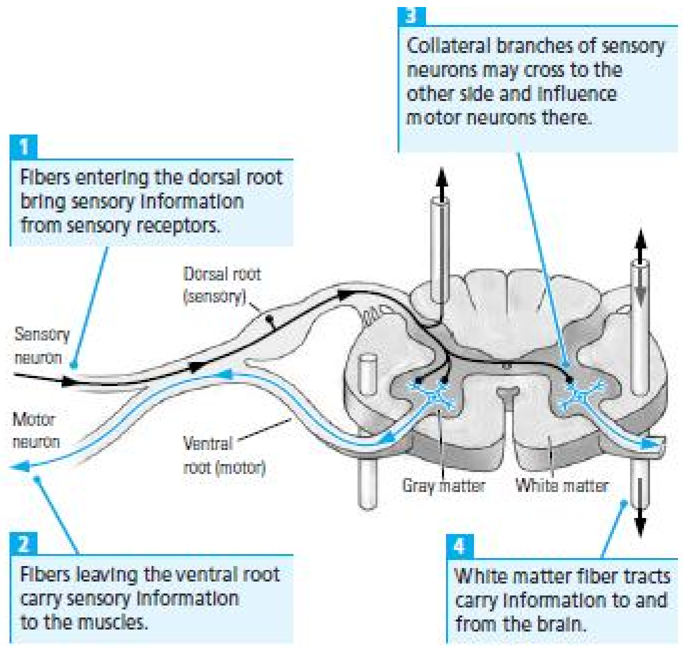

Figure 2: Cross section of the spinal cord showing fibres entering the dorsal root and leaving the ventral root. (Kolb & Wishaw, 2003 p. 57)

Information from the sensory receptors of the body is brought to the spinal cord from fibres entering the cord dorsally (see Figure 2). These fibres converge as they enter the spinal cord forming the dorsal root. The ventral root (fibres leaving the ventral part of the spinal cord) carries information from the spinal cord to the muscles (Kolb & Wishaw, 2003).

Within the spinal cord itself, the outer part consists of white matter or tracts. The dorsally located tracts are mainly motor and those located ventrally are mainly sensory. The tracts carry information to and from the brain. The inner part of the cord consists of grey matter, made up largely of cell bodies, which organise movements and give rise to the ventral roots. The grey region is shaped like a butterfly in cross section (Kolb & Wishaw, 2003) which is illustrated in Figure 2.

2.1.1.2 Function

According to the Bell-Magendie law, the dorsal part of the spinal cord is sensory and the ventral part is motor. This principle is based on experiments conducted in the early nineteenth century by Francois Magendie, a French experimental physiologist and Charles Bell, a Scottish. This enabled sensory and motor impairments to be differentiated from one another and made it possible to determine the location of neural damage on the basis of symptoms displayed by the patient. Understanding of spinal cord function was further advanced by Sir Charles Sherrington and his students, who showed that the spinal cord retains many functions even after it has been separated from the brain (Kolb & Wishaw, 2003, p. 57).

Sensory information plays a central role in eliciting different kinds of movements organised by the spinal cord. Movements dependant only on spinal cord function are referred to as reflexes (Kolb & Wishaw, 2003).

Although the spinal cord controls both simple and complex behaviour, it does depend on the brain, as evidenced by the severe behavioural impairments that follow spinal cord injury (Kolb & Wishaw, 2003). However, there are various factors that may influence behaviour, such as culture, life experiences and education. According to Perry (1996) adverse experiences such as chaos, threat, traumatic stress, abuse and neglect alters the developing brain in ways that result in enduring emotional, behavioural, cognitive, social and physical problems.

2.1.2 Spinal cord injury (SCI)

SCI is defined as damage or trauma to the spinal cord that results in an interruption of the nerve signals from the brain to parts of the body below the injury (Apparelyzed, 2005; WHO, 1996).

SCI occurs when sufficient force causes the cord to be compressed, lacerated or stretched and may also be associated with a fracture or fracture-dislocation of the vertebral column and displacement of the intervertebral discs (Webster & Kennedy, 2007). SCI causes a disruption in the motor and sensory pathways at the site of the lesion (Atkins, 2002) and hence can impair motor, bladder, bowel, and sexual function below the level of injury (Duff & Kennedy, 2003). Individuals with SCI may present with paraplegia or quadriplegia, which is also known as tetraplegia (Figure 3).

Figure 3: Levels of spinal cord injury and extent of paralysis

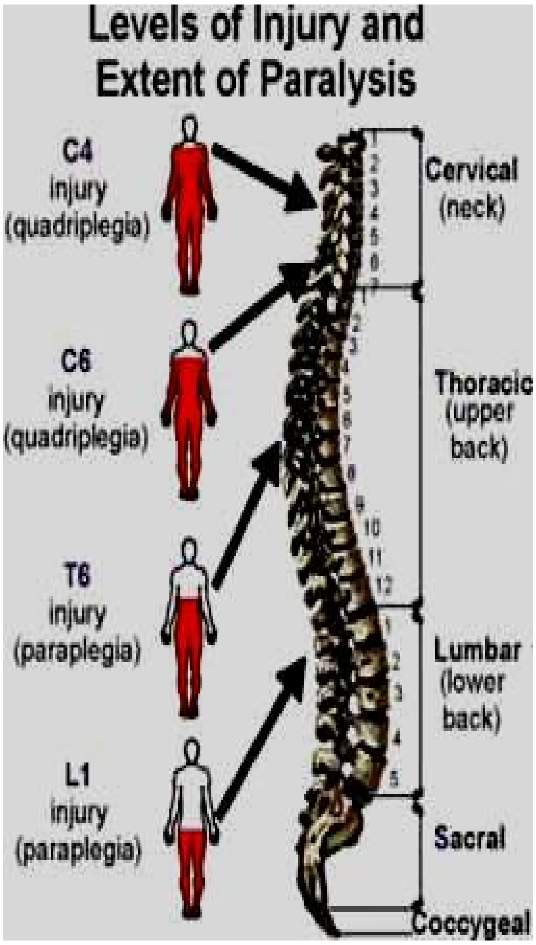

Figure 3. Diagram illustrating the levels of spinal cord injury and the extent of paralysis. Source: Spinal Injuries Association. Accessed on 12/01/2010 from: www.spinal.co.uk/ spinal_injuries_association

2.1.2.1 Quadriplegia/Tetraplegia

Quadriplegia refers to impairment or loss of motor and/or sensory function in the cervical segments of the spinal cord and results in impairment of neurological function in the arms as well as the trunk, legs and pelvic organs (Bromley, 2002).

The term "tetraplegia" is synonymous with "quadriplegia" and is the term officially accepted by the International Medical Society of Paraplegia (WHO, 1996). However, in South Africa, paralysis of all four limbs is more frequently referred to as "quadriplegia".

2.1.2.2 Paraplegia

Paraplegia refers to impairment or loss of motor and/or sensory function in the thoracic, lumbar or sacral segments of the spinal cord, and arm function is spared (Bromley, 2002). Thus individuals with paraplegia have paralysis mainly of the lower limbs.

2.1.2.3 Complete and Incomplete SCI

Paralysis can be complete or incomplete. A complete injury of the cord results in complete loss of sensation and voluntary movement below the level of injury, whereas an incomplete injury involves some degree of sensory or motor function (Duff & Kennedy, 2003). Completeness is measured using either the Frankel Grade system or the American Spinal Injuries Association scales (ASIA), which are similar. Frankel or ASIA grade A refers to total motor and sensory loss and the degree of loss is graded through to grade E, which refers to “no functional deficit” (Duff & Kennedy, 2003, p. 251).

The area of damage is used to categorise incomplete injuries. These categories include: central, lateral, anterior, or peripheral (Adler, 2002, p. 765).

2.1.2.3.1 Central Cord Syndrome

Central Cord Syndrome (CSC) occurs when there is more cellular destruction in the centre of the spinal cord than in the periphery and results in greater paralysis and sensory loss in the upper extremities.

2.1.2.3.2 Brown-Sequard Syndrome (lateral damage)

This syndrome results when only one side of the cord is damaged, such as in stabbing or gunshot injuries

2.1.2.3.3 Anterior Spinal Cord Syndrome

Injury that damages the anterior spinal artery or the anterior aspect of the cord leads to anterior spinal cord syndrome. Paralysis and loss of pain, temperature and touch sensation occurs.

2.1.2.3.4 Cauda Equina (Peripheral)

This involves peripheral nerves rather than the spinal cord directly. There is better prognosis for recovery with this injury as peripheral nerves have a regenerating capacity.

2.1.3 Implications of the variations of SCI for treatment/rehabilitation

The nature of SCI is such that it can result in many variations or types of injury, as mentioned above. This is usually associated with the aetiology of the SCI and the extent of the impact of the injury.

The variations of SCI such as quadriplegia, quadriparesis (incomplete injury of all four limbs), paraplegia, paraparesis (incomplete injury of the lower limbs) has implications for treatment/rehabilitation. Individuals who have limited or no functional use of their hands, such as those with quadriplegia or quadriparesis, pose an enormous challenge for the use of most psychological and neuropsychological assessment tools. The administration procedures of some of these tests have to be modified for use with individuals with quadriplegia. For example, verbal responses have to be given for self-report measures, and this would require the examiner to record the responses verbatim. This is a significant challenge faced by psychologists working in the area of disability and rehabilitation. There is a need for more orally-based psychological instruments as well as tests that have been validated for use in the South African context. Nevertheless, clinicians do on a regular basis adapt instruments so has to obtain reliable and valid outcomes. However, more research is required to validate these adaptations.

According to Webster & Kennedy (2007) long term overall adjustment is predicted by psychological factors and not by the extent of the physical disability. These authors further emphasize that the person who regains walking ability may experience greater difficulties with psychosocial adjustment than the individual with quadriplegia. The important factor for coping is the injured person's perception of the situation. In addition, other factors such as resources, motivational relevance and appraisal of the situation are important. When a stressor is appraised as having a high impact on a person's goal that person is likely to experience anxiety and if a person perceives himself or herself as responsible for the stressor, this may lead to feelings of guilt and depression rather than anxiety (Smith, Haynes, Lazarus & Pope, 1993; Lewis & Daltroy, 1990 cited in Wenzel et al., 2002). Moreover, as further pointed out by Wenzel et al., (2002), treatment compliance may be influenced by physical limitations and by emotional reactions such as worry, depression and denial. Individual and group psychotherapy, which addresses these psychological factors during rehabilitation, can include individuals with all types of SCI. However, it is important for therapists to be sensitive to the needs of individuals with the different variations of SCI.

2.1.4 International Classification of Functioning, Disability and Health (ICF)

The ICF was adopted by the World Health Organisation (WHO) in 2001. The ICF, which is a multipurpose classification system where impairments and resources of a patient are shown multidimensionally, is designed to record and organize a wide range of information about health & health related states (WHO, 2001). The ICF Core Sets for spinal cord injury, which facilitates the application of the ICF in clinical practise, was developed in international collaboration with the WHO, the ICF Research Branch Munich, The Swiss Paraplegic Research, the International Spinal Cord Society (ISCoS), the International Society for Physical and Rehabilitation Medicine (ISPRM) and other international clinical partners (Behle, Kirchbergr, Stuki, Cieza, *in press)*.

The ICF is a highly influential model of disability that places greater emphasis on behavioural and social factors in the optimal adjustment of individuals with disabilities (Elliot and Warren, 2007). It describes the process of functioning and disability as an interaction or complex relationship between the health conditions and contextual factors such as environmental and personal factors (WHO, 2001). According to this classification system, mental (or psychological) functions are included under body functions. "Body" refers to the human organisation as a whole; thus the mind (which is the brain and its functions) is regarded as part of the body (WHO, 2001). This shift from the medical model to a biopsychosocial approach in physical disability highlights the imperative for psychology to become actively involved in disability and rehabilitation. The ICF core sets for SCI from the perspective of psychologists are currently being validated by the ICF Research Branch of the WHO (Behle et al., in press). The ICF is a valuable tool that promotes universal understanding of patients but its practical implementation and utilisation in the current South African public healthcare system, where there are drastic staff shortages, is debatable.

2.1.5 Incidence of SCI

The annual incidence of SCI in the UK is between 10 and 15 per million; in the USA it is between 30 and 40 per million; and in Japan 27 per million (Webster and Kennedy, 2007). In South Africa there are no official statistics on SCI. Census 2001 reported that 5 percent of the population in South Africa were disabled. This included the various types of disabilities: sight, hearing, communication, physical, intellectual and emotional disabilities. Physical disability accounted for 29.6% of the total population of disability (Statistics South Africa, 2005). According to the national director of the QuadPara Association of South Africa (QASA), Mr Ari Seirlis, it is estimated that the incidence for SCI in South Africa is 600 per annum (personal communication, Jan 11, 2007). This appears to be a low figure for South Africa, considering the high rate of violent crime, road traffic and railway accidents. According to the South African Police Service report on the national serious crime figures for the period 2009/2010 a total of 205 293 of reported cases was assault with the intent to inflict grievous bodily harm (South African Police Service, 2009/2010). A further 197 284 cases of common assault, 17 410 cases of attempted murder and 13 902 cases of carjacking was also reported during this period. These statistics may be an underestimation of the actual incidents. It is possible that some individuals in very remote areas may not have been included in these figures. In addition, it is important to note that many individuals who sustain traumatic spinal injuries lose their lives immediately following the injury. Motor vehicle crashes were found to be the main external cause of death in South Africa in 2007, accounting for 30 percent of all reported causes of death (Donson, 2007). Further, this study has also identified that the leading manner of non-natural death for males was sharp-object related violence, and pedestrian injury for females. Njoki, Frantz & Mpofu (2007) reiterate that South

Africa has a serious lack of reliable information on the statistics and nature of disability. The planning and development of services and intervention strategies for people with disabilities have been severely impeded by the paucity of reliable statistics (Bhagwanjee & Stewart, 1999).

There are four male injuries for every female SCI. The mean age of SCI patients being 28 years (Webster and Kennedy, 2007, p. 105). Statistics of the Provincial Spinal Rehabilitation Centre (PSRC) in KwaZulu-Natal (KZN) have shown that an increasing number of patients with SCI are young male adults aged between 18 and 30. A total of 322 spinal cord injured patients had been admitted between 2000 and 2006. Of these patients, 57% were adult male; 11% were quadriplegic (PSRC-KZN, Statistics, 2006). A study of the forecasting of SCI annual case numbers in Australia revealed that the incidence of SCI is likely to increase, with older people accounting for almost half of new injuries by 2021 (O'Conner, 2005).

2.1.6 Aetiology of SCI

Internationally, traumatic SCI results most frequently (47%) from road traffic accidents (RTA's), while 27% are caused by domestic and industrial falls, and between 15% and 20% from sporting injuries (Webster & Kennedy, 2007). In the United States 50.4% of all spinal cord injuries resulted from road traffic accidents (RTAs). The second leading cause of SCI were falls (23.8%), followed by acts of violence (primarily gunshot wounds), and recreational sporting activities, such as diving ("Spinal Cord Injury Facts", 2004; "National Spinal Cord Injury Association Resource Centre", para. 4). An aetiological trend showing RTAs as the most common cause of traumatic SCI is evident in South Africa (QASA/Department of Health Database, Feb 2005). However, acts of violence, such as gunshot wounds, are the second most common cause of SCIs after motor vehicle accidents. In addition, motor vehicle accidents were commonly taxi-related (PSRC-KZN, Statistics 2002-2009). Non-traumatic SCIs are caused by infective diseases (such as tuberculosis), ischaemic insults, neoplastic disorders and multiple sclerosis (Webster and Kennedy, 2007).

2.2 Psychological Functioning and Adjustment

Psychological functioning following SCI is not as predictable as physical functioning, due to various differences such as cultural and personality. However, some of the expected emotions are disbelief, depression, anger, anxiety and grief (WHO, 1996). Considering the traumatic nature of the majority of SCIs, posttraumatic stress is also expected. How an individual copes with these emotions and adjusts to his or her disability will also vary. According to Webster & Kennedy (2007), an injured person's appraisals, emotional responses and coping behaviours change and develop according to the changing situation – during acute medical care, rehabilitation and reintegration into the community (p. 110).

2.2.1 Depression, Suicide and Anxiety in SCI

Among the most common forms of psychological distress in SCI patients are depressive disorders (Krause, Kemp, Coker, 2000). Major Depressive Disorder (MDD) is a common mood disorder, with a prevalence of about 15% (Kaplan & Sadock, 1998). The Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) defines Major Depressive MDD as a clinical course characterised by one or more Major Depressive Episodes (MDE) without a history of Manic, Mixed or Hypomanic episodes. The main feature of MDE is a period of at least two weeks during which there is depressed mood or the loss of interest or pleasure in nearly all activities (APA, 2000, p. 349).

Depression is also related to other medical conditions. Twenty percent of patients with longstanding physical illness may also suffer from significant depression, and the depressive symptoms can be difficult to distinguish from those of the physical illness (Hallstrom and McClure, 2005). According to Adler (2002), individuals who experience a sudden trauma that causes or necessitates amputations are likely to experience profound psychological shock, disbelief, and subsequently feelings of hopelessness, despondency, bitterness and anger. A quarter of women with breast cancer suffer significant depression, anxiety and sexual dysfunction after mastectomy, and the risk is increased in those with poor marital relationships, unsupportive social networks, recent adverse life-events and previous psychiatric illnesses (Hallstrom and McClure, 2005). According to Celikyol (2002), a person may feel a multitude of painful emotions after limb loss such as amputations, and can respond with anger, feelings of guilt, denial, hopelessness, bitterness, revulsion or depression.

The thought of ending one's life, which is also a symptom of depression, can be found in those faced with severe medical conditions. In a study on suicidal ideation after life-threatening physical illnesses – for example, stroke, traumatic brain injury, myocardial infarction and spinal cord injury – Kishi, Robinson and Kosier (2001) found that about 20% of patients developed suicidal ideation sometime within the two years following the illness. Zigler and Capen (1998) state that there is a fivefold increase in suicide amongst individuals with SCI when compared to the able-bodied population. The loss of job, sexual function, self esteem, and limb function may be too great to endure and death might be considered a more palatable alternative to life of paraplegia or quadriplegia (Zigler and Capen, 1998). According to Kishi et al. (2001), suicidal ideation during the acute medical treatment period was associated with the presence of a diagnosable depressive disorder. Zigler and Capen (1998) highlight the need for psychological counselling and rehabilitation therapy to help reduce the incidence of suicide amongst individuals with SCI.

SCI results in many physical, functional and emotional losses (Boekamp, Overholser & Schubert, 1996; Nielsen, 2003). According to Boekamp et al.(1996), the consequences of SCI involve, *inter alia*, loss of motor function, loss of sensation, loss of control over bowel and bladder function, and impaired sexual functioning, which lead to changes in vocational roles, financial insecurity and disrupted interpersonal relationships. When disability causes loss of function, the individual is often faced with a series of gradual and insidious losses which cause a prolonged grief reaction (Jansen, 1985). Krupp (1976, cited in Jansen, 1985) states that this is the most difficult grieving process to work with because of the continued and long-term loss of functioning and hope for recovery. Working with spinal cord injured patients is further complicated by the fact that very often the prognosis for recovery of motor function is poor. In addition, a large number of spinal cord injuries are traumatic in nature, such as RTAs, acts of violence, etc. In such cases, very often family members or close friends are killed in the traumatic incidents as well, which results in an even greater sense of loss.

Jansen (1985) stresses that the continued support from loved ones is important, as balancing acceptance of lost functioning and potential with realistic hope for as full a life as possible is very difficult. However, acceptance of the decreased potential and opportunity increases possibilities for fully utilizing remaining capacities (Jansen, 1985).

Kennedy and Rogers (2000) found, in a longitudinal analysis of anxiety and depression after spinal cord injury, that the longer patients stayed in a hospital environment, the more depressed and anxious they became. According to Krause et al. (2000), individuals with the least education, those from minority backgrounds and those oldest at the time of spinal cord injury may be particularly vulnerable to depression. Kennedy, Duff, Evans & Beedie (2003) state that anxiety and depression found in individuals with SCI during their initial rehabilitation is linked to the lack of predictability and sense of control they experience.

2.2.2 Depression in Women with SCI

An observation that is universal and independent of country or culture is that there is a twofold greater prevalence of MDD in women than in men (Kaplan and Sadock, 1998). There are many theories that explain women's susceptibility to depression. These range from biological theories (the role of hormones in women's mood), social theories (the effects of oppression in women's mental health, and psychological theories (the influence of women's personality traits) (Nolen-Hoeksema, 1990**).** Kaplan & Sadock (1998) explain that hormonal differences, the effects of childbirth, differing psychosocial stressors for men and for women, and behavioural models of learned helplessness contribute to depression in women. Nolen-Hoeksema (1990) argue that the absence of clear cultural differences in the rates of depression in men and women suggest that some factor universal to all women, such as a biological factor, predispose them to depression.

According to Hallstrom and McClure (2005), men often have their depression diagnosed as problems with alcohol or personality problems, and tend to project their suffering outwards. Women, on the other hand, are culturally allowed to express their suffering and tend to seek help more than men. The factors that make women more vulnerable to depression include: having three or more children under 15 at home; not working outside the home; lack of a supportive relationship with a husband; loss of a mother as a result of death or separation before the age of 11 (Hallstrom and McClure, 2005, p. 68). However, more women today are empowered emotionally and financially and play a significant role in society in various sectors such as business, education and health. Moreover, women headed households are a growing presence worldwide, especially in developing countries (Chant & Campling, 1997).

Women experience losses and tragedies throughout their lives, and a grief reaction can be triggered by death, separation and divorce, children leaving home, miscarriage, and the agonizing pain of losing a child (Zisook, Chentsova-Dutton & Shuchter, 2000). Similarly, a grief reaction is also triggered after a spinal cord injury which has led to a loss of motor functioning. The stages of grief leading from an initial period of shock, denial, numbness, and confusion to a subsequent period of acute grief and mourning where intense feelings of despair and anger are felt and social withdrawal occurs (Zisook, Chentsova-Dutton & Shuchter, 2000) are similar to the stages of grief a newly spinal cord injured person undergoes. Very often a complicated grief reaction – explained by Zisook, Chentsova-Dutton and Shuchter (2000) as a grief reaction that is absent, delayed, intensified or prolonged – also occurs with spinal cord injured individuals.

The historically disadvantaged groups in South Africa who were discriminated against in the apartheid regime include Blacks,[1] women, and people with disabilities. Hence, a Black woman with SCI in South Africa is faced with the greatest challenges.

[1] The term "Black" is a racial classification used in South Africa to refer to the indigenous people of the country. The racial classification of people such as Black, Whites, Coloureds and Indians arose from the apartheid era and is still being used in order to redress imbalances of the past and ensure equity.

Many rural South African women are single parents. With the effects of apartheid still resonating after 16 years of democracy, men have been forced to leave their homes and seek employment in far away towns. This has led to a breakdown in the family unit. This problem is further exacerbated by the effects of HIV and AIDS. The loss of a spouse, according Zisook, Chentsova-Dutton and Shuchter (2000), is a tragic and traumatic event that affects a woman's health, mood, and social and spiritual life, deprives her of companionship, and often depletes her financial resources and forces her to alter her established lifestyle (p. 84). Little has changed for rural South African women in the post-apartheid era. Many women are forced to raise their children – and of late, because of the effects of HIV/AIDS, also their children's children – by themselves, and to take on the roles of both homemaker and breadwinner. For such women a spinal cord injury is a double tragedy which means loss of stability in the home environment (Moodley & Pillay, 2010).

2.2.3 Posttraumatic Stress Disorder and SCI

Post traumatic stress disorder (PTSD) following SCI has received little research attention (Duff & Kennedy, 2003) internationally or locally. According to Nielsen (2003), a spinal cord lesion can be understood as a traumatic event which is accompanied by a number of losses such as movement, bladder and bowel functioning, sexual dysfunction and social functioning. Absence of essential coping resources can contribute to various pathological reactions such as PTSD.

Traumatic spinal cord injuries mainly result from motor vehicle accidents, falls, and acts of violence such as stab and gunshot wounds, internationally and locally. Given the traumatic and life threatening nature of most spinal cord injuries, especially in a country like South Africa where there is a high level of violent crime and RTAs, PTSD can be an expected common sequel for many patients. South African roads are "war zones" were thousands are injured, losing lives (MacRitchie & Seedat, 2006) or disabled.

2.2.3.1 Definition of PTSD

The term *posttraumatic stress disorder* was adopted by the American Psychiatric Association in 1980 after it was recognized that psychiatric impairment may follow horrific and life threatening events (Rosen, 2004). PTSD is defined in the DSM-IV-TR as "the development of characteristic symptoms following exposure to an extreme traumatic stressor". Defining criteria for PTSD include the following: direct personal experience or witnessing of an event that involves actual or threatened death or serious injury; response that involves intense fear, helplessness or horror; persistent re-experiencing and avoidance of the traumatic event; numbness; increased arousal. In addition, the disturbance should last for more than a month and cause clinically significant distress in important areas of functioning (APA, 2000, p. 463).

2.2.3.2 Relationship between SCI and PTSD

According to Kennedy and Evans (2001), PTSD has a specified aetiology which involves experiencing, exposure to or witnessing of a life-threatening, traumatic event. This is similar to the aetiology of the majority of SCIs. A high level of intrusive images and memories as well as psychiatric symptomatology was found in a study by Landsman (1990) of 137 people who had severe injuries resulting from road accidents, falls, pedestrian accidents, stabbing and gunshot wounds (Kennedy & Evans, 2001). A study among war veterans with SCI showed the link between PTSD and SCI (Radnitz et al., 1995, cited in Chung et al., 2006).

The psychological impact of trauma has important clinical implications for people with SCI. A great degree of adaptation and re-evaluation of beliefs and attitudes are required. Trauma related distress is likely to jeopardize a person's ability to cope with their injury and will impact further on their quality of life (Kennedy & Evans, 2001). Duff (1997) revealed relationships between PTSD symptomatology, mood and coping over time, following spinal cord injury.

2.2.3.3 Risk Factors for Developing PTSD

People with SCI are at greater risk of developing PTSD soon after the injury than later on. In a study of 69 SCI patients from two rehabilitation centres in Denmark, Nielsen (2003) found that persons with recent onset SCI are at increased risk of having PTSD, co-morbid depression, and other symptoms of emotional distress; a 20% prevalence rate of PTSD was found in the study. High levels of post traumatic distress were found in 14% of the sample in a study conducted by Kennedy and Evans (2001) in the first 6 months following SCI.

Ratnitz et al. (1998) found strong evidence that factors related to the spinal injury, category of spinal injury and concurrent head injury were predictive of developing PTSD symptomatology. Paraplegics are reported to suffer more from PTSD than quadriplegics, owing to biological and physiological determinants. The argument is that the nerve fibres responsible for the sympathetic arousal that accompanies PTSD may be impaired in quadriplegics, as the level of lesion on the spinal cord is higher than with paraplegics, thus protecting them from experiencing the arousal symptoms. This view is contradicted by Nielsen's (2003) study which reported a negative association between age and PTSD, indicating that being older may mitigate against the development of PTSD after SCI. But a later study conducted by Chung et al. (2006) at a spinal rehabilitation clinic in Greece found that, while people of different ages reacted to traumatic events in a similar fashion, younger SCI patients tended to use a more external health locus of control than did middle aged or elderly patients.

A very high prevalence rate, ranging from 25% to 33%, was found in children with SCI (Boyer et al., 2000, cited in Nielsen, 2003). PTSD may be more prevalent among paediatric SCI survivors than among adults with SCI (Radnitz et al., 1995 cited in Nielsen, 2003). Kennedy (2007) found that trauma-related distress was significantly higher in female patients or patients with high levels of anxiety or depression.

2.2.4 Adjustment

"Adjustment", in the context of chronic illness and disability, occurs when a person assimilates his or her functional limitations and becomes fully engaged in the environment (Livneh & Antonak, 1997). There has been a long-standing suggestion that psychological response in rheumatoid arthritis patients is important to adjustment (Anderson, Bradley, Young, McDaniel & Wise, 1985). According to Keenan and Morris (2002), the process of adjustment to amputations is similar to the grieving process; patients progress through identifiable stages of denial, anger, depression, coping and acceptance and ultimately adapt to the loss. Abdinor (2004), however, regards rehabilitation literature that describes the process of psychological adjustment following SCI in terms of stage theories as being dated. It had been proposed that individuals go through predictable, but not strictly sequential, emotional and cognitive reactions to their SCI, but the stage theories were challenged after researchers found variability in the reaction to SCI (Treischmann, 1988). Individuals with SCI come from different cultural and social backgrounds; these factors, along with personality, social support, and cognitive functioning, will impact on adjustment.

According to Livneh and Antonak (1997), adjustment is an outcome of coping. Webster and Kennedy (2007) state that coping and adjustment is a process that occurs over time; for an individual with SCI to be fully functioning, adjustment must take place in the various spheres of life: socially, vocationally and educationally, at the interpersonal level (family and friends), and psychologically.

There are many factors that may influence the process of adjustment, ranging from internal cognitive constructs to external factors. Lustig (2005) indicated a positive relationship between adjustment and strengthened sense of coherence. Sense of coherence is a worldview that can be conceptualized as a meaning-making construct which facilitates personal adjustment by increasing the likelihood that an individual (a) will believe that dealing with the stressor is worthwhile and that attempts to resolve the problem are worth the effort, (b) will view the stressor as a challenge rather than a burden, and (c) as a result, will decide to do something about the stressor (Lustig, 2005, p. 147). This author further states that a person who believed that his or her SCI significantly reduced their ability to manage everyday affairs and find meaning in life would more likely have adjustment problems. According to Abdinor (2004), anxiety and depression are used by most researchers as indicators for psychological adjustment to SCI.

In a study of the relationship of cognitive constructs to adjustment in rheumatoid arthritis patients, Beckham, Rice, Talton, Helms and Young (1994) found that self-efficacy, a cognitive construct signifying an individual's judgement of his or her capabilities, is associated with adjustment in such patients. Loy, Dattilo and Kleiber (2003) found that engagement in leisure had a direct influence on SCI adjustment while also promoting social support, which in turn influenced the adjustment of individuals with SCI. In a study predicting post-discharge adjustment of a group with SCIs, Richards et al. (1991) found that patients defined by neuropsychologists as cognitively impaired were more likely to report adjustment difficulties or were described by a significant other as having adjustment difficulties.

Keenan and Morris (2002) state that long-term adjustment will depend on the individual's personality structure, sense of accomplishment, and place in the family, community and world.

2.3 SCI and Neuropsychology

An understanding of the basic structure and functioning of the nervous system is essential in providing explanations for neuropsychological functioning and psychological responses. According to Perry, Pollard, Blakley, Baker, & Vigilante (1995) all systems in the brain are composed of networks of nerve cells (neurons) which are continuously changing, in chemical and structural ways, in response to "signals" from other parts of the brain, the body, or the environment (e.g., light, sound, taste and smell). The higher functions such as memory and learning, language, emotion, attention and spatial behaviour form the basis of cognitive functioning and are discussed further.

Perry et al. (1995) state that the "changes" in neurons allows for the storage of information. This storage of information forms the basis for all types of memory such as motor, sensory, cognitive and affective. The memory system can be seriously impacted on during periods of psychological distress. According to Perry (2001) neurobiological changes of the hippocampus are likely related to some of the observed functional problems with memory and learning that accompany stress related neuropsychiatric syndromes such as posttraumatic stress disorder. A study conducted by Johnsen and Asbjørnsen (2009) on the role of encoding strategies in verbal learning and memory impairments in posttraumatic stress disorder found that there were less serial organisation, more intrusive errors, and more pronounced recency effect in patients with PTSD compared to violence exposed controls without PTSD during learning and memorizing verbal material. Further, these authors emphasize that memory impairment and the use of ineffective learning strategies may not be related to PTSD symptomatology only, but also to self-reported symptoms of depression and general distress.

Emotions are a response to environmental events and are goal directed (Andrewes, 2001, p. 391). The amygdala is recognised for its role in analysing the emotional significance of information and as a central processor of emotion (Andrewes, 2001). The left amygdala plays a special role in generating one particular emotion, which is fear (Kolb & Wishaw, 2003). However, Trieschmann (1988) quoted in Hess et al. (2003) suggested that cognitive difficulties consequent to SCI may be mainly attributable to emotional factors and the impact of hospitalization.

The neural mechanisms underlying attention are an extensive network of structures that includes sensory regions and the parietal, prefrontal and anterior cingulated cortex (Kolb & Wishaw, 2003). Further, an investigation by Stutts et al. (1991) found that attention and information processing speed were the most significant problem areas in the first weeks of recovery following SCI. Hess et al. (2003) also found that information processing speed and attention are most vulnerable to trauma.

Plasticity refers to the brain's ability to constantly change and not remain a static organ (Kolb & Wishaw, 2003, p. 693). The functioning of the brain can be affected by head injury, by causing direct damage to the brain, by the disruption of blood supply, by inducing bleeding which leads to increased intracranial pressure, by swelling which also results in increased intracranial pressure, by opening the brain to infection and by producing scarring of brain tissue (Kolb & Wishaw, 2003, p 702). Moreover, it is important to take cognisance of possible brain injury in SCI. Richards, Osuna, Jaworski, Novack, Leli & Boll (1991) point out that trauma from accidents severe enough to damage the spinal cord may also produce concomitant traumatic brain injury.

The main classic indicators of mild traumatic brain injuries (TBI) include loss or alteration of consciousness, post-traumatic amnesia, and some alteration in mental or neurologic status (McCrea et al., 2008). McCrea et al. note that the WHO definition of mild TBI explicitly states that this loss or alteration of consciousness is due to biomechanical force to the brain and not to other injury related factors, such as systemic injuries, psychological trauma, or medication. Closed head injuries that damage the frontal and temporal lobes impact significantly on personality and social behaviour (Kolb & Wishaw, 2003).

Moreover, traumatic stress exerts adverse effects on the brain (Weniger, Lange, Sachsse, & Irle, 2008). Prefrontal cortex dysfunction has been linked to stress, as the stress response involves increased secretion of many neurotransmitters, such as norepinephrine and dopamine, which leads to symptoms of inattention and impairment in executive functions, new learning and memory (De Bellis, Hooper, Spratt & Wooley, 2009).

In a study conducted by De Bellis et al. (2009) on children with PTSD, it was found that many of the neurocognitive tests were lower in the group with PTSD. According to these authors the findings suggests weakness in neurological functioning involving stress sensitive areas, such as the dorsolateral and medial prefrontal cortex, and right hemisphere and hippocampal regions in such individuals. However, these studies were conducted on children and further studies are required to see if there are similar findings in adults.

According to Samuelson, Neylan, Lenoci, Metzler, Cardenas, Weiner and Marmar (2009), cognitive decline in patients with chronic PTSD may be associated with neuroanatomical changes in the prefrontal cortex and hippocampus. Individuals with trauma exposed PTSD show reduced amygdale and hippocampal size and impaired cognition (Weniger, Lange, Sachsse, & Irle, 2008).

A large proportion of spinal cord injuries are of a traumatic nature. As mentioned earlier trauma from accidents that are severe enough to damage the spinal cord can also result in concomitant traumatic brain injury. This can happen as a result of shearing and/or stretching of nerve fibres in the brain with the resulting axonal damage (Gennarelli, 1986). In addition, such injuries involve a rapid acceleration/deceleration incident that results in head injury, such as a fall or a motor vehicle accident (Stover, Fine, Go, Lazarus, DeVivo, Vaughn, Inman, Kartus, Rutt, Gayles & McClam, 1986). Neugebauer, Lefering, and Noth (1999) state that in approximately 60% of cases, multiple trauma is accompanied by head injury.

A concomitant head injury is usually overlooked by health care professionals (Narayan et al., 1990) due to the emphasis being placed on the SCI itself (Dowler, O'Brien, Haaland, Harrington, Fee and Fielder, 1995). There are a few international studies that have looked at the cognitive functioning of such patients (Davidoff, Morris, Roth, and Bleiberg, 1984; Dowler et al., 1995; Hess et al., 2003; Richards, Brown, Hagglund, Bua and Reeder, 1988). Dowler et al. (1995) have shown deficits in information processing speed in SCI patients with a concomitant head injury. In a study by Hess et al. (2003) examining neuropsychological impairments after SCI, individuals with SCI having no loss of consciousness were compared to individuals with mild TBI. The results revealed that although those with SCI outperformed those with mild TBI, more than 40% of the SCI patients were identified as having impairments in processing speed, motor speed and verbal learning.

In general some of the cognitive deficits seen after mild head injury are attention, rapid processing speed, memory, and learning (Gronwall, 1987; Dikmen et al., 1995; Lewin et al., 1997 cited in Dowler et al., 1995). Such skills are vital in SCI patients as they have to adjust to and cope with important changes in their life. According to Hess et al. (2003), injury to the brain can have a profound effect on individuals with SCI who must learn new skills and coping strategies as a result of their injury. This involves learning many new skills, such as manoeuvring a wheelchair, transferring from the wheelchair to the bath, toilet, and bed and vice versa, and learning more complex skills such driving an adapted vehicle.

Cramer, Tievsky, Parker, Riskind, Stein, Wedeen and Rosen (2001) state that diseases of the spinal cord are associated with reactive changes in cerebral cortex activation (p. 204). In a study by Levy Jr, Amassian, Traad and Cadwell (1990) it was found that the motor cortical system is reorganized in humans after traumatic quadriplegia. In view of changes of this nature occurring within the cortex following injury to the spinal cord, it is crucial to investigate whether such patients, without a head injury, experience cognitive deficits as a result of the SCI itself.

2.4 Rehabilitation Psychology and Spinal Rehabilitation

Psychologists became involved in medical rehabilitation in the mid-twentieth century as medical interventions and technologies improved and also in response to the large numbers of soldiers who survived debilitating wounds in wartime, when psychologists were hired to provide rehabilitation services for them (Elliot & Warren, 2007). One of the pioneers of rehabilitation medicine was Sir Ludwig Guttmann, who recognized the need for patients to participate actively in their therapies, resume leisure and recreational activities as part of the rehabilitation program, and reintegrate into their communities (Elliot & Warren, 2007). According to Kennedy (2007), the impact of disability stretches from the individual to the systemic, crossing many dimensions including pain and suffering, beliefs and attitudes, losses and adjustment and coping and resilience.

Spinal rehabilitation programs enhance the residual functional abilities of individuals with an acquired disabling impairment because of SCI, as noted in a study by physiotherapists Mothabeng, Malinga, Van der Merwe, Qhomane and Motjotji (2007, p. 22), who observe that the main goal of the rehabilitation program is to facilitate adjustment to life by equipping the individual with skills and resources needed for community living, which therefore requires the full participation of the individual. In Ireland, the National Rehabilitation Hospital employs five psychologists in recognition of the need for psychological services for individuals with disabilities (Johnstone et al., 2008). The WHO (1996) states that, in developing countries, rehabilitation following SCI presents a challenge to rehabilitation personnel who often lack adequate resources such as staff, facilities and equipment to assist individuals with SCI. A decade later, government sector spinal rehabilitation facilities in South Africa continue to be faced with similar challenges. Nor has the need for psychological services in disability and rehabilitation been adequately recognized in South Africa. The Provincial Spinal Rehabilitation Centre in KwaZulu-Natal is provided with part-time psychological services. Clairwood Hospital in KZN, which is one of the major rehabilitation hospitals in South Africa, has not employed psychologists and does not have the services of psychologists. The national rehabilitation policy (2000) and the KZN disability and rehabilitation policy (2008) cite, as rehabilitation therapists providing services for people with disabilities, only physiotherapists, occupational therapists, speech and language therapists and audiologists, failing to recognise in their policies the value of a strong multi-disciplinary approach in disability and rehabilitation. Kennedy (2007) emphasizes that treatment should be interdisciplinary, involving a combination aimed at restoring the functioning of the whole person within their context. This is in keeping with the WHO model of disability (WHO, 1999) and the ICF which is based on a biopsychosocial approach.

According to McCrea et al. (2008), neuropsychologists and rehabilitation psychologists are uniquely trained specialists who play a vital role in evaluation and treatment of patients with all forms of TBI, as well as post-concussion syndrome and PTSD. Rehabilitation psychologists and neuropsychologists also have a crucial role in the psychological rehabilitation of individuals with SCI. According to Johnstone et al. (2008), rehabilitation psychology is a speciality area similar to health psychology, with the need to serve a population of individuals with unique health needs and issues, namely persons with acquired disabilities. SCI patients with mild head injury will experience some limitations and difficulties in terms of rehabilitation. According to Hess et al. (2003), brain injury can limit the ability of such persons to make significant lifestyle changes and benefit from rehabilitation. Intact cognitive functioning is required for effective and successful rehabilitation in SCI patients.

Traban, Pepin and Hopps (2006) found that people who underestimate their disabilities are less likely to adhere to early rehabilitation treatments, which is a process that is essential to optimizing functional outcomes. As part of the multidisciplinary team, rehabilitation psychologists play a fundamental role not only in the psychological rehabilitation and adjustment of individuals with SCI but in motivating individuals to persevere in rehabilitation in order to attain maximum functioning in all spheres. According to Mothabeng (2007), the ultimate outcome of rehabilitation is measured at the level of society, whether individuals with SCI are functioning as independent members and fully reintegrated into their communities.

2.5 Disability, Legislation and Healthcare in South Africa

The African decade of persons with disabilities, from 1999 to 2009, was declared by the African Union in recognition of the rights and needs of persons with disabilities (Mothabeng, 2007). Accordingly, as Mothabeng (2007) comments, disability should be given priority by all health professionals; but as the decade comes to an end there has been no sign of increased interest in disability either in the field of psychology or on the part of the South African government.

2.5.1 Sociopolitical Circumstances of Disability/ SCI in South Africa

People with disabilities are one of the groups previously disadvantaged in the apartheid era in South Africa. Prior to the first democratic elections in 1994, people with disabilities, as along with Black people and women, were discriminated against (Briggs, 2006). This implies that individuals with SCI, especially Black women, had no opportunities to improve the quality of their lives.

2.5.2 Disability, Legislation and Constitutional Issues

Historically, people with disabilities were considered to be "dependant and unable to care for themselves or lead independent lives" (Briggs, 2006, p. 6). This medical model, which regards people with disabilities as being sick and in need of special care, has been criticized by disability organisations such as QASA for disempowering such persons and isolating them socially, financially and politically from mainstream society. With recent global trends, a more acceptable approach is one that views disability as a human rights and development issue. The Social Model considers people with disability as equal members of society with equal rights and responsibilities, and emphasizes abilities and capabilities (Briggs, 2006; KZN Disability & Rehabilitation Policy, 2008).

The South African Constitution which came into effect in 1996 is the highest law in South Africa and guarantees human rights to all South Africans. Chapter Two of the Constitution is the Bill of Rights which is a list of human rights protected in South Africa. One of the human rights guaranteed in the Constitution is Equality. Equality means that all people should be treated the same, irrespective of their age, race, religion or disability. Economic and social rights, such as the rights to access housing, water, healthcare, education, social security and food, are included in the Bill of Rights. These issues, such as access to disability grants, are significantly important for individuals with disabilities. Hence, the Constitution and the Bill of Rights ensure that all people, including people with disabilities, are protected and treated fairly in South Africa (Briggs, 2006). But the reality of the situation for people with disabilities in South Africa is far from what the Constitution prescribes. With attitudes towards disability being slow to change, many disabled people are still marginalized by society – and, shockingly, even by some healthcare workers themselves.

Briggs (2006) further states that people with disabilities experience the highest rates of unemployment in South Africa, across race and gender. The contributing factors to this problem include lack of qualifications due to the lack of accessible schools and tertiary education institutions, lack of physically and socially accessible workplaces, and the lack of accessible and safe transport to and from the workplace (Briggs, 2006). The Employment Equity Act and the Affirmative Action policy were implemented to ensure the fair employment of people from previously disadvantaged groups (Briggs, 2006).

Briggs (2006) further emphasizes that the prevention, treatment and management of disability, including rehabilitation and the provision of assistive devices, are the responsibility of the Department of Health. A collaborative effort by individuals, organisations and other stakeholders together with the Department of Health will lead to improved outcomes for people with disabilities.

Despite having one of the "most fair and stable" constitutions in the world (Briggs, 2006), together with elaborate policies and codes, the current reality in South Africa is that the majority of people with disabilities are marginalised, lack skills and education, and are unemployed. The KZN Disability and Rehabilitation Policy (2008) argues that the legislative framework in South Africa is weak and discriminatory and has failed to protect the rights of persons with disabilities that are outlined in the Constitution. This policy, which was implemented in May 2010, aims to "create an enabling environment in which people with disability, those at risk, and their families can influence, reach and maintain their optimal physical, emotional, intellectual, sensory, social and economic functional levels" (p. 10). However, there is presently no disability-specific legislation in South Africa (Briggs, 2006).

2.5.3 Health Care in South Africa

In South Africa there is a significant disparity in health care between the private and public sectors. The effects of the racial segregation of the health system under the previous apartheid regime are currently still being experienced. Previously advantaged groups are slowly being forced to access the government hospitals, but there are still large disparities in health services between the different population groups. Disability and rehabilitation services are largely under-developed and quite inaccessible to the majority of the population, especially in remote rural areas (National Rehabilitation Policy, 2000). The majority of people with disabilities live in poverty and are dependent on state welfare systems (KZN Disability and Rehabilitation Policy, 2008).

There is a general shortage of medical doctors and other health professionals such as clinical psychologists, physiotherapists and occupational therapists in the public sector. According to the KwaZulu-Natal Guide on the Retention Strategy of Employees in the Department of Health (2009), staff shortages caused by an increase in the attrition of highly skilled employees is currently one of the challenges faced by the Department, and compromises service delivery.

The KZN Disability and Rehabilitation Policy (2008) states that disability and rehabilitation services have suffered from poor resource allocations owing to priorities that tend to privilege programmes aimed at reducing mortality from preventable conditions. The well-resourced private healthcare sector, which is located in urban areas, is financially and physically inaccessible to individuals with poor socio-economic status.

According to Khan (2009), an increasing burden of disease and disability, and the problem of recruiting and retaining of health care professionals in rural and under-served areas, make providing equitable and quality health care more difficult to achieve.

2.6 Conclusion

SCI impacts on many aspects of an individual's life, affecting personal attitudes and mood, together with psychosocial functioning in regard to employment, managing responsibilities and relationships, and the consequences of physical changes (Webster & Kennedy, 2007). Therefore psychological intervention, especially rehabilitation psychology and neuropsychology play a fundamental role in the adjustment process and in the integration of individuals with SCI back into their social and economic communities. Psychology also has a significant role in terms of legislation, psycho-education, and advocacy aimed at improving the lives of people with physical disability. According to the WHO (1996), educating community, political and business leaders will help to promote changes in attitudes towards people with disabilities. Such intervention will advance opportunities for people with SCI to have access to education, job training and work within the community.

Chapter 3
Theoretical Framework

There is a plethora of models and theories that explain health behaviour, health education and health promotion, such as health belief model, theory of reasoned action, theory of planned behaviour, transtheoretical model, social learning theory, and protection motivation theory (Tones & Green, 2004). In addition there are many sociological and social psychological theories that explain interpersonal processes related to social relationships and health, such as exchange theory, attachment theory, and symbolic interactionism (Heaney & Israel, 2002).

This chapter outlines the theoretical framework for understanding psychological and neuropsychological functioning and adjustment following spinal cord injury. Some of the models discussed provide insight into why maladjustment occurs after SCI (e.g. Stress-Diathesis Model), whilst others provide an understanding of how adjustment can be facilitated (e.g., the Copenhagen-Medici Model in Positive Psychology and Positive Health). The neuropsychological models put the accent on processes that occur in cognitive functioning, such as working memory and executive functioning. The theoretical and intervention models of psychological adjustment are presented first, followed by the neuropsychological models.

3.1 Psychological Adjustment Models

3.1.1 Diathesis-Stress Model

The literature review indicates that depressive disorders are the most common forms of psychological distress following SCI. There are many factors that may contribute to depression following a spinal cord injury. Boekamp et al. (1996) have proposed a diathesis-stress model (see Figure 6) to explain these factors.

Figure 4: Diathesis-stress model

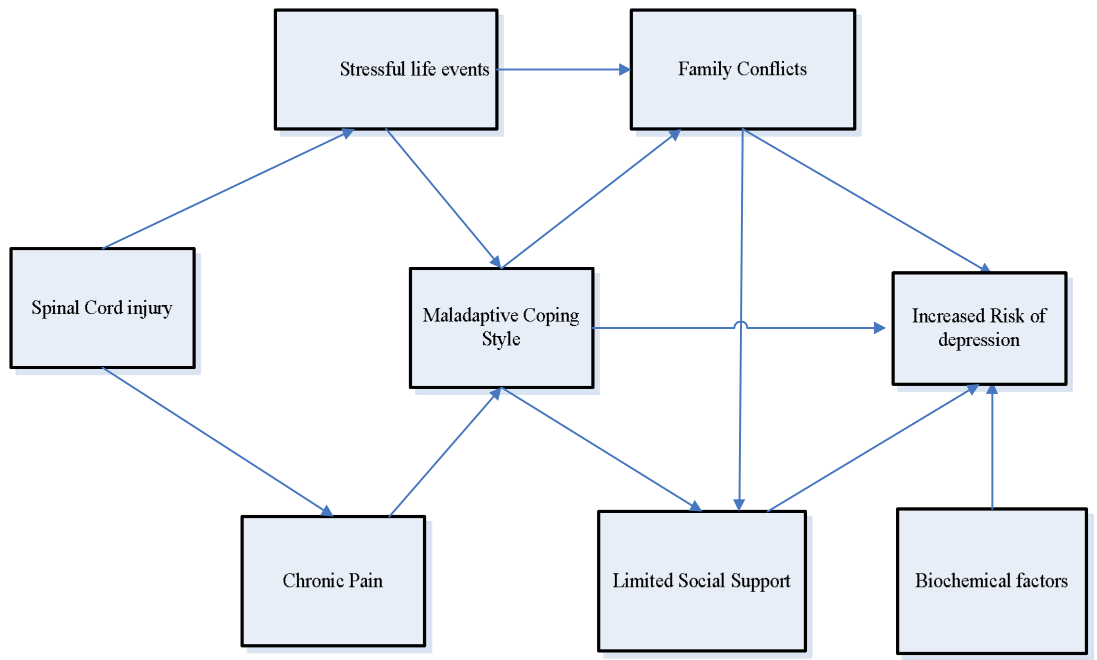

Figure 4. Diathesis-Stress Model showing the factors influencing risk of depression following a spinal cord injury (Boekamp et al., 1996, p. 335).

According to this model, biochemical factors associated with the injury, chronic pain and the frequency of stressful life events can increase the individual's risk of depression following a SCI. However, numerous psychological and social factors can intervene. Following the injury, the individuals coping styles may influence the vulnerability to stressful life events. In addition, the individual's adjustment may be strained by the limited availability of social support and the presence of family conflict (Boekamp et al., 1996, p. 335).

Various international studies (Kennedy & Rogers, 2000; Kennedy et al., 2003; Krause et al., 2000) found significant levels of depression following SCI. The current study set out to examine whether similar findings occur locally. In this study depression is assessed using two instruments: viz. Beck's Depression Inventory II and the Hospital Anxiety and Depression Scale. In addition, the Social Support Questionnaire is also used to assess social support received. These may be useful in understanding the link between depression, adjustment and social support as construed in this model.

3.1.2 The Transactional Model of Stress and Coping (TMSC)

According to Elfström (2007), coping models illustrate people's behaviours, emotions and thoughts when they undergo physical, psychological and social stress. Hence, such coping models may be valuable for understanding how people who sustain SCI cope, considering the huge physical, psychological and social adjustment that needs to occur following such injury.

The theoretical framework often regarded as the most useful in this area is Lazarus and Folkman's transactional theory of stress and coping (TMSC), the *transactions* in this case being the interactions between individual efforts to cope with a situation and the external situation itself (Elfström, 2007). The TMSC evaluates the process of coping with stressful events (Wenzel, Glanz & Lerman, 2002). A person with a chronic illness or disability, such as SCI, must cope with potential stressors such as incapacitation, pain and other symptoms as well as with treatment procedures and hospital environments (Elfström, 2007). This model is relevant and appropriate to the current study, as individuals with SCI were assessed in a hospital environment and had to deal with such stressors such as pain, incapacitation, treatment procedures, etc.

According to the TMSC, stressful events are interpreted as person-environment transactions where the impact of an external stressor is arbitrated by the person's appraisal of the stressor as well as the psychological, social and cultural resources available to him or her (Lazarus and Cohen, 1977; Antonovsky and Kats, 1967; Cohen, 1984, cited in Wenzel et al., 2002).

The components of this model include primary appraisal, secondary appraisal, coping efforts, and outcomes (see Figure 5).

Figure 5: Transactional model of stress and coping

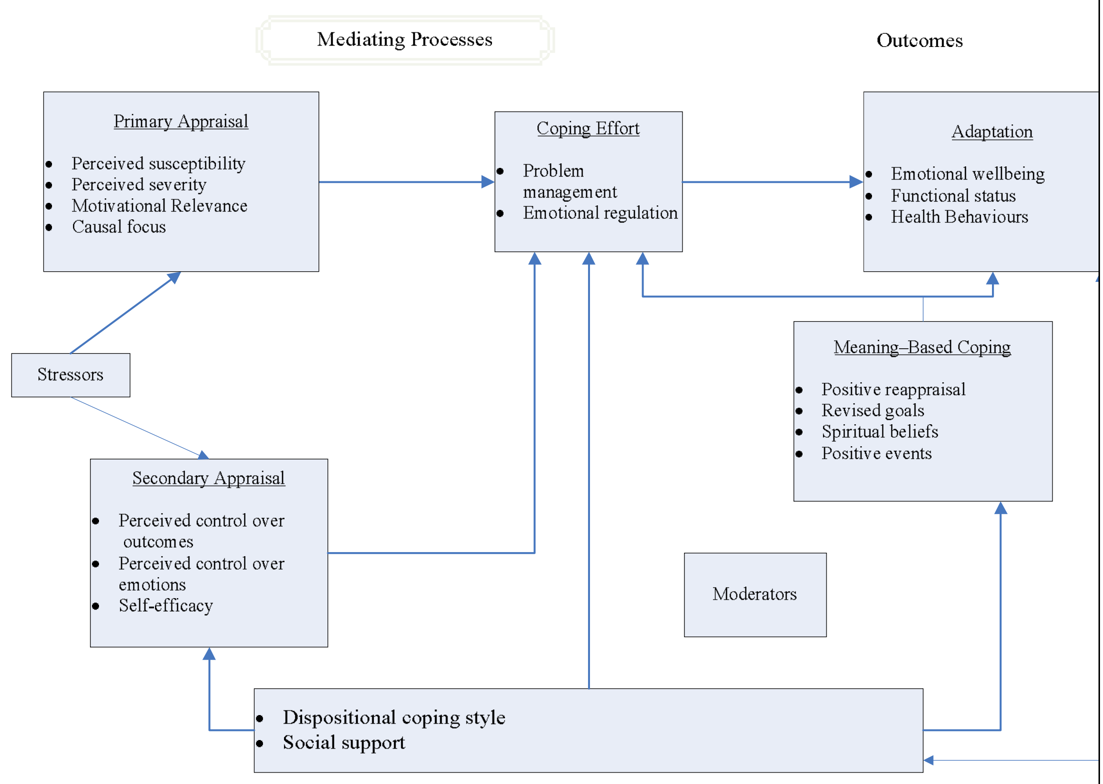

Figure 5. Diagram of the transactional model of stress and coping (Wenzel et al., 2002, p. 215).

Primary appraisal: This refers to an individual's judgement about the significance of an event as stressful, positive, controllable, challenging, benign or irrelevant. According to this model, appraisals of severity of personal risk and threat induce efforts to cope with the stressor, and increased perceptions of risk can generate distress. The motivational relevance and causal focus of the stressor is important. According to Smith & Lazarus (1993, cited in Wenzel et al. 2002), when a stressor is appraised as having a high impact on a person's goals or concerns (high motivational relevance) that person is likely to experience anxiety and situation specific distress. In addition, if a person perceives himself or herself as responsible for the stressor (self-causal focus) this is more likely to generate guilt and depression than anxiety (Smith, Haynes, Lazarus & Pope, 1993; Lewis & Daltroy, 1990 cited in Wenzel et al., 2002).

Secondary appraisal: This is an evaluation of the controllability of the stressor and of a person's coping resources. Secondary appraisals focus on what can be done about a situation. These include perceived ability to change the situation, perceived ability to manage one's emotional reaction to the threat, and expectations about the effectiveness of one's coping resources. There have been positive associations between perception of control over illness and psychological adjustment over a wide variety of diseases, such as cancer and HIV/AIDS (Wenzel et al., 2002).

Coping Efforts: This refers to the actual strategies used to mediate primary and secondary appraisals. Problem management and emotional regulation are two dimensions of coping efforts that were included in the original formulations of the model. Problem management, or problem-focused coping, is aimed at changing the stressful situation, whereas emotion-focused coping efforts are directed at changing the way an individual thinks or feels about a stressful situation. According to this model, problem-focused coping strategies will be most applicable for stressors that are changeable; whilst emotion-focused strategies are most applicable when the stressor is unchangeable or when all problem-focused coping attempts have been made. Disengaging coping strategies, which shift attention away from the stressor, such as distancing, cognitive and behavioural avoidance, or distraction and denial are likely to be used when a stressor is perceived to be highly threatening and uncontrollable. However, avoidance and denial are considered maladaptive, as they may lead to intrusive thoughts which can increase distress over time (Carver et al., 1993; Schwartz et al., 1995 cited in Wenzel et al., 2002). According to Aspinwall & Taylor (1992), engaging coping strategies, such as active coping, information seeking and social support, are most likely to be employed when a stressor is appraised as controllable and the individual has greater self efficacy. Meaning-based coping, such as positive reinterpretation, acceptance, and the use of religion and spirituality, which induces positive emotion is another coping method (Folkman, 1997). This strategy involves the interpretation of a stressful situation in a way that provides personal meaning (Wenzel et al., 2002).

Coping Outcomes: These are the person's adaptation to a stressor, depending on their appraisal of the situation (primary appraisal) and resources (secondary appraisal) which are influenced by coping efforts. Emotional well being, functional status (or health status) and health behaviours are the main categories of outcomes that may interact with one another. Health behaviours such as treatment compliance can be influenced by physical limitations (functional status) and by emotional reactions such as worry, depression and denial. Desirable health behaviour may be similarly influenced by meaning based processes such as positive reappraisal, which can decrease worry and increase positive effects (Wenzel et al., 2002).

A recent study by Chen-Ping (2009) evaluated the transactional theory of coping as a psychosocial adaptation model for persons with SCI in Taiwan. The results of this study indicate that the relationship between functioning and life satisfaction cannot be mediated by using cognitive appraisals or coping strategies.

Cultural and environmental factors were emphasized in understanding the stress-coping process of individuals with SCI (Chen-Ping, 2009). However this model is useful in not only understanding how individuals with SCI adjust to their circumstances but also how they can be managed psychologically to facilitate adjustment.

3.1.3 Conceptual Model of the Relationship of Social Networks and Social Support to Health

The concept of social networks was first presented by Barnes (1954), who worked in a Norwegian village, to describe patterns of social relationships other than extended families or work groups (Heaney & Israel, 2002). The pioneer in the area of social support was social epidemiologist John Cassel (1976), who postulated that social support was the main "protective" factor that made individuals less vulnerable to the adverse effects of stress on health (Heaney & Israel, 2002, p. 188). This model has similarities with other models described in this chapter such as the Diathesis Stress Model, TMSC and the Leisure and SCI Adjustment Model, which emphasize the role of social support on the effects of stress on health. As discussed earlier, the effects of social support on adjustment to SCI is an important component of the current study. In the literature review it is pointed out that continued social support is an important factor for acceptance of lost functioning and potential in individuals with SCI. Through its various pathways, the model of the relationship of social networks and social support can specifically be used to explain how social support and social networks contribute to physical, mental and social health which facilitates adjustment in individuals with SCI.

Figure 6: Model of the relationship of social networks and social support to health

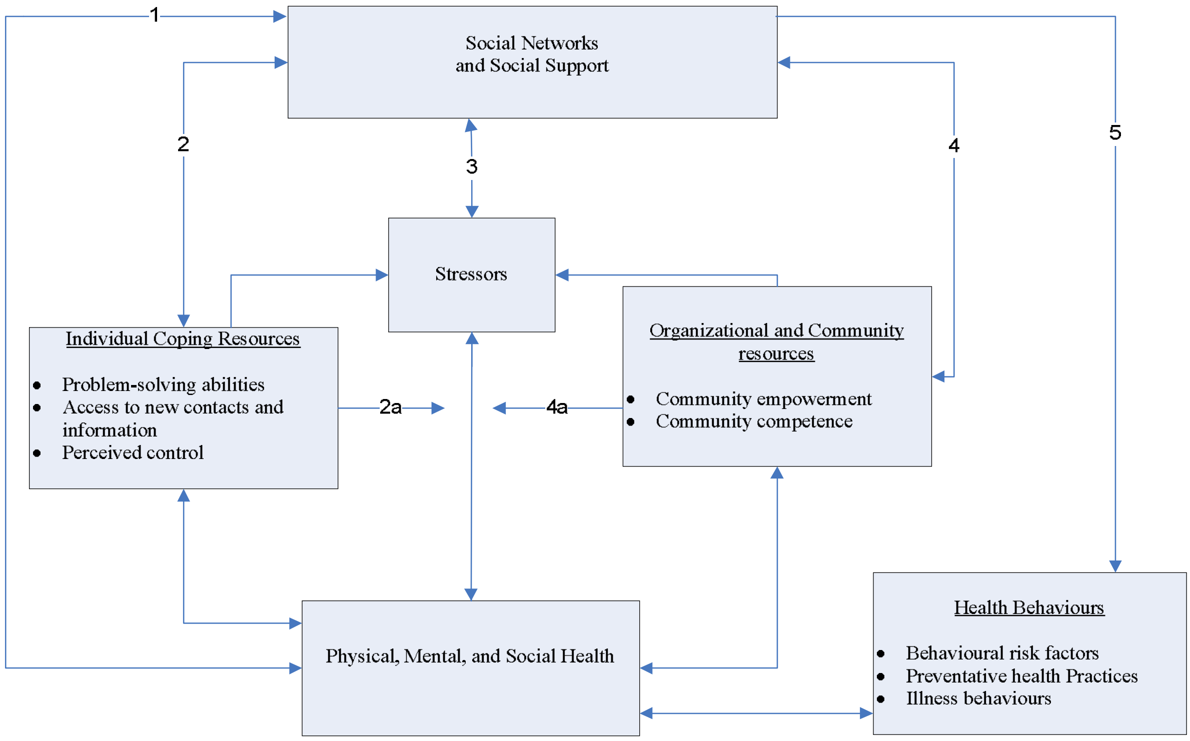

Figure 6. Diagram illustrating the conceptual model of the relationship of social networks and social support to health (Heaney & Israel, 2002, p. 190).

This model depicts social network and social support as the initiator of a causal flow towards health outcomes (Heaney & Israel, 2002). The relationships in this model are reciprocal in nature. A hypothesized direct effect of social networks and social support is shown in pathway 1 (Figure 6). Supportive ties can enhance wellbeing and health, irrespective of stress levels, if a basic human need for companionship, intimacy, a sense of belonging, and reassurance of one's worth as a person, are met (Berkman & Glass, 2000 cited in Heaney & Israel, 2002). Pathways 2 and 4 represent the hypothesis of the effect of social networks and social support on individual coping resources and community resources. If social support leads to a reduction in uncertainty and unpredictability, and achievement of desired outcomes, this will result in a sense of control over specific situations and enhancement of life domains. According to the theory of symbolic interactionism, behaviour is based on the meaning that people assign to events. This meaning is largely attained from social interactions (Israel, 1982 & Berkman, Glass, Brissette and Seeman, 2000 cited in Heaney & Israel, 2002). According to Thoits (1995), social network linkages can help reinterpret events or problems more positively and constructively (Heaney & Israel, 2002).

Strong social networks and improved social support can increase a community's resource gathering and problem solving ability. Individual and community level resources can enhance health directly and also reduce exposure to stressors and their negative effects on health. The "buffering effect", shown in pathways 2a and 4a in Figure 6, refers to enhanced community and individual resources that assist individuals who experience stress to cope better and reduce negative health consequences. According to Heaney and Israel (2002), the ability of social support and social networks to influences the coping process and buffer the effects of stressors on health has been shown in studies (Rhodes, Contreras, and Mangelsdorf, 1994; Hirsch and DuBois, 1992) involving people going through major life transitions such as the loss of a spouse. It is important to understand the impact of social support on those with SCI considering that they are also experiencing a major transition of life. In the current study social support is examined using the Social Support Questionnaire.

Social networks and social support can influence the frequency and duration of exposure to stressors (pathway 3). Hence, mental and physical health can improve with reduced exposure to stressors.

The potential effects of social networks and social support on health behaviours is reflected in pathway 5. This pathway emphasizes that social networks and social support affects the incidence of and recovery from ill health, through influences on preventative health behaviour, illness behaviour and sick-role behaviour (Heaney & Israel, 2002).

3.1.4 The Leisure and SCI Adjustment Model

This model is incorporated in the current study in order to gain an understanding of the possible factors that may promote adjustment following injury to the spinal cord. As outlined in this model, such factors include leisure and social support. The Leisure and SCI Adjustment Model (LSCIAM) ties in closely with the next two models discussed, viz. Cognitive Behaviour Therapy (CBT) and the Copenhagen-Medici Model in Positive Psychology and Positive Health, which are used in this study as a basis and background to psychological treatment and rehabilitation – this being one of the goals of the study. These models are incorporated particularly in the recommendations for treatment in Chapter 7 where a Bio-psycho-social-cultural Intervention Model of Adjustment to SCI is proposed.

The Leisure and SCI Adjustment Model (LSCIAM) was proposed by Loy and Kleiber (2003) after examining the influence of leisure on adjustment in individuals with SCI. Following this research, a conceptual model was generated to provide a better understanding of the influences of leisure engagement on SCI adjustment. The background to this model is provided by Tinsley and Tinsley's (1986) leisure experience theory which suggests that psychological needs, as conceptualized by Maslow (i.e., physiological, safety, belongingness, self-esteem, self actualization) can be met through leisure (Loy & Kleiber, 2003). According to Tinsley and Tinsley, satisfaction of psychological needs promotes life satisfaction, positive mental health and improved physical health that resulted in personal growth. The context of leisure provides an opportunity for people to develop an idea of their strengths and weaknesses, develop their skills and abilities, become the people they would like to be, and improve their self concept (Mannell and Kleiber, 1997, cited in Loy & Kleiber, 2003). These studies provide the conceptual foundation for the direct causal pathway in the LSCIAM.

According to Loy & Kleiber (2003) this model recognises certain dimensions of leisure engagement including diversity (breath of leisure involvement), intensity of leisure engagement (amount of energy expended in leisure engagement), frequency of leisure engagement (how often individuals engage in leisure), leisure identity salience (how salient one's identity is tied to his/her leisure), and perceived freedom (sense of autonomy contributing to leisure engagement). Leisure activities with high physical intensities leads to physiological changes such as elevated endogenous opiods, temperature, and brain neurotransmitters that are beneficial to health and well being (Morgan, 1997 cited in Loy & Kleiber, 2003). The relationship between the frequency of leisure engagement and mood and depression was examined by Dupuis and Smale (1995, cited in Loy & Kleiber, 2003). It was found that mood and depression was related to the frequency of engaging in hobbies/crafts, visiting friends and swimming, but not to the frequency of engaging in other activities such as viewing television, participating in social clubs/organisations, or walking for exercise.

According to Loy and Kleiber, leisure may also have an indirect influence on adjustment to SCI through the generation of social support: "If social support mediates the influence of leisure on SCI adjustment as the LSCIAM model suggests, it may be that this mediation occurs through the development of social relationships and social networks formed through leisure engagement" (p. 238). The results of the study by Loy and Kleiber indicated that leisure engagement had a direct influence on SCI adjustment while also promoting social support that in turn influenced the adjustment of individuals with SCI.

The models discussed thus far assists in conceptualizing the fundamental aspects involved in adjustment following SCI. These aspects include psychological distress, such as depression and anxiety and how factors such as social support and leisure can play a role in mediating these aspects to facilitate coping. Hence the current study uses instruments to assess for possible depression, anxiety, posttraumatic stress disorder as well as social support.

3.1.5 Cognitive Behaviour Therapy

The cognitive behavioural framework is similar to the coping models as it focuses on people's behaviours, cognitions and emotions (Elfström, 2007). This framework is used in this study not only to understand coping and adjustment following SCI but also for the psychological management of individuals with SCI. Cognitive Behaviour Therapy (CBT) has been referred to as a "paradigm revolution" (Mahoney, 1974) because it created a radical shift in psychological treatment from early childhood events and behaviour to cognition (Sharoff, 2004). Cognitive restructuring (CR) is the dominant approach in this model. The aim of CR is to focus on the central role of thinking in human functioning and how it influences the emotional, physical and behavioural response. Beliefs are examined to determine whether they are rational and realistic, and thoughts are converted into a hypothesis and tested for validity. CBT approaches are framed within the mediational model, which assumes that behaviours, cognitions and emotions are interlinked and mutually dependant (Elfström, 2007).

Researchers involved in SCI and rehabilitation began developing CBT interventions to assist individuals with their psychological adjustment to the traumatic injury in the mid 1990s (Abdinor, 2004). Two main groups of authors, who implemented a group-based intervention, have been identified in a review of literature by Abdinor (2004) in assessing the effectiveness of CBT in a SCI population. The first group has Ashley Craig and Karen Hancock as principle authors and the second group has Paul Kennedy as principle author. The intervention by Kennedy and co-workers is called Coping Effectiveness Training (CET) which is grounded in Lazarus and Folkman's (1984) cognitive theory of stress and coping.

Coping skills therapy, which has existed for many years, provides psycho-education and skills training for specific situations (D'Zurilla & Goldfried, 1971; Goldfried, 1980 cited in Sharoff, 2004), such as relaxation training, problem solving therapy, social skills training and assertiveness training. Coping skills therapy is part of CBT. Rational-Emotive-Behaviour-Therapy (REBT) (Ellis & MacLaren, 1998) and Cognitive Therapy (Beck et al., 1979) are cognitive restructuring methods that utilize coping skills but are secondary to the belief-change approach (Sharoff, 2004). REBT emphasizes that core irrational beliefs are the root of mental health problems.

Cognitive Coping Therapy (CCT) (Sharoff, 2002) is a relatively new approach that has expanded the number of coping skills, provided a cohesive practice theory, and a theory of pathology and health (Sharoff, 2004). This theory postulates that although CR addresses thought content, difficulties arise due to the degree of confidence in a belief. A high degree of confidence is termed "certainistic thinking". Certainistic thinking becomes problematic when there is a lack of supporting empirical evidence for a belief but the idea is deemed correct by the individual. A closed feedback loop then ensues and the search for supporting data ceases. The intention of CCT is to create an open feedback system that allows facts and other people's inputs to be heard and objectively analysed.

Cognitive distortions, where cognitive tendencies in information processing distort the perception of the situation, are another problem that exists in the process of thinking (Sharoff, 2004). This rationalist school of CR in CBT emphasizes that cognition is the prime catalyst in adjustment. CCT also makes cognition as a central part of its treatment by either giving individuals appropriate thoughts that are part of a coping skill or inculcating a coping skills package that indirectly changes individuals' thinking.

CCT incorporates three types of beliefs – policy beliefs, executive beliefs, and operational beliefs – that shape the development of coping skills (Sharoff, 2004). Policy beliefs refers to the policy that people set for their lives by making important plans for how they want to live which declare the principle for a situation, executive beliefs are self-instructions that structure the exact response to an activating event, and operational beliefs are the thoughts that are given to others. CCT assumes that psychopathology and emotional distress are influenced largely by executive beliefs and hence places emphasis on changing executive beliefs and inculcating new ones (Sharoff, 2004).

3.1.6 The Copenhagen-Medici Model in Positive Psychology and Positive Health

The Copenhagen-Medici Model in Positive Psychology and Positive Health is a recent model, developed in 2000 by Seligman, Csikszentmihalyi, Diener, Peterson, and Vaillant (Seligman, 2008), which is based on positive psychology (PP) and positive health (PH). As mentioned earlier, this model is used in the current study to understand adjustment following SCI and also a modality for the psychological management of individuals with SCI. SCI is understood as one of the most devastating physical injuries that can be sustained as most individuals have to adjust to a life that no longer includes walking. Positive psychology provides an excellent framework for understanding how individuals with SCI can find hope and meaning in life following such a life changing experience.

The growing discipline of positive psychology was initiated by two US psychologists, Seligman and Csikszentmihalyi (2000), who take issue with models rooted in the medical model and focused on pathology. Seligman and Csikszentmihalyi argue that these traditional psychological models fail to take into account the positive features that make life worth living, such as hope, wisdom, creativity, future mindedness, courage, spirituality, responsibility and perseverance. Although some of these positive aspects are emphasized in the TMSC model, as discussed above, Seligman and Csikszentmihalyi state that such explanations are "transformations of more authentic negative impulses" (p. 5). PP is defined as "a science of positive subjective experience, positive individual traits, and positive institutions that promises to improve quality of life and prevent the pathologies that arise when life is barren and meaningless" Seligman and Csikszentmihalyi (2000, p. 5).

PP has been formulated by unpacking the concept of "happiness" and decomposing it into several more quantifiable aspects such as positive emotion (the pleasant life), engagement (the engaged life), and purpose (the meaningful life) (Seligman, 2008; Seligman and Csikszentmihalyi, 2000; Seligman, Rashid, & Parks, 2006). The pleasant life is made up of positive emotion about the present, past and future and acquiring skills to improve the intensity and duration of these emotions. Low positive emotion can lead to depression, but building positive emotions can buffer against depression (Seligman, Rashid, & Parks, 2006). The engaged life is one that pursues engagement, involvement, and absorption in work, intimate relations and leisure. This can be enhanced by identifying an individual's greatest strengths (signature strengths) and talents and finding opportunities to use them more. According to Seligman et al. (2006), depression is related to the lack of engagement in the main areas of life and that lack of engagement can cause depression. The meaningful life involves the pursuit of meaning, where signature strengths and talents are used to belong to and serve something that is believed to be bigger than the self, such as religion, family, politics, etc. According to research on meaning-making done by McAdam et al. (1997) and Pennebaker (1993, cited in Seligman, Rashid, & Parks, 2006), those that use meaning to transform the perception of their circumstances from unfortunate to fortunate will benefit the most. Seligman et al. (2006) propose that a lack of meaning is just not a symptom but a cause of depression and that meaning building interventions will hence relieve depression. Each of these three lives is viewed as three different roads to happiness (Duckworth, Steen & Seligman, 2005).

Positive health (PH), a new field proposed by Seligman (2008), describes a state beyond the absence of disease. Its theoretical framework is parallel to and grounded in the field of positive psychology. PH is broken down into three quantifiable variables: subjective, biological, and functional. The combination of these variables can be used to predict health targets such as longevity, health costs, mental health and prognosis (Seligman, 2008).

3.2 Neuropsychological Models of Functioning

3.2.1 Movement

According to the theory of neocortical control of movement, most voluntary movements are thought to be produced by four general regions of the neocortex (Kolb & Wishaw, 2003). These regions are the prefrontal cortex, the premotor cortex (Brodmann's area 6), the supplementary motor cortex (Brodmann's area 6), the primary motor cortex (Brodmann's area 4) and the posterior sensory regions of the cortex. The current theory states that the primary motor cortex and the premotor cortex can be thought to contain a lexicon of movements, from which appropriate selections are made. The prefrontal cortex, which produces plans for movements, sends instructions to these regions which travel from the prefrontal cortex to the premotor cortex and then to the primary motor cortex. Movement is planned in the prefrontal cortex, sequenced in the premotor cortex and produced by the primary motor cortex. However, this system is interrupted and may not result in movement if there is damage to the spinal cord as the spinal cord is responsible for conveying motor and sensory information to and from the brain. Moreover, Sanes and Donoghue (2000) suggests that the primary motor cortex is not simply a static motor control structure as they modify in association with skill learning. Further, the primary motor cortex contains a dynamic substrate that participates in motor learning and possibly in cognitive functioning as well. The plasticity of the primary motor cortex and its ability to modify is an important factor to consider for individuals with SCI who have to relearn basic motor skills.

It is important for the current study to understand the neuropsychological aspects of movement which are associated with motor functioning. As part of the neuropsychological test battery, various tests such as the Grooved Pegboard are included to assess motor functioning. In addition, evaluating motor functioning will help determine whether the loss of limb functioning in individuals with SCI is associated with damage to the spinal cord alone or if there is also a cognitive component.

3.2.2 Memory

Memory is fundamental for individuals with SCI to cope with adjustment for daily living, as new skills will have to be learnt and remembered. Individuals with traumatic SCI may be susceptible to memory impairment due to trauma exposure. According to Elzinga and Bremmer (2002) memory disturbances in individuals with PTSD is concerned with impoverished memory functioning which results from diminished encoding or impaired retrieval abilities. The various types of memory discussed below are assessed in this study using different tools, such as Narrative Prose Memory Test and the Rey Taylor Complex Figure Test, in order to gain a comprehensive understanding of memory functioning in individuals with SCI.

Short term memory (STM) was described previously by Atkinson and Shiffrin (1968) as a temporary memory store for material, before being stored more permanently (Andrewes, 2001). The function of the STM store was to allow a limited amount of information to be held temporarily in mind while the information was processed and analysed further. Kolb & Wishaw (2003) describe multiple memory systems where no single region of the brain is responsible for all memory and each region makes a specific contribution.

Working memory is defined as “being part of long term memory and which also comprises short term memory” (Sternberg, 1999, p. 166). It holds only the most recently activated portion of long term memory and moves these activated elements into and out of brief, temporary, memory storage (Sternberg, 1999).

Moreover, popular term “short term memory” has been superseded by “working memory” (WM) which is a modern substitute (Andrewes, 2001). WM, a brief memory store with a decay rate of a few seconds, allows a person to manipulate information in mind during and prior to, the process of storing information into memory (Andrewes, 2001, p. 208).

WM, which was developed by Graham Hitch and Allan Baddeley in the 1970s, evolved out of a need to define a temporary memory system that incorporated everyday needs (Andrewes, 2001). According to this model, WM is made up of a visuospatial sketchpad, a phonological loop, a central executive, and other subsidiary systems. The visuospatial sketchpad briefly holds some visual messages; the phonological loop briefly holds inner speech for verbal comprehension and acoustic rehearsal (without which acoustic information decays after about 2 seconds); the central executive coordinates attentional activities and governs responses; and the other subsidiary systems, referred to as “subsidiary slave systems”, perform other cognitive or perceptual tasks (Baddeley, 1989 cited in Sternberg, 1999, p. 166). The various levels of processing are integrated by the central executive which moves items in and out of short term memory and integrates the information arriving from the senses and from long term memory. The working memory index of the Wechsler Adult Intelligence Scale III (WAIS III) is used in this study to evaluate working memory in individuals with SCI.

Further, WM is used for learning and is closely related to attention. Learnt information is stored in the long term memory store (LTMS). For this to happen the information has to be stored into memory by the consolidation system. The hippocampus, parts of the thalamus, and possibly the mammillary bodies are brain structures that serve as the engine room of the consolidation system. These structures act to "stamp in" the activations within the LTMS to make them permanent features of this store (Andrewes, 2001).

Moreover, Sternberg (1999) states that the WM model highlights the function of working memory in governing the processes of memory, such as encoding and integrating information (cross-modal integration of acoustic and visual information, organizing information into meaningful chunks, linking new information to existing forms of knowledge representation in long term memory, etc.) (p. 168).

Needless to say, memory is a very important component of cognitive functioning for individuals with SCI. As discussed in the working memory model above, memory is an important aspect of learning and this is fundamental for SCI individuals acquiring new skills to adapt to a new way of life.

The next set of models, relating to perception, attention, executive functioning, and language, are included in this study because they provide a description and understanding of important cognitive skills. According to Dowler et al. (1995) 10-60 percent of the spinal cord population retains residual cognitive deficits following the injury. Therefore specific neuropsychological tests have been selected in the current study to assess these aspects of cognitive functioning in individuals with SCI. These cognitive skills, together with memory, are fundamental for treatment and rehabilitation of individuals with SCI. Moreover, as discussed in the literature review, such aspects of cognitive functioning have generally been overlooked or misunderstood by healthcare professionals, and have therefore been included as an important part of this study. Further, Dowler et al. (1995) points out that such cognitive skills are important for SCI individuals and their families as it would have implications for vocational rehabilitation, social adjustment as well as long term management of health care.

3.2.3 Perception

Perception is "the set of processes by which we recognize, organize and make sense of the sensations we receive from environmental stimuli" (Sternberg, 1999, p. 110). The perceptual modalities include visual, touch, smell, etc. The gestalt approach of perception focuses on aspects of the stimuli that influence perception. The explanatory theories of perception include top down and bottom up approaches. However, the main bottom up approaches include direct perception, template theories, prototype theories, feature theories and structural-description theories. Further, the alternative paradigm is the top down approaches such as constructive perception.

According to Sternberg (1999), the theory of direct perception, a bottom up approach, was postulated by James J Gibson (1904–1980). According to this theory, in order to perceive anything, all we need is the array of information in our sensory receptors. However, higher cognitive processes are not required to mediate between sensory experiences and perception. Moreover, the roles of perception and intelligence are seen as separate and sequential in this model, unlike the constructive-perception viewpoint that sees them as interactive.

Sternberg (1999) names cognitivists Jerome Bruner, Richard Gregory and Irvin Rock as the founders of the top down constructive perception approach, building on the work of Hermann von Helmholtz (1821–1894). In this approach a cognitive understanding (perception) of a stimulus is constructed using sensory information as the foundation in addition to other sources of information. Further, higher order thinking plays an integral role in this model.

As outlined by Sternberg (1999), the theory of visual perception proposed by David Marr (1982) incorporates both the richness of sensory information and the value of prior knowledge and experience in perception. Therefore, this approach, which is a computational theory of perception, recognises the complexity of cognitive processes required for perceiving a mental representation of the environment based on raw sensory data. Also included are the descriptive principles of perception such as depth cues and perceptual constancies, as well as Gestalt principles of form perception.

The human brain uses a three-step process for computing a 3-D percept of what we see (Marr, 1982 cited in Sternberg, 1999, p. 140). In the first step, the visual area of the brain creates a 2-D primal sketch of the sensory information that reaches the eyes. This represents the object in just two dimensions. Edges, contours and regions of similarity are mapped out using sensory data. The brain then creates a two-and-a-half-D sketch of the data which incorporates depth cues and surface orientations. In the final step the brain creates a 3-D model which represents three-dimensional objects and the spatial interrelationships among the objects. In forming the 3-D perception the individual's prior knowledge and experiences may influence perception. However, Marr did not specify how this may occur (Sternberg, 1999). Moreover, for patients with SCI, perception not only of their environment, such as the hospital, but of their situation as well, will determine how well they adjust. Needless to say, deficits in perception will impact negatively on treatment and outcomes for such individuals.

3.2.4 Attention

"Attention is a limited capacity process that allows the preferential process of certain sensory or imaged information at the expense of other stimuli" (Andrewes, 2001, p. 204). According to Strauss et al. (2006), attention is described in most models as a complex system of interacting components that allows the individual to filter relevant and irrelevant information in the context of internal drives and intentions, hold and manipulate mental representations, and monitor/modulate responses to stimuli (p. 546). Further, these models divide attention into component processes such as alertness/arousal, focussed attention, selective attention, divided attention, and sustained attention or vigilance.

Some of the early theories include filter and bottleneck theories of selective attention, and also capacity theories (Reed, 1996; Sternberg, 1999). Bottleneck theories such as Broadbent's Filter Model, Moray's Selective Filter Model and Treisman's Attenuation Model explain how people select information when some information processing stage becomes overloaded with too much information. Capacity theories, such as Kahneman's Capacity Model, propose that there are limitations on the number of tasks we can perform at the same time, since we have a limited amount of mental effort to distribute across tasks. The capacity models were designed to supplement rather than to replace the bottleneck models (Reed, 1996).

According to Reed (1996) concentration is investing mental effort in one or more tasks and is an aspect of attention. Lezak et al. (2004), refer to concentration as the capacity to highlight the one or two important stimuli or ideas being dealt with while suppressing awareness of competing distractions. Moreover, attention skills are necessary for individuals with SCI to be able to absorb new information from the outside world and transfer it to the brain to be used in thinking, learning, problem solving, as well as memory. Such skills are vitally important for individuals with SCI benefiting from physical and psychological treatment.

3.2.5 Executive Functioning

The executive functioning skills play a significant role in information processing, abstract thinking, problem solving, inhibition as well as initiation. Needless to say that these are fundamental skills required by individuals with SCI for planning, reasoning and making decisions. Hence, it is important to understand how the executive system functions.

According to Andrewes (2001), the supervisory attentional system (SAS) is a model of executive functioning that was originally developed as a descriptive framework by Norman and Shallice in 1986. According to this model, there are certain routines of automatic behaviour that are cued or triggered by certain environmental stimuli or other routines. The Norman and Shallice model refers to the process of "contention scheduling" whereby a schema representing, for example, a routine of behaviour, is selected over another. Therefore, in order for this to take place, contention scheduling inhibits one behaviour and activates another. Further, a perceptual trigger leads to contention scheduling activating an automatic response or schema. However, when two competing behaviours are present, contention scheduling will select one behaviour over the other, because we cannot cope with more than one thing at a time. Moreover, in some instances, contention scheduling requires direction and modulation from the supervisory attentional system (SAS), most commonly when something unusual happens and the automatic behaviour must be overridden. Andrewes states that the SAS to which Shallice refers is similar to the "executive system" referred to by other authors as a hypothetical controlling device that monitors and directs behaviours. However, a "capture slip" occurs when the SAS fails to cut in and control behaviour which results in routine behaviour that is inappropriate: for example, a patient drinking from a cup handed to him or her even when it is empty. Needless to say, patients with gross frontal lesions are prone to making such "capture slips" (Della Malva, Stuss, D'Alton & Wilmer, 1993, cited in Andrewes, 2001). Andrewes notes that this model is unclear, however, on how behaviours are planned and organised, and does not indicate how the prefrontal cortex acts to select a new behaviour.

A schema is "a broad term that describes the content of a typical set of ideas or experiences and their logical relationships" (Andrewes, 2001, p. 112). Moreover, the schema is based on past knowledge in a given context. Grafman (1989, 1995) proposed a model based on the hierarchy of schemas that are stored within the prefrontal cortex (Andrewes, 2001, p. 113). In this model these schemas are referred to as managerial knowledge units. These schemas are represented at nodes, starting at the top at a general and abstract level with more specific subunits beneath them. According to Grafman, these schemas are located in the frontal lobe. Further, this model makes reference to the structured event complex (SEC). The SEC is made up of representations of stored events that have occurred in the past and will probably occur again in the future. According to Andrewes (2001), this model is useful in describing the breakdown of planning, reasoning and organisation following prefrontal damage.

The Grafman model proposes that the executive system cannot be seen in isolation from the structure of knowledge and executive roles takes place within this structure (Andrewes, 2001). Nevertheless, it is important to consider that the cognitive skills such as executive functioning, memory, attention, perception and language interplay to create knowledge used for learning and hence are important for patients with SCI.

3.2.6 Language

Language is "a collection of symbols, and rules for combining symbols, which can express an infinite variety of messages" (Reed, 1996, p. 292). The cognitive skills described above are necessary to produce language, which is fundamental for learning. Moreover, learning is crucial for psychological and physical adjustment following SCI as well as for vocational rehabilitation.. Hence it is important to understand how the language system functions.

The Wernicke-Geschwind model of language, also called the Wernicke-Lichtheim-Geschwind model, proposes that connections between specialised centres in the brain allow the progression from sensory input to speech output (Andrewes, 2001). The two areas of sensory input include the visual area for reading and the auditory area for analysing auditory input. Sensory inputs are analysed at Heschl's gyrus for auditory input and the striate cortex for visual information. According to this model, the angular gyrus, as part of the association area, is responsible for translating from one sensory modality to another i.e. from the visual modality to the auditory and vice versa. Moreover, Wernicke's area is considered to be the place where the basic auditory information at Heschl's gyrus is transformed into the phonological representation of words and then to their meaning. However, for the transformation of visual information into meaning (e.g., of reading material) there must be an initial translation of the visual input in the visual cortex. This visual information is then sent to the angular gyrus so that it may be translated into an auditory modality for meaning. Therefore, this process is necessary before the final translation for meaning in Wernicke's area takes place. Lastly, for the production of speech to occur, the meaning of what is to be said must be transferred from Wernicke's area to Broca's area via a group of axons called the arcuate fasciculus (Geschwind,1970, cited in Andrewes, 2001). Further, the sentence to be spoken is planned and organised within Broca's area, before it is sent on to the "face area" within the motor strip. The appropriate motor movements for the articulation of speech, which has been pre-programmed within Broca's area, is then activated and executed by the face area.

According to Andrewes (2001), the Wernicke-Geschwind model is a useful starting point for theoretical thinking about language disorders, but modern views of language disorders require refinement of this model. Nevertheless, the Boston classification system proposed by Luria divides the perisylvian aphasias into Broca's aphasia (difficulties in expression or production of language) and Wernicke's aphasia (a disorder of comprehension). Further, conduction aphasia is where repetition is the main impairment, whilst global aphasia is associated with features of both Broca's and Wernicke's aphasia. However, the localisation of Broca's aphasia varies between individuals and there is no clear and consistent relationship with the area originally described by Broca, although this type of aphasia is most often associated with the frontal areas (Andrewes, 2001). Moreover, Andrewes argues that there is uncertainty in the localisation of different types of aphasia's and he therefore proposes a new model of language disorders in which the types of impairments are analysed from the psychological viewpoint alone, without reference to brain structure.

3.3 Stress and Coping: Asymmetry of Dopamine Efferents in the Prefrontal Cortex

Traumatic SCI can be one of the most stressful situations a individual is faced with. This is due to the fact that not only do they have to cope with the traumatic experience that resulted in their injury, such a being hijacked and shot, but also they are faced with coping with the loss of physical function such as walking. Therefore it is important to understand how the brain may be affected as a result of such exposure to stress. This model provides an understanding of the neurobiological effects of stress. Studies in the early twentieth century that gave rise to the concept of stress within modern society identified two important principles (Berridge, España & Stalnaker, 2003), the first being the sensitivity of physiological systems to challenging environmental conditions and the second demonstrating a strong association between stress (and anxiety) and an array of physiological, cognitive, and affective dysfunctions. Insight into the neurobiology of stress and anxiety was obtained by using animal models. According to Berridge et al., an early observation was that a strong activation of certain neurotransmitters such as cerebral dopamine (DA) and other monoamines occurs in stress, including within the prefrontal cortex (PFC). According to Perry (2001) stress, threat and fear influences the regulation of the hypothalamic-pituitary-adrenal axis (HPA) and abnormalities of the HPA axis has been seen in adults with PTSD.

Moreover, the PFC plays an important role in the coordination of behavioural and autonomic processes associated with interacting with the environment and adapting to challenging situations. Further, DA influences a variety of PFC-dependant motor, cognitive, and affective processes that are important for dealing with challenging environmental situations. Therefore, manipulations of DA neurotransmission within the PFC lead to alterations in autonomic and behavioural functions. Further, some of these actions show lateralization with right and left hemisphere DA neurotransmission associated with different patterns of effect on behaviour and physiology. In addition, engaging in coping behaviour suppresses rates of DA release within the PFC in stress and impacts on stress related PFC neuronal activity (Berridge et al., 2003).

However, the central nucleus of the amygdala appears to modulate a variety of stress-related physiological and behavioural processes, including stress-related activation of DA efferents to the PFC. In addition, the DA efferent's to the right hemisphere may play a unique role in affective and cognitive processes in stress, and engaging in certain coping behaviours may have a significant impact on anxiety-related cognitive and/or affective processes (Berridge et al., 2003, p. 93).

The above model, which describes stress and coping from a neurobiological perspective, will be used in this study to further understand and explain the impact of stress or coping following SCI on physiological and cognitive systems as well as on affective components of the individual. According to Perry (2006), it is the human brain that mediates all emotional, behavioural, social, motor, and neurophysiologic functioning. Hence, without an appreciation of how the brain is organised and how it changes, therapeutic interventions are likely to be inefficient and ineffective.

3.4 Conclusion

The models explained in this chapter provide the framework for understanding and accounting for neuropsychological functioning and adjustment following SCI. In addition, these models provide the theoretical background to understanding the intervention that is proposed in Chapter 7 for adjustment following SCI.

Chapter 4
Methodology

"Research methods are aids to the journey of discovery and exploration." Gilbert & Irons (2005, p. 1). This chapter is an explanation of the methods used in the study to gather and analyse the data. The study location, participants, procedure and tests used are described in detail.

4.1 Location of Study and Historical Background

This study was conducted at major public rehabilitation centres and hospitals in and around the city of Durban in the Province of KwaZulu-Natal (KZN), South Africa (Figure 7). KZN, regarded as the home of the Zulu nation, is one of the nine provinces of South Africa. It has a population of 10.45 million people, making it the province with the second largest population in SA (Statistics SA, 2009). The capital of KZN is Pietermaritzburg and its largest city is Durban. In terms of its municipal structure it is divided into 11 districts ("KwaZulu-Natal", para. 1 & 2, "Provincial Government KwaZulu-Natal", 2004). The study site for this research was the eThekwini district which is Durban metropolitan and surrounding areas.

Figure 7: Map of South Africa

Figure 7. Map of South Africa showing the various provinces. (Source: unknown)

Participants in the SCI group were obtained from King George V Hospital Spinal Unit (KZN Department of Health), located in Durban, and the Provincial Spinal Rehabilitation Centre (PSRC), located in Phoenix, north of Durban. Phoenix is predominantly an Indian township, established in terms of the Group Areas Act under the Apartheid regime. King George V Hospital (KGV), historically known as King George V Jubilee Hospital, was officially opened in 1939, just prior to World War II, with 139 beds for the treatment of tuberculosis patients. Over the years, the hospital expanded to 1291 beds and came to include psychiatric services, thoracic surgery, spinal surgery and, more recently, oesophageal carcinoma services, as well as a family planning clinic ("King George V Hospital", para. 1, 2 & 6.) The PSRC, a specialized spinal rehabilitation hospital for the province of KZN, is a wing of King George V Hospital Spinal Unit but administered by the Mahatma Gandhi Memorial

Hospital (MGMH), KZN Department of Health. It is an 18-bed in-patient facility that was established in 1999 by Professor S Govender, Department of Orthopaedics, Nelson R Mandela School of Medicine and Professor Green Thompson, Provincial Department of Health, after a need for such a unit was identified.

The control group was selected from Clairwood Hospital (CH), under the KZN Department of Health, and the Phoenix Assessment and Therapy Centre (PATC). CH is a specialised general rehabilitation hospital which is located in Durban. Historically, Clairwood Hospital was a transit camp of the World War II Imperial Forces which was later developed into a rehabilitation hospital (Pillay, 1993). PATC is a community-based rehabilitation centre that was established in 1989 and, is located in Phoenix. It is part of the Mahatma Gandhi Memorial Hospital Complex (MGMHC) under the KZN Department of Health.

4.2 Participants

The total sample (N=191) consisted of adults with spinal cord injury (SCI group) and amputations (control group).

4.2.1 SCI Group

The SCI group comprised 112 adults of which 72 (64.3%) were males and 40 (35.7%) were females with a mean age of 29.54 years. This group was made up of predominantly isiZulu-speaking Black participants from urban/semi-urban areas, mainly with paraplegia. There were more individuals with a tertiary education in this group than in the controls, indicating higher levels of education.

4.2.2 Control Group

The control group consisted of 79 adults with surgical or traumatic amputations, of which 47(59.5%) were males and 32(40.5%) were females. The mean age was 42.46 years. The majority of participants in this group were Blacks from urban/semi-urban areas with mainly a secondary education.

People who had amputations were selected into the control group because the loss of a limb to amputation was considered similar to loss of function of a limb in SCI. This group rather than a 'normal' sample, was considered because those who had amputations were expected to react to their trauma similarly or worse than individuals with SCI. Individuals who had amputations were expected to have their own psychological issues hence a comparison with the SCI group, i.e. on how these two 'medically-affected' groups differ, rather than how the SCI group is different from the general population. The control group was not matched on all demographics as it was based on available admissions.

4.2.3 Inclusion & Exclusion Criteria

Inclusion criteria for the study were adults with a traumatic SCI or an amputation, with at least seven years of formal schooling. Patients with a concomitant head injury or with a history of head injury and/or psychiatric disorders as well as alcohol and drug abuse were excluded from the study. This was established by examining medical records and by obtaining collateral information from significant family and friends. All patients who were not able to give informed consent were also excluded from the study.

4.2.4 Sampling

A nonprobability, purposive sampling method based on the number of willing, eligible and available participants was used. All study sites were physically checked on a regular basis for the admission of traumatic SCI patients and patients with amputations. Nurses and doctors in the wards provided information on the patient and medical records were examined. Patients who were eligible to participate in the study were then informed of the study and asked to participate. Those who consented to participate in the research were then closely tracked by regularly telephoning the nurses in the wards or the patients directly. This was necessary as patients were often sent to other hospitals for medical procedures, sent home for pass-outs or sometimes discharged. Patients who were discharged were followed up when they visited the outpatient clinics of the hospital or rehabilitation centres.

4.3 Materials

The instruments used in data collection are listed and discussed below.

A biographical questionnaire (see Appendix 1), designed by the author, was used to obtain background and demographical information. The development of the biographical questionnaire was guided mainly by the background information questionnaire proposed by Colley (1997). Based on the information obtained from the biographical questionnaire and the semi-structured interview, participants were either included or excluded from the study.

A psychological test battery comprising the General Health Questionnaire-28 (GHQ-28), the Social Support Questionnaire (SSQ), Beck's Depression Inventory 11 (BDI-11), the Hospital Anxiety and Depression Scale (HADS), the Impact of Events

Scale-Revised (IES-R) and the Posttraumatic Diagnostic Scale (PDS), was used to assess psychological functioning and adjustment in the participants.

A neuropsychological tests battery comprising the Rey Taylor Complex Figure Test (RTCFT), the Narrative Prose Memory Test (NPMT), the Trail Making Test (TMT), the Finger Tapping Test (FTT), the Controlled Oral Word Association Test (COWA), the Symbol Digit Modalities Test (SDMT), the Seashore Rhythm Test (SRT), the Stroop Colour and Word Test (Stroop), the Rey Auditory Verbal Learning Test (RAVLT) and the Grooved Pegboard (GP), was used to assess neuropsychological functioning.

The Wechsler Adult Intelligence Scale 111 (WAIS III) and Standard Progressive Matrices (SPM) were used to assess intellectual and cognitive functioning of the participants. The SPM, which requires the examinee to provide verbal responses, was administered to those participants who were unable to complete the WAIS III due to poor upper limb functioning: e.g. severe quadriplegia and upper limb amputations.

Individuals with SCI, more specifically quadriplegia, pose a significant challenge in completing psychological tests that require full use of hands. This is a similar challenge for individuals with upper limb amputations. Hence, individuals who had complete upper-limb paralysis or amputations were excluded from tests that required full use of hands, such as the Grooved Pegboard, Finger Tapper Test, Trail Making Tests, etc. Where possible, tests were substituted that measured similar constructs but were administered differently, as mentioned above with the WAIS III and SPM. In addition, with the psychological test battery, which included mainly self-report questionnaires, individuals with poor upper-limb functioning were asked to provide verbal instead of written responses. In such cases, the responses of the participant were recorded verbatim.

4.4 Translation of Instruments

Some of the questionnaires and assessments that were not available in isiZulu, such as GHQ-28, BDI II, IES-R and RAVLT, were translated from English into isiZulu for use with isiZulu-speaking participants, who were the majority in this study. The translation was done in 2005 by two independent isiZulu-speaking psychologists from the Department of Behavioural Medicine, University of KwaZulu-Natal. One of the psychologists did the initial translation into isiZulu which was then back-translated by the other psychologist. According to Brislin (1980) this method of back-translation produces translations of good quality. Discrepancies found were corrected to produce the final translated instruments in isiZulu. The psychologists involved in the translation were experienced health workers who were fluent in both languages.

4.5 Psychological Test Battery

4.5.1 General Health Questionnaire-28

The General Health Questionnaire-28 (GHQ-28), developed by Goldberg and Hillier (1979), is a self-administered screening questionnaire (Turner & Lee, 1998). This questionnaire is a popular measure in trauma research and can be applied in cross-cultural settings as it is available, in validated forms, in many languages (Turner & Lee, 1998, p. 14). In this study the 28-item version in English and isiZulu was used. The two other, less popular versions of the GHQ are the 12-item version and the 60-item version. The GHQ-28, which provides a useful measure of general psychological difficulty, is good at recognizing those in most need of psychological intervention from within a mixed population and is also a useful measure of change (Turner & Lee, 1998). An important reason for selecting this questionnaire for use in this study was its ability to measure change. The GHQ-28 was a valuable tool in the longitudinal design of this study, which measured changes in emotional functioning over time.

The GHQ-28 consists of four subscales: somatic symptoms, anxiety and insomnia, social dysfunction, and severe depression. Respondents are asked to rate their feelings on a four-point Likert scale for every question in each subscale. According to Turner & Lee (1998) the depression scale is useful in identifying suicidal risk. This is a valuable aspect in this study as the severe depression subscale can provide information on suicidal ideation or risk in the adjustment to SCI.

4.5.2 Hospital Anxiety and Depression Scale

The Hospital Anxiety and Depression Scale (HADS), which was developed by Snaith and Zigmond (1994), is a self-report questionnaire designed to detect anxiety and depressive states (Turner & Lee, 1998, p. 17). The HADS is made up of two subscales, one measuring anxiety (A scale) and the other measuring depression (D scale).

The HADS has been subjected to a factor analytic study in 568 cancer patients (Moorey, et al., 1991 cited in Turner & Lee, 1998). Fifty-three percent of the variance was explained by two independent factors. Studies by Snaith and Zigmond (1994) have shown good validity.

According to Turner & Lee (1998) the HADS avoids some of the physiological items which may be confounded by injury or illness; hence, weight loss and pain are excluded from the HADS (p. 17). The use of the HADS with individuals with physical impairments such as SCI and amputations is especially advantageous as it does not include physiological symptoms. Thus the HADS can be regarded as a strong indicator of anxiety and depression in individuals with SCI as it does not focus on symptoms such as weight loss, which could also arise due to the medical condition of the individual.

4.5.3 Beck's Depression Inventory II

Beck's Depression Inventory II (BDI II) has been widely used to assess depression in both psychiatric patients and the normal population (Groth-Marnat, 2003). Its predecessor, the BDI, was initially introduced in 1961 by A.T. Beck, Ward, Mendolson, Mock and Erbaugh (Beck, Rush, Shaw & Emery, 1979 cited in Groth-Marnat, 2003, p. 587). The later version, BDI-IA, was found to be highly correlated to the BDI, and hence it underwent major revision in 1996 (BDI II) which increased its congruency with the DSM IV criteria for depressive disorders (Groth-Marnat, 2003).

The BDI II consists of 21 groups of statements related to various symptoms of depression. Respondents are requested to rate the intensity of these symptoms on a scale from 0 to 3. The questions relate to areas such as sense of failure, guilt feelings, irritability, sleep disturbance and loss of appetite (Groth-Marnat, 2003).

The BDI II has high internal consistency ranging from .89 to .94, high test-retest reliability (.93) over a one-week interval, and favourable content, concurrent, and discrimination validity (Groth-Marnat, 2003). According to Kennedy and Rogers (2000), the BDI has been successfully used to assess adjustment to injury and trauma, such as SCI. These authors further state that although there is some indication that the

BDI may inflate estimates because of the somatic bases items, it has been shown to be reliable.

4.5.4 Social Support Questionnaire

The Social Support Questionnaire (SSQ) is a 15-item questionnaire designed for use among Black isiZulu-speaking South Africans to measure the qualitative and quantitative aspects of a person's network of relationships that assists him or her during adversity (Pillay, 1993). According to Pillay (1993, 1996), a social support measure is important since social support acts as a buffer against disease and is therefore important in coping with life changes and adverse events. A Cronbach's coefficient alpha of 0.91 was obtained by Pillay (1993), indicating that the SSQ is a highly reliable questionnaire.

The SSQ is a bilingual instrument with all 15 items in both English and isiZulu. The language aspect is important to this study as the majority of participants in both the SCI group and controls indicated that their first language was either isiZulu or English.

There is a two-part response to each question in the SSQ. In the first part, participants are asked to list the people (initials and their relationship to them) who provide support for each of the questions listed. In the second part they are asked to rate their level of satisfaction with the support on a four-point Likert scale ranging from very satisfied to very dissatisfied. The questionnaire also allows for the accessibility, proximity and mode of support to be rated (Pillay, 1993).

4.5.5 The Impact of Event Scale – Revised

The Impact of Event Scale – Revised (IES-R) is a self-report scale used to assess current subjective distress for any specific life event. It was developed by Daniel S Weiss and Charles R Marmar in 1997 to parallel the DSM IV criteria for PTSD (Weiss & Marmar, 1997). The original IES, developed by Horowitz, Wilner, and Alvarez in 1979 (Briere, 1997) only taps taps two of the four criteria set out for PTSD in the DSM IV, which is intrusion and avoidance (Weiss & Marmar, 1997).

The total scale was found to have high split-half reliability (r = 0.86) and the subscales had high internal consistencies (Cronbach's alpha for intrusion = 0.78, for avoidance = 0.82). The subscales were found to be sensitive in that they discriminate between different populations of person and also detect change over time (Zilberg et al., 1982, p. 413). A correlation of 0.42 (p>0.0002) between the subscale scores indicates that they are associated but do not measure identical dimensions (p. 213). In a cross-validation study of the IES, Zilberg et al. (1982) further reiterate that the IES is a psychometrically-sound instrument that assesses the essential characteristics associated with stress disorders. These authors advocate the use of separate subscale scores, as more valuable information is obtained by keeping the scales separate. Furthermore, they discourage the use of a single total subjective stress score from adding the subscales. According to Horowitz et al. (1979), the IES can be used successfully with persons of various educational, economic and cultural backgrounds. These aspects are important in this study, hence the selection of this scale. The IES taps dimensions that parallel the DSM's diagnostic criteria for PTSD (Zilberg et al., 1982). This scale was therefore important to this study as the diagnosis of PTSD was based on the DSM IV- TR criteria. The revised version of the IES (i.e., IES-R), was used in this study. IES-R is a 22-item scale and it includes a third subscale of hyperarousal which includes symptoms such as anger and irritability, heightened startle response, difficulty concentrating, hypervigilance and one new intrusion item that taps the dissociative-like re-experiencing when experiencing a true flashback (Weiss & Marmar, 1997). The IES-R was found to have good reliability. In their study of four different population samples, Weiss and Marmar (1997) reported that the internal consistency of the three subscales was found to be very high, with intrusion alphas ranging from .87 to .92, avoidance alphas ranging from .84 to .86, and hyperarousal alphas ranging from .79 to .90 (Briere, 1997)

4.5.6 The Posttraumatic Diagnostic Scale

The Posttraumatic Diagnostic Scale (PDS) (Foa, 1995) is a self-report measure that assesses posttraumatic stress responses in adults (Briere, 1997). The 17 items of the PDS correspond with the symptoms outlined in the DSM IV TR criteria for PTSD (Boyer et al., 2003). This test yields a potential diagnosis of PTSD, as well as symptom severity rating and an estimate of level of impairment in functioning (Briere, 1997, p. 137). The PDS has a high internal consistency and test-retest reliability, high diagnostic agreement with the Structured Clinical Interview (SCID), and good sensitivity and specificity (Foa et al., 1997). The psychometric properties of the PDS indicate that it is a valid and reliable instrument for screening and assessing both PTSD diagnoses and symptom severity in clinical and research settings (Boyer et al., 2003; Foa et al., 1997).

4.6 Neuropsychological Test Battery

4.6.1 Rey-Taylor Complex Figure Test (RTCFT)

The Rey-Taylor Complex Figure Test (RTCFT), a memory test of visual reproduction, was developed by Rey Taylor (Lezak et al., 2004). This test is used to assess visual-spatial construction ability and visual memory. Strauss, Sherman and Spreen (2006) state that the Complex Figure Test produces a copy score (which reflects the accuracy of the original copy and is a measure of visual-constructional ability), the time required to complete the figure, and immediate or 3-minute and 30-minute delayed-recall scores (which assesses the amount of information retained over time). According to Lezak et al. (2004), memory tests that require reproduction of a design have been used to assess right-hemisphere damage (p. 454). Visual reproduction performance has, more recently, been associated with extra hippocampal volumes in the right medial temporal lobe, but not the hippocampus (Kohler et al., 1998 and Martin et al., 1999 cited in Lezak et al., 2004, p. 455).

This test is popular in the field of neuropsychology as it allows assessment of a variety of cognitive processes, such as planning, organizational skills, and problem solving strategies, as well as perceptual, motor and episodic memory functions (Meyers & Meyers, 1995; Waber and Holmes, 1986, cited in Strauss et al., 2006, p. 811).

There are other versions and alternate figures to the Complex Figure Test, one such being the Rey-Osterrieth Complex Figure test (ROCFT), the original version of which was developed by Rey (1941) and elaborated by Osterrieth (1944) (Strauss et al., 2006, p. 811). The Taylor Figure (Taylor, L.B, 1969) was used in this research, with measures including copy, immediate recall, and 30-minute delayed recall.

4.6.2 Narrative Prose Memory Test

According to Lezak et al. (2004), story recall tests, or narrative prose memory tests (NPMTs), represent everyday memory demands for the meaningful discourse found in conversation, radio and television, and written material (p. 444). These tests are used to obtain a measure of the amount of information that is retained when the material exceeds immediate memory span, and also the contribution of meaning to retention and recall.

The story for the NPMT that was used in this study was the "Farmer from Transkei". This story is an adaptation by Frank B Wood and Basil J Pillay in 1997, of the Cowboy Story, first used by medical practitioners in 1919 (Lezak et al., 2004) for the South African context. A Zulu version was used with Zulu-speaking participants.

4.6.3 Trail Making Test

The Trail Making Test (TMT) was originally constructed in 1938 as "Partington's Pathways" or the "Divided Attention Test" (Partington & Leither, 1949), and was part of the Army Individual Test Battery (1944). It was adapted by Reitan (1985) and added to the Halstead Reitan Battery (Strauss et al., 2006).

The TMT is made up of part A and part B. In part A, the subject is asked to connect, using pencil lines, 25 encircled numbers arranged on a page in numerical order. In part B, the subject is asked to encircle 25 numbers and letters in alternating order. The TMT is used to assess scanning and visuo-motor tracking, divided attention, and cognitive flexibility (Lezak et al., 2004).

The TMT has a motor component, so motor strength and agility contributes to success (Schear and Sato, 1989, Shum et al., 1990 cited in Lezak et al., 2004). This test, like others that involve motor speed and attention, is highly sensitive to the effects of brain injury (Armitage, 1946; Spreen & Benton, 1965 cited in Lezak et al., 2004). According to Lezak et al. (2004), when the time taken to complete part A is much less than the time taken to complete part B, it is indicative of difficulties in complex, double or multiple, conceptual tracking. In a study by Korrte, Horner & Windham (2002) it was found that performance on part B is sensitive to cognitive inflexibility.

4.6.4 Finger Tapping Test (FTT)

The Finger Tapping Test (FTT) (Reitan, 1985) was part of Halstead's (1947) test battery (Strauss et al., 2006). This test, also called the Finger Oscillation Test, is used to measure self-directed manual motor speed, and also to assess subtle motor and other cognitive impairment (Strauss et al., 2006). It has been ranked sixth in terms of use with regard to predicting an individual's ability to return to work (Rabin, Barr, & Burton, 2005). There are variants of the test and its related procedures; the procedure used in this study (following Reitan and Wolfson, 1985) is a commonly used method.

4.6.5 Controlled Oral Word Association Test

In the Controlled Oral Word Association Test (COWA) (Benton & Hamsher, 1989) the subject is asked to say as many words as possible beginning with a certain letter and within a certain time limit (Groth-Marnat, 2003). Other common names for this test are: FAS test (the letters *F, A*, and *S* are frequently used), Verbal Fluency Test; Letter Fluency Test, and Word Fluency Test.

The purpose of the COWA is to evaluate the spontaneous production of words under restricted search conditions (Strauss et al., 2006, p. 499). Word fluency difficulties have been found in patients who have lesions to the frontal (especially left) lobes which are evident in lower COWA performance (Miceli et al., 1981; Perret, 1974 cited in Groth-Marnat, 2003). Patients with bilateral frontal lesions have produced the lowest overall word fluency scores (Benton, 1968 cited in Groth-Marnat, 2003). In this study, participants were given the letters, *F*, *A* and *S* and were asked to say as many words as they could beginning with these letters with a time limit of 60 seconds each.

4.6.6 Symbol Digit Modalities Test

The Symbol Digit Modalities Test (SDMT) (Smith, 1982) was originally developed by Aaron Smith as a screening measure for cerebral dysfunction in children and adults (Strauss et al., 2006).

The SDMT assesses complex scanning and visual tracking (Shum, McFarland, and Bain, 1990) with an advantage of providing a comparison between visuomotor and oral responses (Lezak et al., 2004, p. 370). It also has been used to assess divided attention, memory, perceptual speed and motor speed (Strauss et al., 2006). Like the TMT, manual speed and agility significantly contributes to test performance of the SDMT (Schear and Sato, 1989, cited in Lezak et al., 2004). In this test, the participant was given a sheet that has a coding key consisting of nine abstract symbols each of which is paired with a number. The participant was then asked to look at the key and then write down, as quickly as possible, the number corresponding to each symbol. The oral response option is valuable for use with individuals who cannot use their hands to write due to motor disabilities involving the upper limb, such as quadriplegia.

4.6.7 Seashore Rhythm Test

The Seashore Rhythm Test (SRT) (Reitan & Wolfson, 1985; Seashore et al., 1960), a part of the Halstead Reitan Battery, is widely used for the assessment of non-verbal auditory perception (Lezak et al., 2004). It is a subtest of Seashore's Test of Musical Talent, where the subject is asked to discriminate between like and unlike pairs of musical beats (Lezak, et al., 2004). Non-verbal auditory perception defects have been associated with aphasia and bilateral temporal lobe lesions and less often with right-hemisphere damage alone (Bachman & Albert, 1988; Hecan & Albert, 1978 cited in Lezak et al., 2004, p. 408). In addition, the SRT has been shown to be most sensitive to attention and concentration deficits (Hom and Reitan, 1990; Lezak et al., 2004). In this study, participants who were unable to write due to their physical disability, such as individuals with quadriplegia or upper limb amputations, were asked to provide verbal answers which were then written down by the examiner.

4.6.8 Stroop Colour and Word Test

The Stroop Colour and Word Test (Stroop) was originally developed by Stroop (1935) and later adapted into other versions such as the Comalli version and the Victoria Stroop Test (Mitrushina et al., 2005, Strauss et al., 2006). The Stroop is a measure of cognitive control, selective attention, and cognitive flexibility (Mitrushina et al., 2005; Strauss et al., 2006). It assesses the ease with which a person can maintain a goal in mind and suppress a habitual response in favour of a less familiar one (Mitrushina et al., 2005). The Golden version (Golden, 2002) was used in this study. The Stroop is a valuable tool for use with individuals with physical disability such as quadriplegia, as the task involves only reading. There is no motor component involving use of hands, such as writing.

4.6.9 Rey Auditory Verbal Learning Test

The original version of the Rey Auditory Verbal Learning Test (RAVLT), a one-trial word list memory test, was developed by Swiss psychologist Édouard Claparède in 1919, making it one of the oldest mental tests (Boake, 2000). The test was initially modified by Andre Rey (1958) who added five recall trials and a story-recognition trial, and later further altered by Taylor (1959) and Lezak (1995) who adapted it for use in English (Boake, 2000).

The RAVLT assesses verbal learning and memory, including immediate memory span, new learning, susceptibility to interference, and recognition memory (Strauss et al., 2006).

According to Strauss et al. (2006), the analysis of task performance produces valuable information such as acquisition, learning rate, susceptibility to retroactive and proactive interference, and retention/forgetting. Learning is evaluated by changes in the number of words recalled across the five trials (Woodard et al., 1999, cited in Strauss et al., 2006). Acquisition is evaluated by adding the total number of words recalled across the first five recall trials, and learning rate is obtained by comparing the number of words recalled on the first trial with the number of words recalled on the fifth recall trial. The recognition trial allows for the identification of individuals with suspected retrieval problems, who may perform better on this trial than on free recall (Strauss et al., 2006, p. 778). The translated isiZulu version was used in this study with isiZulu-speaking participants.

4.6.10 Grooved Pegboard

The Grooved Pegboard (GP) (Mathews and Klove, 1964) measures eye-hand co-ordination and motor speed and is used in a neuropsychological examination to assess motor impairment (Strauss et al., 2006, p. 1061). According to Lezak et al. (2004), the GP is part of the Repeatable Cognitive-Perceptual-Motor Battery (Lewis and Kupke, 1992) and the Wisconsin Neuropsychological Test Battery (Harley et al., 1980).

The GP is a more cognitively demanding task than tasks of other motor tests such as grip strength and finger tapping (Haaland & Delaney, 1981). Strauss et al. (2006) state that in this test vision, speed, attention, and continuous monitoring of accuracy are important components of task performance, in addition to motor dexterity.

4.7 Intellectual Assessments

4.7.1 Wechsler Adult Intelligence Scale 111

The Wechsler Adult Intelligence Scale 111 (WAIS 111) (The Psychological Corporation, 1997) which is a revised version of the WAIS-R (Wechsler, 1981) provides a measure of general intellectual function in older adolescents and adults (Strauss et al., 2006). According to Lezak et al. (2004), the WAIS III is a core instrument that provides information about the overall level of intellectual functioning and the presence or absence of a significant intellectual disability, as well as clues to altered functions.

South African norms and scaled scores provided by Claassen, Krynauw, Paterson, and Mathe (2001) in the standardization of the WAIS III for English-speaking South Africans were used in this study.

4.7.2 Standard Progressive Matrices

The Standard Progressive Matrices (SPM), which is one of the three forms of the Raven's Progressive Matrices (RPM), was published originally in 1938 (Raven, 1938). The RPM was used to assess reasoning in the visual modality (Strauss et al., 2006).

According to Strauss et al., (2006), the RPM is advantageous to patients from diverse ethnic and racial groups due to its simplicity, the nonverbal nature of the test, and the culture fairness of the task. The RPM is therefore valuable in the evaluation of people whose test performance may be confounded by language, hearing or motor impairments or who lack proficiency with English. The RPM was especially valuable in this study with participants who were unable to perform tasks using their hands, such as individuals with quadriplegia.

4.8 Procedure

A quantitative study design was employed. The psychological battery was administered at two different time points. The initial assessment (time point 1) was conducted immediately after the traumatic incident, when the patient was medically stable, and then repeated after a month (time point 2). A neuropsychological test battery was conducted when the patients were stable.

The total time taken to administer the tests on each participant was approximately 41/2 hours, split into four sessions, each session an hour or an hour-and a half in duration, and each session on a separate day. In the first session (one hour), the psychological questionnaires were administered. The second session (hour and a half) was allocated to the neuropsychological tests, the majority of the tests ranges from 5–10 minutes. In the third session (one hour), the intellectual assessments (WAIS III or SPM) were administered. The fourth session (one hour) was scheduled approximately a month later, when the initial psychological test battery was repeated.

Only those who were fluent in English and who had the appropriate education level completed the WAIS III. Participants who completed the WAIS III and other non-self-report instruments were generally bilingual in English and Zulu. However, with tests such as the RAVLT and the Narrative Prose Memory, the translated Zulu versions were used with isiZulu speaking participants.

4.8.1 Method

A biographical questionnaire was administered to obtain relevant background information and to determine the subject's suitability to participate in the study. Patients' psychological and neuropsychological functioning was established by using the appropriate tools. Psychological functioning was initially assessed once the patients were medically stable following the trauma (T_1). This was done to establish a baseline level of psychological functioning. Psychological functioning was reassessed after approximately a month (T_2). Neuropsychological evaluation commenced only when patients were well-settled medically and there was no evidence of a progressive disease.

4.9 Ethics

The ethical principles applicable to research (viz., autonomy and respect for persons, nonmaleficence, beneficience and justice) were strictly adhered to in this study. An application for ethical approval of the study was made to the Biomedical Research

Ethics Committee (BREC), University of KwaZulu-Natal. The study commenced only when full ethical approval was obtained. Thereafter, an application for recertification of ethics approval was made annually to the BREC. A letter requesting permission to conduct research at the MGMHC, KGH and CH, and the necessary ethics application was sent to the hospital managers, Head of Department at KwaZulu-Natal Department of Health, and ethics committees. Once permission was granted, patients were informed of the study and were asked to sign the informed consent form. For those who were unable to sign due to physical limitations, a thumbprint was obtained or a witness, usually a nurse in the ward, was asked to verify informed consent with the participant and sign as a witness. In this way, voluntary informed consent was obtained from all research participants and they were assured of strict confidentiality. The risks and benefits of participating in the study were fully explained. All participants were treated with fairness and equity.

During the sessions participants were given sufficient breaks between tests to rest, relieve pressure of their bodies if they were sitting on wheelchairs, empty their catheters, etc. Most participants were keen to perform the tests as these tasks were perceived as a stimulating activity during their long stay in hospital.

In keeping with the ethics committee's recommendations, data will be kept anonymous and an electronic form as well as a hard copy was safely stored. The data will be stored for a period of at least five years before being discarded. According to the American Psychological Association (APA) ethical guidelines, raw data are expected to be retained for a minimum of five years after publication of the research (APA, 2010).

4.10 Pilot Study

A pilot study was conducted to determine appropriateness of the biographical questionnaire and suitability of other instruments. The pilot study provided significant information that determined the sequence of administration of the instruments and the need for sufficient intervals between the neuropsychological testing. This was found to be a crucial element when administering psychological and especially neuropsychological batteries to patients with physical disabilities, as they had specific needs such as time-specific catheterization, relieving pressure of their bodies whilst sitting, and managing spasms. In addition, it was found that an adjustable table or a higher desk had to be used in order for participants in wheelchairs to sit comfortably at a work surface.

4.11 Data Analysis

The raw data was prepared by coding using numerical codes, entering, and cleaning. According to Tredoux & Smith (2006), coding is the application of a set of rules to the data to transform information from one form to another. The data was then captured on an MS Excel spreadsheet by an assistant. Thereafter it was cleaned to eliminate errors and outliers were excluded. Statistical analysis was done using the statistical package SPSS (for Windows). A biostatistician was consulted to guide and do analysis. Descriptive and inferential data analysis was performed. Comparisons were made for the SCI group and the control group for each of the outcomes tested.

Adjustment for the effects of demographic variables (i.e., age, education and income level, which varied significantly between the SCI group and control group and which could have qualified as confounding variables) was done using multiple linear regression. Case/control status as well as age, education and income were entered into the model as independent variables for each quantitative outcome variable and a model was constructed using the enter method. The adjusted differences are reported in Tables 4, 5 & 12.

4.12 Conclusion

"Tools are available to make it possible for us to assess (measure) human behaviour" Foxcroft & Root (2009, p. 4). However, these tools must be used appropriately and understood in relation to the context within which they are employed. Language and culture were fundamental aspects that were taken into consideration in this study to provide a meaningful description and understanding of participants drawn from multicultural and multi-lingual societies. The methodology of the study provided the framework to facilitate this process.

Chapter 5
Results

This chapter presents the results of the various measures administered. The demographics of the participants are presented first, followed by the psychological functioning and adjustment results. An analysis of the neuropsychological functioning data is then reported and other significant correlations found in the study are highlighted. Finally, the testing of the hypotheses stated in Chapter 1 is presented.

5.1 Descriptive Data

The total participants in this study (N=191) was made up of a spinal cord injury (SCI) group and a group who had surgical or traumatic amputations. There were approximately 30 individuals from both groups who had agreed to participate but were excluded from the study for reasons such as been transferred to another hospital or having been discharged and subsequently unreachable. In addition, some individuals were exempt from certain tests due to physical limitations. The exact number of individuals who completed each test is indicated in the footnotes of Tables 4, 5 & 12. As mentioned in the previous chapter, the group with amputations was the control group. The SCI group, n=112 (59%), consisted of 40 (35.7%) female and 72 (64.3%) male participants. The total number of participants in the control group was 79 (41%) of whom 32 (40.5%) were female and 47 (59.5%) male. The demographics for all participants are listed in Table 1 and Table 2.

Table 1: *Descriptive data 1 for the SCI group & control group*

	SCI Group (n=112	Control Group (n=79)	Differences *(p)*
Age	Mean (SD)	Mean (SD)	t
	29.54 (9.650)	42.46 (13.503)	-7.714 (0.000) ***
	n (%)	n (%)	χ^2
Gender			
Male	72 (64.3)	47 (59.5)	
Female	40 (35.7)	32 (40.5)	
df = 1			0.453 (0.501)
Ethnicity			
Black	87 (77.7)	57 (73.1)	
Indian	15 (13.4)	14 (17.9)	
White	8 (7.1)	2 (2.6)	
Coloured	2 (1.8)	5 (6.4)	
df = 3			5.254 [a] (0.154)
Marital Status			
Married	22 (19.6)	25 (31.6)	
Single	75 (67.0)	36 (45.6)	
Divorced/Separated	5 (4.5)	10(12.7)	
Living together	9 (8.0)	4 (5.1)	
Widowed	1 (0.9)	4 (5.1)	
df = 6			.009 [a,b] (0.009)**
Area			
Urban/semi-urban	72 (64.3)	48 (63.2)	
Rural/semi-rural	40 (35.7)	28 (36.8)	
df = 1			0.025 (0.875)
Education			
Primary	10 (8.9)	6 (7.8)	
Secondary	73 (65.2)	65 (84.4)	
Tertiary	29 (25.9)	5 (6.5)	
df = 3			13.382 [a,b] 0.004**

[a] More than 20% of cells in this sub table have expected cell counts less than 5.
[b] The minimum expected cell count in this sub table is less than one.
* $p < 0.05$. ** $p < 0.01$. *** $P < 0.001$.

The mean age of the SCI group was 29.54 years and the mean age of the control group was 42.46 years. A t-test revealed a significant age difference between the SCI group and the control group (t =-7.714, p=0.000). The SCI group was a much younger group when compared to the control group.

The majority of participants in the SCI group (n=87, 77.7%) were Black. The control group also had a majority (n=57, 73.1%) participants who were Black. Indians were the second largest race group for both the SCI group (n=15, 13.4%) and the control group (n=14, 17.9%). The other race groups were Whites and Coloureds.

The Pearson chi-square test indicated a significant difference in marital status between the SCI group and the control group (χ^2 =16.955, p=0.009). Seventy-five (67.0%) of participants in the SCI group were single. In the SCI group, those that were married or living together had spent a mean of 10 years with their partners; the corresponding mean for those in the control group was 15 years with their partners. The mean number of children for those in the SCI group who were parents was one; for those in the control group the mean was three children. The SCI group having fewer children than the control group may be attributable to the fact that they were a younger group who were predominantly single.

In Table 1 the distribution of urban/semi-urban and rural/semi-rural living for the SCI group and the control group is shown. The majority of participants in the SCI group (n=72, 64.3%) came from urban/semi-urban areas, as did a similar majority (n=48, 63.2%) in the control group.

The educational levels of the groups are outlined in Table 1. A chi-square analysis revealed a significant difference in the level of education between the SCI group and the control group (χ^2 =13.382, p=0.004). Although the majority of participants in both the groups have a secondary education, there were more individuals in the SCI group (n=29, 25.9%) with a tertiary education than in the control group (n=5, 6.5%).

Table 2: *Descriptive data 2 of the SCI group & control group*

	SCI Group (n=112) n (%)	Control Group (n=79) n (%)	Differences χ^2 *(p)*
Occupation			
Skilled labourer	24 (21.4)	2 (2.6)	
Student	19 (17.0)	1 (1.3)	
Unemployed	15 (13.4)	32 (41.0)	
Other	14 (12.5)	14 (17.9)	
Driver	11 (9.8)	7 (9.0)	
Self Employed	8 (7.1)	1 (1.3)	
Unskilled labourer	6 (5.4)	3 (3.8)	
Engineer/Technician	6 (5.4)	2 (2.6)	
Teacher	4 (3.6)	0 (0.0)	
Police/ security	4 (3.6)	13 (16.7)	
Domestic Worker	1 (0.9)	3 (3.8)	
df = 10			55.764 [a](0.000) ***
Income			
0-R500	4 (3.6)	8 (10.5)	
R500-R1000	18 (16.4)	26 (34.2)	
R1000-R1500	13 (11.8)	13 (17.1)	
R1500-R2000	11 (10.0)	13 (17.1)	
R2000-R3000	28 (25.5)	6 (7.9)	
R3000-R6000	16 (14.5)	9 (11.8)	
>R6000	20 (1 8.2)	1 (1.3)	
df = 6			31.167 (0.000) ***
Religion			
Christian	97 (88.2)	65 (83.3)	
Shembe	6 (5.5)	2 (2.6)	
Hindu	5 (4.5)	8 (10.3)	
Other	2 (1.8)	1(1.3)	
Muslim	0 (0.0)	2 (2.6)	
df = 4			6.076 (0.194) [a,b]
Home Language			
Zulu	81 (73.0)	49 (62.0)	
English	17 (15.3)	22 (27.8)	
Afrikaans	6 (5.4)	4 (5.1)	
Xhosa	4 (3.6)	3 (3.8)	
Other	2 (1.8)	1 (1.3)	
Eng/Afrikaans	1 (0.9)	0 (0.0)	
df = 4			5.151 (0.398) [a,b]

[a] More than 20% of cells in this sub table have expected cell counts less than 5.
[b] The minimum expected cell count in this sub table is less than one.
CI (.95) * $p < 0.05$. *** $p < 0.001$.

The employment status of the participants is presented in Table 2. Chi-square analysis indicated a highly significant difference in the employment status between the SCI group and the control group (χ^2 =55.764, p=0.000). A high percentage (n=32, 41%) of participants in the control group was unemployed when compared to the SCI group (n=15, 13.4%). In addition, a greater number of individuals in the SCI group than in the control group performed skilled or professional work.

A chi-square analysis revealed a highly significant difference in the income levels between the SCI group and control group (χ^2 =31.167, p=0.000). More than half of the SCI group (n=64, 58.2%) had a household income of R2000 and more per month, in comparison with just 16 participants (21%) in the control group. Most of the participants in the control group (n=26, 34.2%) had a household income between R500 to R1000. There were more individuals in the control group who relied on the government's disability grants than in the SCI group. In the SCI group, 8 (7.2%) were in receipt of a disability grant whilst 103 (92.8%) were not. With the control group, 24 (30.8%) were receiving disability grants and 54 (69.2%) were not. Education, employment, income and disability grants are interrelated factors. Hence, this study found that the SCI group were more highly educated, had more individuals that were employed, were higher income earners and had fewer individuals receiving government disability grants.

The majority religious affiliation for both groups was the Christian religion (SCI group: n=97, 88.2%; control group: n=65, 83.3%). The Shembe religion ranked second in the SCI group (n=6, 5.5%), and shared third-ranking position with the Muslim religion in the control group (Shembe: n=2, 2.6%; Muslim: n=2, 2.6%). Hinduism ranked second in the control group (n=8, 10.3%) and third in the SCI Group (n=5, 4.5%).

IsiZulu was the predominant home language for both the SCI group (n=81, 73.0%) and the control group (n=49, 62.0%). The second-ranked home language in both groups was English (SCI group: n=17, 15.3%; control group: n=22, 27.8%). Other home languages recorded included Afrikaans and Xhosa.

Table 3: *Description of the aetiology and level of SCI*

	SCI Group (n=112)	
	n	(%)
Medical Diagnosis		
Paraplegia	68	(60.7)
Paraparesis	18	(16.1)
Quadriplegia	13	(11.6)
Quadriparesis	12	(10.7)
Aetiology of SCI		
Road Traffic Accidents (RTA)	63	(56.5)
Gunshot Wounds	18	(16.1)
Fall	12	(10.7)
Recreation / Sport	5	(4.5)
Assault	3	(2.7)
Stab	3	(2.7)
Construction	3	(2.7)
Other	3	(2.7)
Level of Injury		
Thoracic (1-12)	52	(46.4)
Cervical (1-7)	29	(25.9)
Lumbar (1-5)	18	(16.1)
Thoracic and Lumbar	7	(6.3)
Cervical and Thoracic	5	(4.5)
Cervical and Lumbar	1	(0.9)
Neurology (Frankel Grade)		
Grade A	12	(42.9)
Grade B	5	(17.9)
Grade E	5	(17.9)
Grade C	2	(7.1)
Grade D	2	(7.1)
Grade B to C	1	(3.6)
Grade C to D	1	(3.6)

A description of the aetiology and severity of the SCI is presented in Table 3. Participants with paraplegia formed the majority of the SCI group (n=68, 60.7%).This was followed by individuals with an incomplete lower-limb SCI referred to as paraparesis (n=18, 16.1%). A total of 13 (11.6%) participants presented with quadriplegia and 12(10.7%) with quadriparesis. The control group consisted mainly of people with lower limb amputations (n=76, 93.8%). People with bilateral amputations made up 10 (12.3%) of these participants. The balance of the control group consisted of people with toe amputations (n=3, 3.7%), upper limb amputations (n=1, 1.2%) and finger amputations (n=1, 1.2%). The SCI group and control group were similar in terms of their medical conditions as both groups had impairments mainly related to the lower limb. In addition, mobility of both groups was affected following their traumatic incidents.

Road traffic accidents (RTAs) were the most frequent cause of spinal injuries in the SCI group (n=63, 56.5%). Of those who had incurred an RTA, 15 (13.4%) had been passengers in a car, 11 (9.8%) had been drivers of cars, 7 (6.3%) had been pedestrians, and 9 (8.10%) had been in taxi-related accidents. Gunshot wounds (GSWs) were the second most frequent cause of traumatic SCIs (n=18, 16.1%), followed by falls (n=12, 10.7%), and stabs and assaults (n=6, 5.4%). In the control group, 8 (9.8%) of amputations were related to RTAs, 5 (6.2%) to GSWs, 2(2.4%) to stabs and assaults , and 3 (3.7%) to construction accidents. The balance of the amputations were related to medical causes such as gangrene but the amputation in itself was considered as a traumatic event.

The largest category (n=52, 46.4%) in the SCI group presented with an injury at the thoracic vertebra level. This was followed by cervical (n=29, 25.9%) and lumbar (n=18 16.1%) vertebra injuries. Lower numbers of injuries were at multiple vertebrae levels such as thoracic and lumbar (n=7, 6.3%), cervical and thoracic (n=5, 4.5%), and cervical and lumbar (n=1, 0.9%).

The Frankel Grade was available for 28 of the SCI participants. The largest number (n=12, 42.9%) of these participants had a Frankel Grade A which implies that the injury was severe. Next most frequent, at equal levels, were Frankel Grade B (n=5, 17.9%) and Frankel Grade E (n=5, 17.9%), denoting less severe injuries.

The significant differences in demographic features such as age, education and income between the SCI group and the control group and their impact on the results of the study are further discussed in Chapter 6. The variables that were significantly different between the groups, and which could have qualified as confounding variables, were statistically adjusted for using multiple linear regression. The adjusted differences (p values) are reported on Tables 4, 5 and 12.

5.2 Psychological Functioning and Adjustment

Psychological functioning was assessed using the GHQ-28, BDI II, HADS, IES-R and PDS initially following the traumatic incident (T_1), and again after a month (T_2). The results are presented in Tables 4 and 5.

Table 4: *Psychological functioning at time point 1*

	SCI Group (n=112)	**Control Group** (n=79)	**Differences** t *(p)*	**Adjusted Differences** [k] t *(p)*
	Mean (SD) (n=112)	Mean (SD) (n=79)		
GHQ [a, b]				
Somatic symptoms				
Female	7.40 (4.87)	6.06 (5.55)		
Male	5.39 (4.83)	5.36 (4.57)		
Total	6.11 (4.918)	5.51 (4.918)	0.833 (0.406)	
Anxiety and Insomnia				
Female	8.93 (6.23)	7.75 (7.45)		
Male	6.50 (6.06)	6.00 (5.80)		
Total	7.37 (6.202)	6.54 (6.529)	0.890 (0.375)	
Social dysfunction				
Female	10.35 (5.31)	8.22 (5.41)		
Male	9.31 (5.30)	7.49 (4.84)		
Total	9.68 (5.304)	7.65 (5.075)	2.664 (0.008)**	
Severe Depression				
Female	6.83 (5.72)	6.56 (5.41)		
Male	5.46 (5.76)	6.09 (6.28)		
Total	5.95 (5.754)	6.14 (5.905)	-.223 (0.824)	
Total GHQ	**29.10** (18.341)	**25.84** (19.147)	1.196 (0.233)	-1.03 (.304)
Female	33.50 (17.00)	28.59 (20.42)		
Male	26.65 (18.72)	24.94 (18.09)		
BDI II [c, d]				
Female	16.08 (10.77)	18.93 (13.69)		
Male	18.41 (13.62)	14.49 (12.59)		
Total	**17.62** (12.723)	**16.38** (13.131)	0.683 (0.495)	-1.57 (.117)

HADS [e, f]				
Anxiety	**8.27** (4.790)	**7.59** (4.795)	0.936 (0.351)	-.68 (.497)
Female	8.29 (4.60)	8.79 (5.20)		
Male	8.26 (4.92)	6.80 (4.39)		
Depression	6.73 (3.847)	**8.07** (4.260)	-2.196 (.029)*	1.29 (.196)
Female	6.92 (3.85)	8.72 (4.94)		
Male	6.63 (3.87)	7.64 (3.75)		
IES-R [g, h]				
Avoidance	12.59 (8.303)	12.07 (8.828)	0.413 (0.680)	
Female	13.63 (8.35)	13.83 (9.19)		
Male	12.03 (8.29)	11.16 (8.42)		
Intrusion	10.46 (7.506)	10.47 (8.383)	-0.0009 (0.993)	
Female	12.08 (7.12)	12.90 (8.99)		
Male	9.59 (7.52)	9.09 (7.62)		
Hyper-arousal	6.44 (5.897)	8.61 (7.111)	-2.256 (.031)*	
Female	7.26 (5.26)	10.00 (7.69)		
Male	5.99 (6.21)	7.87 (6.61)		
IESR total	29.49 (19.522)	31.56 (22.411)	-.663 (.508)	-4.54 (.584)
Female	32.97 (18.00)	36.73 (24.72)		
Male	27.60 (20.17)	28.75 (20.06)		
PDS [i, j]				
Female	**17.38** (10.761)	**18.67** (15.271)		
Male	**14.27** (12.325)	**13.93** (10.563)		
Total	**15.35** (11.850)	**15.93** (12.881)	-.311 (.756)	-.33 (.742)

Note. [a] SCI Group n=112; [b]Controls n=79; [c] SCI Group n=106; [d]Controls n=72; [e] SCI Group n=108; [f]Controls n=73; [g]SCI Group n=108; [h]Controls n=76; [i] SCI Group n=107; [j]Controls n=71; [k]Adjusted for age, education and income using multiple linear regression.
CI (.95) * $p < 0.05$. ** $p < 0.01$.

Cronbach's alpha was used to determine the reliability of each domain of the GHQ-28: namely, somatic symptoms (α=0.80), anxiety and insomnia (α=0.89), social dysfunction (α=0.84) and severe depression (α=0.86). High reliability was found on all domains. With the GHQ-28, a total score of greater than 13 is clinically significant (Turner & Lee, 1998). Both the SCI group and the control group had high GHQ-28 total scores that were clinically significant at time T_1, indicating that initially following the trauma both groups presented with high levels of psychological difficulty (Table 4). Although the difference between the two groups is not statistically significant, the SCI group presented with a higher score, showing that they were more distressed at T_1 than the control group. At T_2 the control group presented with a higher total GHQ-28 score than the SCI group, showing a trend of poor improvement in psychological distress with time when compared to the SCI group (Figure 13). There is a significant difference (t=2.664, p=0.008) in social dysfunction at T_1 between the groups, with the SCI group being impacted more (Table 4). With time, there was improvement in social dysfunction in the SCI group and almost no improvement in the controls (Figure 12).

Females presented with higher GHQ-28 scores than males, for both the SCI group and the control group across both time points. This could suggest that females may present with higher levels of psychological difficulty than males following an acquired disability.

The statistically-adjusted differences (adjusted p values) for the variables which varied significantly between the SCI group and control group, such as age, education and income, are presented in Table 4 & 5 for the psychological tests at time point 1 and time point 2. There is no change in significance after adjusting for confounders for the GHQ-28 total, BDI II, HADS anxiety, IES-R and PDS (Table 4). Hence it can be concluded that these tests are not influenced by age, education or income. Nor can the differences in performance on these tests be attributed to demographic differences between the groups. However, the HADS depression, at time point 1, was influenced slightly by the demographic differences, as there was a change in significance following adjustment for confounders (Table 4).

Table 5: *Psychological functioning at time point 2*

	SCI Group (n=56)	**Control Group (n=43)**	**Differences t *(p)***	**Adjusted Differences [k] t *(p)***
	Mean (SD)	Mean (SD)		
GHQ-28 [a, b]				
Somatic symptoms	4.38 (4.507)	4.56 (4.325)	-.204 (.839)	
Female	4.76 (4.86)	5.44 (4.56)		
Male	4.21 (4.40)	4.07 (4.20)		
Anxiety and Insomnia	4.64 (4.971)	5.47 (5.345)	-.800 (.425)	
Female	4.24 (4.60)	6.69 (5.67)		
Male	4.82 (5.17)	4.79 (5.14)		

Social dysfunction	7.39 (5.139)	7.49 (3.935)	-.106 (.916)	
Female	7.82 (4.76)	7.94 (4.51)		
Male	7.21 (5.42)	7.24 (3.64)		
Severe Depression	4.16 (4.504)	4.91 (5.017)	-.791 (.431)	
Female	3.53 (3.56)	6.13 (5.02)		
Male	4.44 (4.88)	4.24 (4.98)		
Total GHQ	**20.57** (16.416)	**22.42** (15.554)	-.576 (.566)	.25 (.803)
Female	20.35 (14.92)	26.19 (17.94)		
Male	20.67 (17.21)	20.34 (13.97)		
BDI II [c, d]				
Female	10.71 (9.38)	17.64 (14.89)		
Male	13.82 (12.82)	8.93 (10.59)		
Total	**12.85** (11.864)	**11.83** (12.707)	.407 (.685)	-.508 (.613)
HADS [e, f]				
Anxiety	6.46 (4.201)	5.93 (4.687)	.588 (.558)	-.421 (.675)
Female	6.12 (4.00)	8.00 (5.01)		
Male	6.62 (4.34)	4.89 (4.24)		
Depression	6.94 (4.044)	6.26 (4.844)	.752 (.683)	-.242 (.809)
Female	6.06 (3.68)	6.71 (5.68)		
Male	7.35 (4.19)	6.04 (4.47)		
IES-R [g, h]				
Avoidance	10.37 (8.918)	10.95 (8.525)	-.336 (.737)	
Female	10.90 (8.90)	11.00 (8.25)		
Male	10.12 (9.02)	10.93 (8.83)		
Intrusion	7.95 (7.952)	11.93 (9.932)	-2.270 (.025)*	
Female	8.95 (7.75)	12.40 (8.09)		
Male	7.49 (8.09)	11.67 (10.96)		
Hyper-arousal	5.41 (5.896)	7.31 (6.795)	-1.519 (.132)	
Female	6.25 (6.08)	7.20 (6.27)		
Male	5.02 (5.84)	7.37 (7.19)		
IESR total	23.73 (20.951)	30.19 (23.410)	-1.477 (.143)	1.00 (.316)
Female	26.10 (21.56)	30.60 (21.41)		
Male	22.63 (20.82)	29.96 (24.84)		
PDS [i, j]				
Female	**13.67**(12.068)	**20.21** (13.081)		
Male	10.92 (11.819)	**11.46** (13.133)		
Total	**11.80** (11.860)	**14.38** (13.611)	-.999 (.320)	0.03 (.975)

Note. [a] SCI Group n=56; [b] Controls n=45; [c] SCI Group n=55; [d] Controls n=42; [e] SCI Group n=54; [f] Controls n=42; [g] SCI Group n=63; [h] Controls n=42; [i] SCI Group n=56; [j] Controls n=42; [k] Adjusted for age, education and income using multiple linear regression.
CI (.95) * $p < 0.05$. ** $p < 0.01$.

From T_1 to T_2 there was a significant difference (Wilk's Lambda=0.945, p=0.018) in the levels of psychological distress (total GHQ-28 score), somatic symptoms (Wilk's Lambda=0.951, p=0.026) and anxiety and insomnia (Wilk's

Lambda=0.956, p=0.035). With time, both the groups improved slightly, with the SCI group showing greater improvement than the controls (Figures 10, 11 & 13); however, the level of psychological difficulty was still clinically significant for both groups at T_2.

On the BDI II, the Cronbach's alpha indicated very high reliability (α=0.90) at both time points. The BDI II scores are interpreted as follows: 5–8 normal, 10–18 mild to moderate depression, 19–29 moderate to severe depression, 30–63 severe depression (Groth Marnat, 2003). Both groups presented with clinically significant scores on the BDI II, indicating moderate levels of depression at T_1 and T_2. There was no significant difference between the groups at T_1 (Table 4). The SCI group and the control group showed improvement in the level of depression with time; however, both groups still presented with clinical levels of depression at T_2, with the SCI group having a slightly higher score (Figure 14). Males of the SCI group presented with higher levels of depression than females at both time points; however, in the control group, females presented with higher levels of depression than males at both time points.

Reliability of the anxiety subscale of the HADS (HADS anxiety) was good (Cronbach's α =0.70) at both time points. With the depression subscale of the HADS (HADS Depression) the reliability at T_1 (Cronbach's α =0.65) and T_2 (Cronbach's α =0.70) was also good. According to Huysamen (1996), the reliability coefficient may be 0.65 or higher for decisions about groups.

The interpretation of the HADS scores per subscale (viz., anxiety and depression) is as follows: 0–7 normal, 8–10 mild, 11–14 moderate and 15–21 is severe (Turner & Lee, 1998). The SCI group presented with a clinically significant score (8.27) for HADS anxiety, affecting males and females equally, at T_1. The control group also presented with a clinically significant level of anxiety (7.59) but it was less than the SCI group at T_1. In this group females presented with higher levels of anxiety than males at T_1. There was a significant difference (t=-2.196, p=0.029) between the SCI group and the control group with HADS depression at T_1. The control group presented with a clinically significant score (8.07), with females scoring higher (8.72) than males (7.64), indicating higher levels of depression in hospital in females with amputations. HADS anxiety and depression scores improved with time for both the SCI group and the control group, with HADS anxiety showing a significant difference (Wilk's Lambda=0.936, p=0.01) from T_1 to T_2. However, with the anxiety subscale of the HADS there was not much improvement over time with the females in the control group when compared to the males. With the SCI group there was little improvement in males or females from T_1 to T_2.

There was a significant difference (Wilk's Lambda=0.955, p=0.039) between the SCI group and the control group with HADS depression from T_1 to T_2, with the control group showing greater improvement. There was no improvement from T_1 to T_2 in HADS depression scores (T_1=6.63, T_2=7.35) in the males of the SCI group. They showed greater depression with time.

The IES-R was also found to have good reliability (Cronbach's alpha=0.80) for avoidance, intrusion and hyper-arousal at T_1. At T_2 Cronbach's alpha was 0.80 for avoidance and hyper-arousal, and 0.70 for intrusion. The IES-R does not have any cut-off points as it is a descriptive rather than a diagnostic tool (Zilberg et al., 1982). Both the SCI group and the control group presented with high IES-R total scores (Table 4). The levels of intrusion and avoidance were higher than the levels of hyper-arousal for both groups at both time points (Tables 4 & 5). Females of both the SCI group and the control group presented with higher levels of avoidance, intrusion, hyper-arousal and IES-R total scores compared to the males, at T_1 and T_2 (Tables 4 & 5), indicating that females may present with greater levels of posttraumatic stress than males following trauma.

At T_1 there was a significant difference (t=-2.256, p=0.031) for hyper-arousal between the SCI group and the control group with the controls scoring higher (Table 4), indicating greater levels of hyper-arousal in the control group soon after the incident. The levels of hyper-arousal (Wilk's Lambda=0.953, p=0.028) and avoidance (Wilk's Lambda=0.955, p=0.032) significantly decrease with time for both groups (Figures 16 & 17).

There was a significant difference in intrusion (Wilk's Lambda=0.925, p=0.005) between the SCI group and the control group, with the SCI group showing improvement in symptoms over time and the control group worsening (Figure 9). Although there was no significant difference between the SCI group and the control group for the IES-R, the control group presented with a higher total score at both time points (Tables 4 & 5), indicating slightly higher levels of posttraumatic stress in the control group than in the SCI group. There is a trend emerging between the SCI group and the control group with the IES-R total score (Tables 4 & 5) showing that with time the posttraumatic stress symptoms of the SCI group improved whilst the control group remained almost static with no improvement (Figure 9).

The PDS had a high reliability (Cronbach's alpha=0.90) at both time points. Clinically significant levels of moderate to severe PTSD (cut off >10), as measured by the PDS, were found for both the SCI group and the control group at T_1 and T_2 (Tables 4 and 5). The interpretations of PTSD symptom severity using the PDS are as follows: 10 or less is mild, 11–20 is moderate, 21–35 is moderate to severe and 36 and above is severe (Foa, 1995). Similar to the IES-R, females presented with higher levels of PTSD symptoms in both the SCI group and control group at both time points. Although there is a slight improvement in time with PTSD, the level of PTSD symptoms is still clinically significant for both groups (Figure 19).

Multivariate analysis was conducted to compare psychological functioning between the SCI group and control group from T_1 to T_2 as well as to measure changes over time. The differences over time are illustrated in Figures 8 to 19.

A repeated measures ANOVA indicated a significant difference from T_1 to T_2 (over time) for GHQ-28 somatic symptoms, GHQ-28 anxiety & insomnia, GHQ-28 total, HADS anxiety, IES-R avoidance and IESR hyper arousal.

Figure 8: HADS depression over time

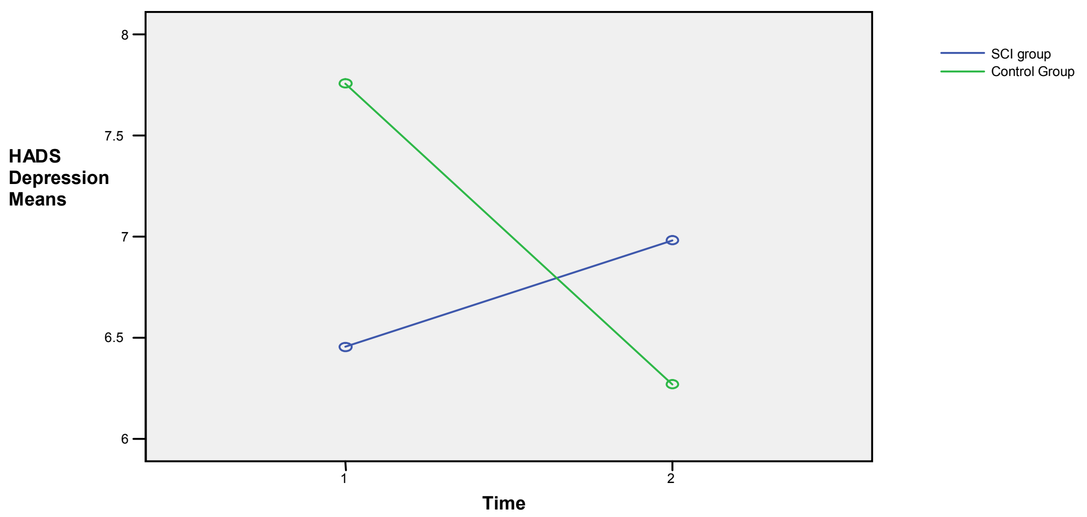

Figure 8 Profile plot of the estimated marginal means of HADS depression.

Figure 8 shows that the level of depression for the SCI group is lower at T_1 than at T_2, indicating an increase in depression over time. The opposite occurs with the control group, where the level of depression is higher at T_1 than at T_2, showing a decrease of depression over time.

Figure 8 also reveals that the control group had a higher lever of depression than the SCI group at T_1. However, the SCI group has higher levels of depression than the control group at T_2. The control group shows a decrease in depression over time whilst the SCI group shows a gradual increase of depression over time, hence the cross-over. The difference over time between the SCI group and the control group for the depression subscale of HADS is significant (Wilk's Lambda=0.955, p=0.039).

Figure 9: IES-R intrusion over time

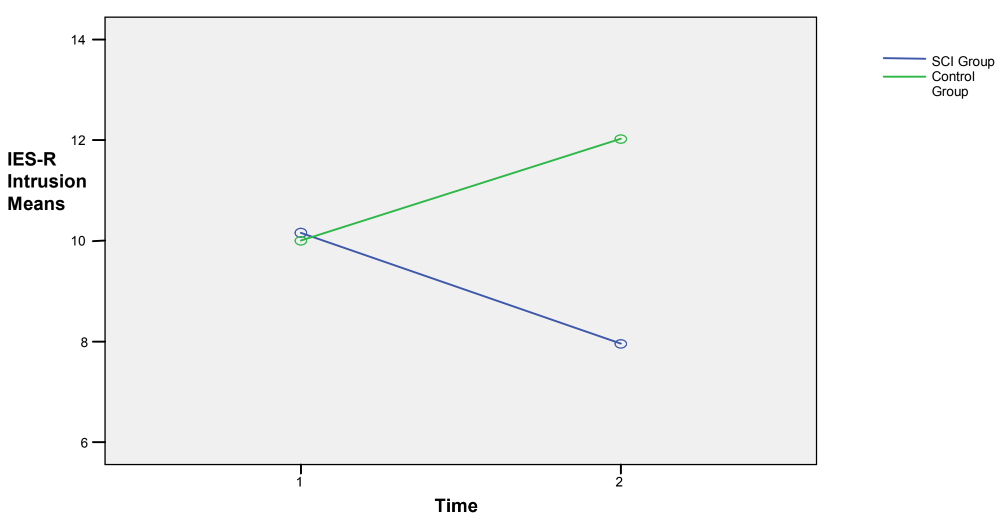

Figure 9. Profile plot of the estimated marginal means of IES-R intrusion.

Figure 9 reveals that the levels of intrusion, which is symptomatic of PTSD, decrease over time in the SCI group. The opposite occurs in control group, where the levels of intrusion increase over time. A divergence in time trend is seen in Figure 9, which is, where intrusive thoughts in one group increases, whilst the other group declines. At

T_1 both groups have an almost similar level of intrusion; however at T_2 the control group has a higher level of intrusion. A significant difference over time was found between the groups for IES-R intrusion (Wilk's Lambda=0.925, p=0.005).

Figure 10: GHQ somatic symptoms over time

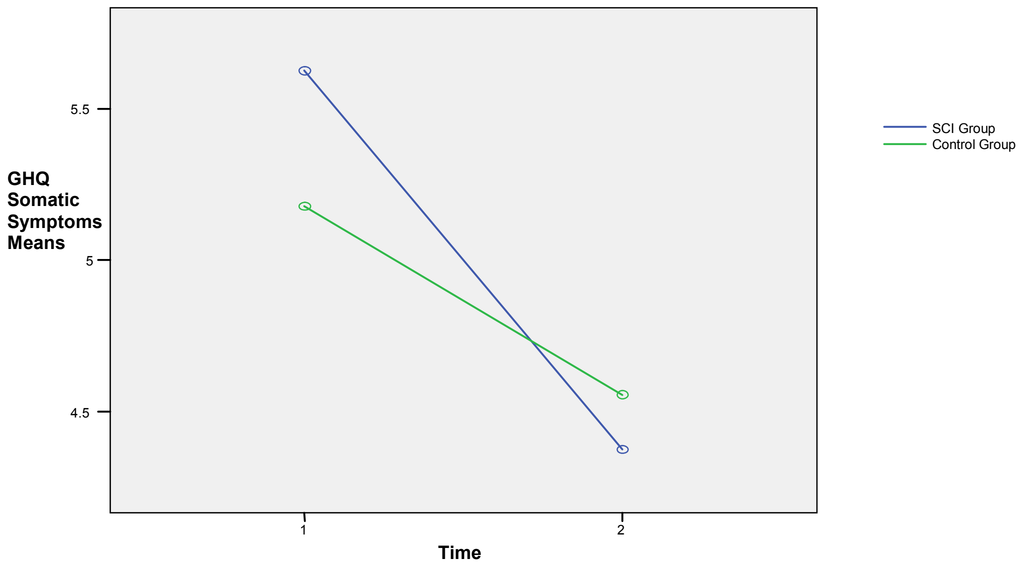

Figure 10. Profile plot of the estimated marginal means of GHQ somatic symptoms.

Figure 10 shows that the SCI group presented with greater somatic symptoms at T_1 than at T_2. A drastic improvement in somatic symptoms is observed over time in both the SCI group and control group. Figure 10 also shows that somatic symptoms are greater in the SCI group at T_1 but with time there is a cross-over. However at T_2 the somatic symptoms of the SCI group are less than those of the control group. This indicates that the somatic symptoms of the SCI group improved at a faster rate than those of the control group.

Figure 11: GHQ Anxiety and Insomnia over Time

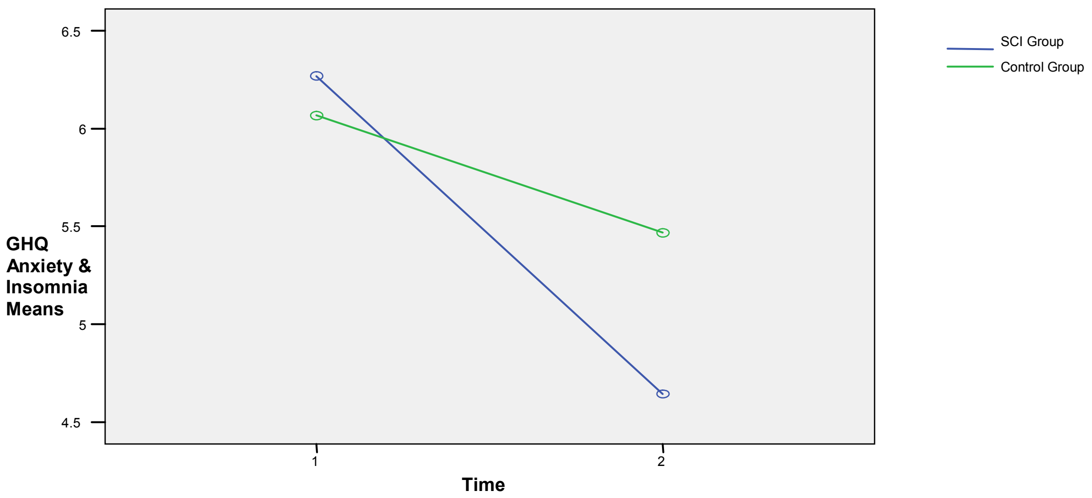

Figure 11. Profile plot of the estimated marginal means of GHQ anxiety & insomnia.

Figure 11 shows that the SCI group presented with high levels of anxiety and insomnia at T_1 which significantly improved over time (Wilk's Lambda=0.956, p=0.035). The control group also shows improvement in anxiety and insomnia over time. However, although the SCI group had higher levels of anxiety and insomnia at T_1 than the control group, the SCI group showed greater rate of improvement over time than the control group.

Figure 12: GHQ social dysfunction over time

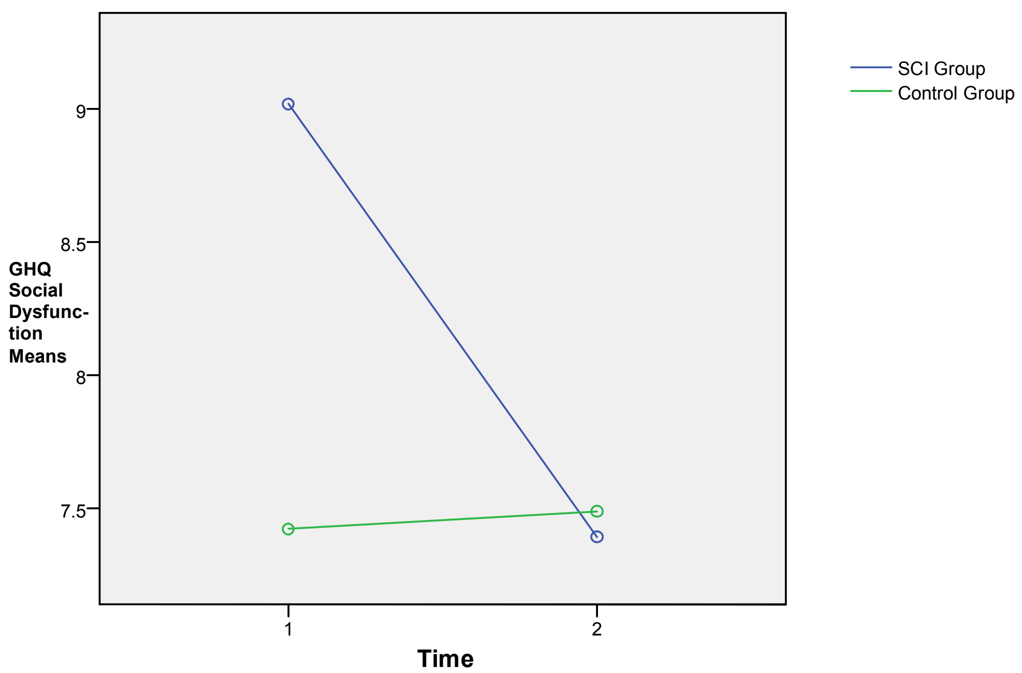

Figure 12. Profile plot of the estimated marginal means of GHQ social dysfunction.

Figure 12 shows that the SCI group had higher levels of social dysfunction at T_1 than at T_2. A major improvement in social dysfunction is seen in the SCI group over time. However, with the control group the level of social dysfunction at T_1 is slightly lower than that at T_2, indicating a slight increase in social dysfunction. As illustrated in Figure 12, the SCI group showed improvement whilst the control group showed worsening of social dysfunction over time.

Figure 13: GHQ-28 total over time

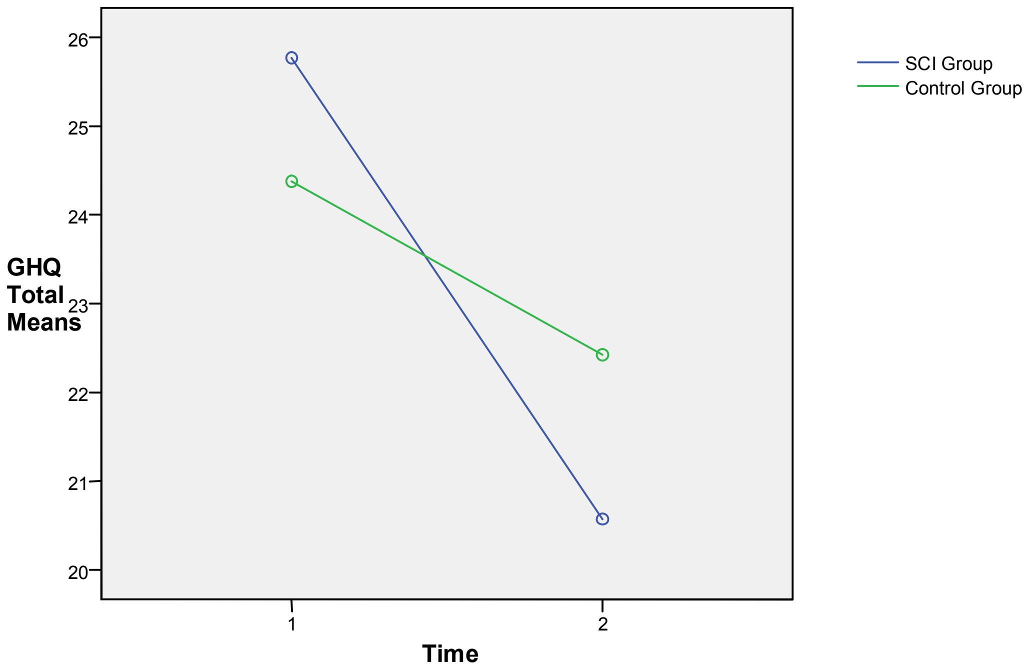

Figure 13. Profile plot of the estimated marginal means of GHQ total score.

As seen in Figure 13, the SCI group presented with significantly more psychological distress, which is measured by the GHQ-28, at T_1 than at T_2 (Wilk's Lambda=0.945, p=0.018). This indicates an improvement in psychological distress over time in the SCI group. The same can be seen in the control group, where higher levels of psychological distress is present at T_1 than at T_2, indicating an improvement over time.

Figure 13 also reveals that the SCI group were more highly distressed psychologically at T_1 than the control group; however, the SCI group showed a lower level of psychological distress than the control group at T_2. Once again, a greater rate of improvement is seen in the SCI group than in the control group.

Figure 14: BDI II total over time

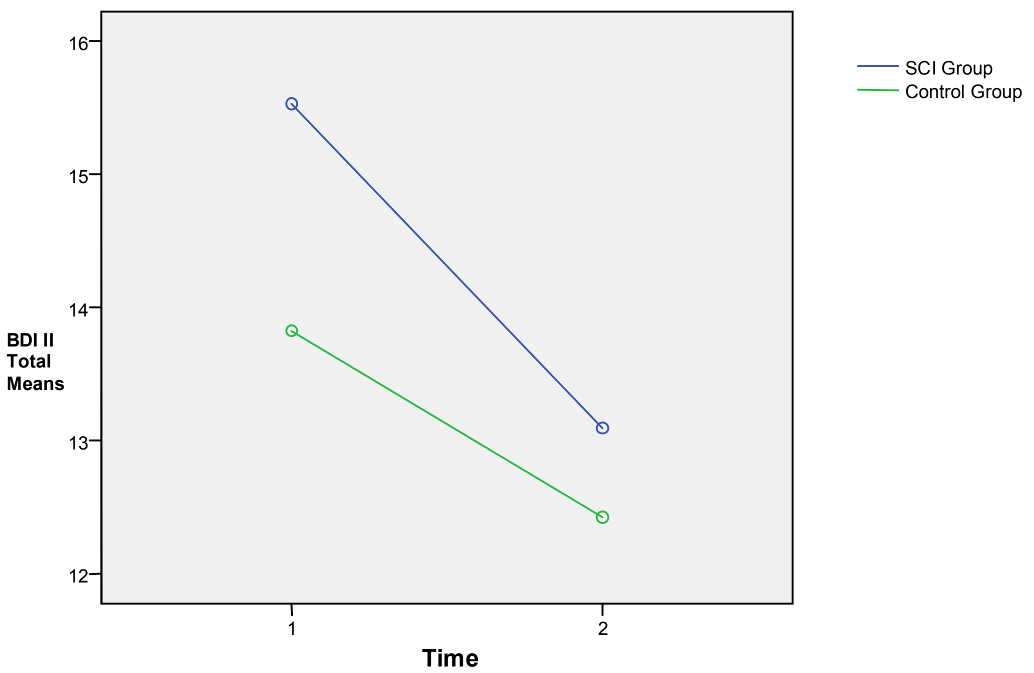

Figure 14. Profile Plot of the estimated marginal means of BDI II.

Figure 14 reveals that the SCI group had a higher level of depression at T_1 than at T_2. This indicates that depression in the SCI group improved with time. The control group also showed improvement in depression over time, with the level of depression being higher at T_1 than at T_2.

Figure 14 shows that the time lines for the groups are almost parallel. This indicates that the SCI group and the control group have an almost similar presentation of depression over time. However, the SCI group had a higher level of depression at T_1 and showed a greater rate of improvement than the control group.

Figure 15: HADS anxiety over time

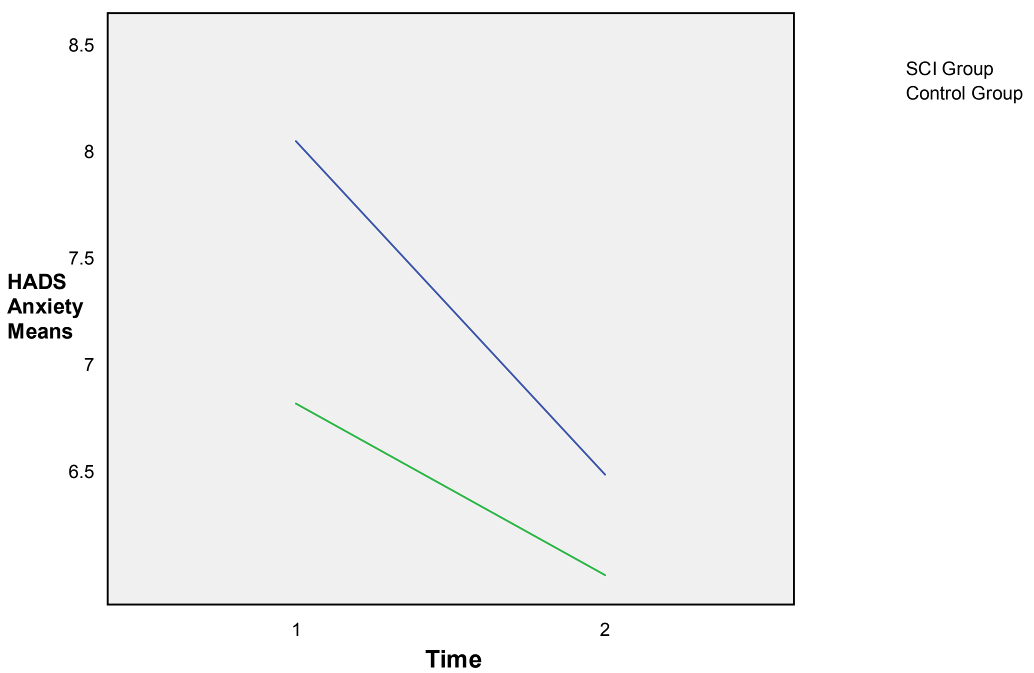

Figure 15. Profile plot of the estimated marginal means of HADS anxiety.

Figure 15 reveals that the SCI group had a higher level of anxiety at T_1 than at T_2, indicating a significant improvement in anxiety over time (Wilk's Lambda=0.936, p=0.014). The improvement in anxiety over time can also be seen in the control group.

The time lines for the SCI group and the control group for anxiety also run almost parallel, indicating an almost similar presentation of anxiety levels over time for both groups. Here again the SCI group present with higher levels of anxiety at T_1 but show greater improvement over time than the control group.

Figure 16: IES-R avoidance over time

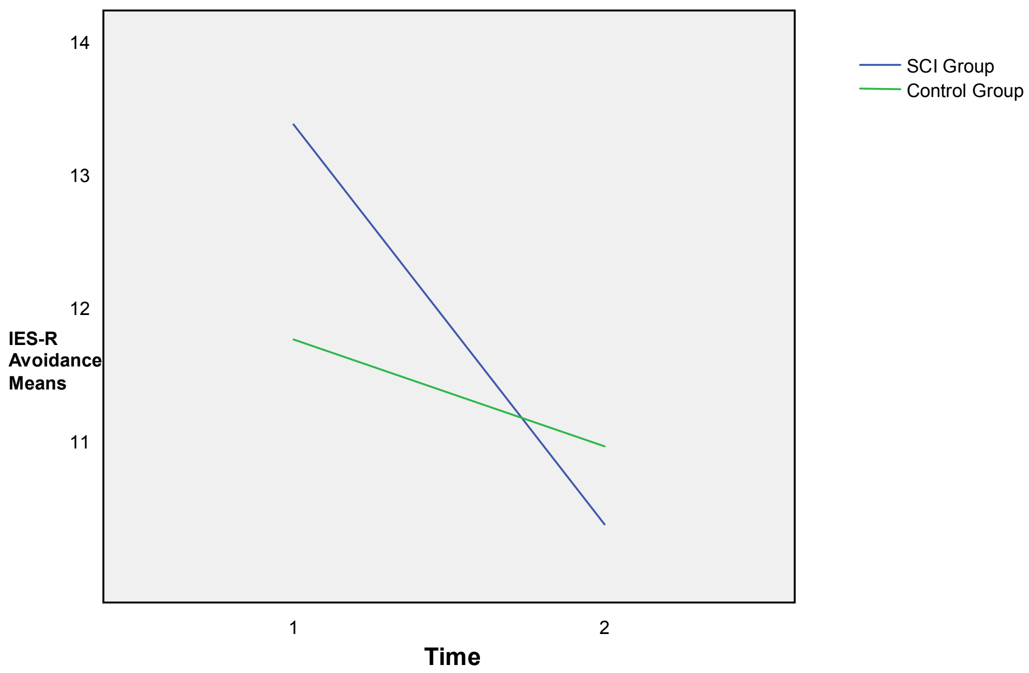

Figure 16. Profile plot of the estimated marginal means of IES-R avoidance.

There was a significantly higher level of avoidance, a symptom of PTSD, in the SCI group at T_1 than at T_2 (Wilk's Lambda=0.955, p=0.032). This indicates an improvement in avoidance in the SCI group over time. The control group also show an improvement in avoidance over time.

The cross-over of the time lines of avoidance indicate that at some point in time both groups presented with a similar level of avoidance. However, Figure 16 also shows that at T_1 the level of avoidance is higher in the SCI group than in the control group but at T_2 it is lower in the SCI group than the control group. This indicates a greater rate of improvement in avoidance in the SCI group over time.

Figure 17: IES-R hyper-arousal over time

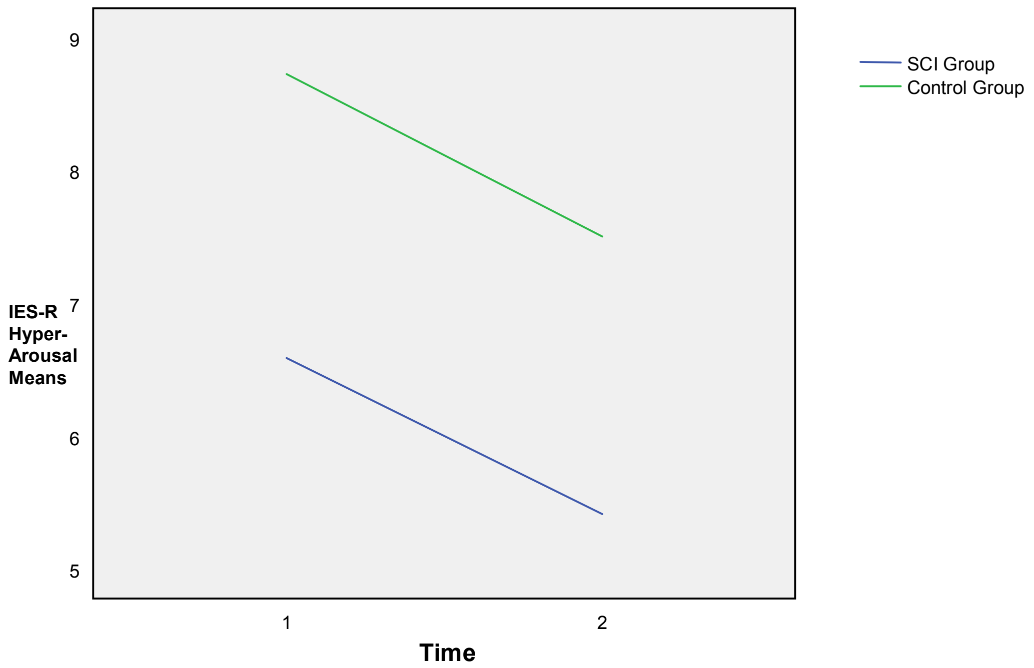

Figure 17. Profile plot of the estimated marginal means of IESR hyper-arousal.

Figure 17 shows that both the SCI group and the control group presented with a significantly higher level of hyper-arousal, which is also a symptom of PTSD, at T_1 than at T_2 (Wilk's Lambda=0.953, p=0.028). This indicates that the symptom of hyper-arousal significantly decreased over time for both the groups.

However, the levels of hyper-arousal are much higher in the control group at both time points. The parallel time lines seen in Figure 17 indicate the same rate of improvement for hyper-arousal over time for both the groups.

Figure 18: IES-R total over time

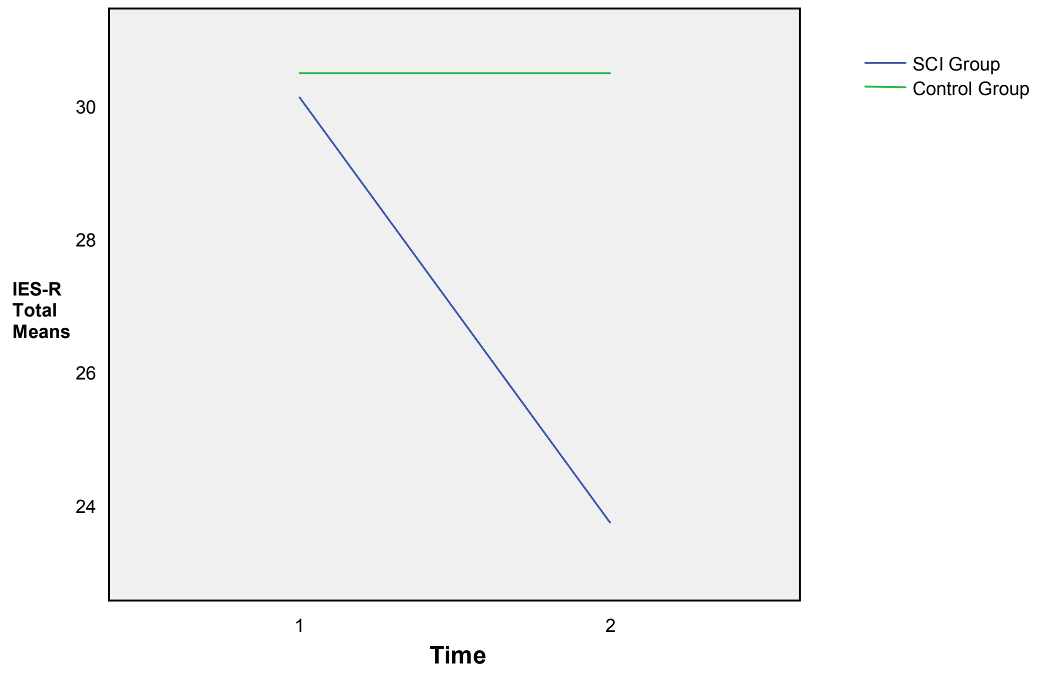

Figure 18. Profile plot of the estimated marginal means of IES-R total score.

Figure 18 reveals that the SCI group presented with higher levels of posttraumatic stress symptoms at T_1 than at T_2. This indicates that the SCI group showed improvement in symptoms of posttraumatic stress over time. However, the posttraumatic stress symptoms of the control group is the same at T_1 and T_2 indicating no improvement over time.

The symptoms of posttraumatic stress are higher in the control group than in the SCI group at both time points. The straight time-line of the control group indicates that the posttraumatic symptoms neither worsens nor improves with time. It is interesting to note that the SCI group made a drastic improvement with time, whilst the control group showed no improvement.

Figure 19: PDS total over Time

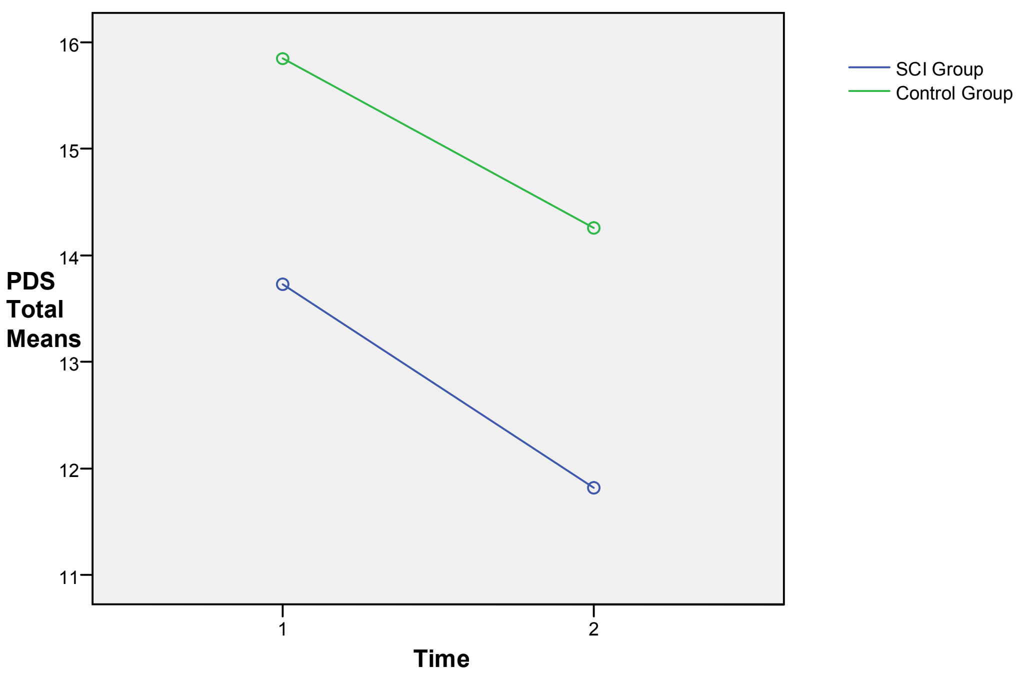

Figure 19. Profile plot of the estimated marginal means of PDS total.

The SCI group has a higher level of PTSD at T_1 than at $T_{2,}$ as seen in Figure 19. This indicates that PTSD improved with time in the SCI group. An almost similar presentation of PTSD occurs in the control group hence the almost parallel time lines seen in Figure 19

Although the two groups show a similar rate of improvement over time, the control group presented with much higher levels of PTSD at both time points.

Table 6: *Gender and severity of psychological functioning*

	SCI Group n (%)		Control Group n (%)	
	Time 1	Time 2	Time 1	Time 2
BDI II				
Minimal or no depression (score <10)				
Female n (% within gender)	11 (30.6)	9 (52.9)	8 (27, 6)	7 (50.0)
Male n (% within gender)	26 (37.1)	18 (47.4)	21 (48.8)	17 (60.7)
Total n (% within BDI II)	37 (34.9)	27 (49.1)	37 (34.9)	24 (57.1)
Mild to severe Depression (score >10)				
Female n (% within gender)	25 (69.4)	8 (47.1)	21 (72.4)	7 (50.0)
Male n (% within gender)	44 (62.9)	20 (52.6)	22 (51.2)	11 (39.3)
Total n (% within BDI II)	69 (65.1)	28 (50.9)	69 (65.1)	18 (42.9)
PDS				
Minimal or no PTSD (score <10) (PTSD -)				
Female n (% within gender)	10 (27.0)	7 (38.9)	11 (36.7)	4 (28.6)
Male n (% within gender)	34 (48.6)	22 (57.9)	19 (46.3)	16 (57.1)
Total n (% within PDS)	44 (41.1)	29(51.8)	30 (42.3)	20 (47.6)
Moderate to severe PTSD (score >10) (PTSD +)				
Female n (% within gender)	27 (73.0)	11 (61.1)	19 (63.3)	10 (71.4)
Male n (% within gender)	36 (51.4)	16 (42.1)	22 (53.7)	12 (42.9)
Total n (% within PDS)	63 (58.9)	27 (48.2)	41 (57.7)	22 (52.4)

A majority of participants in both the SCI group and the control group presented with moderate to severe depression at T_1 (Table 6). Both groups showed improvement with time. A majority of both males and females presented with mild to severe depression at T_1. Although there was no significant gender differences with depression, more males than females showed improvement with time.

A majority of participants in both the SCI group and the control group presented with moderate to severe PTSD at T_1 (Table 6). PTSD improved with time in the SCI group; however, the control group showed little improvement with time. More females than males in both the SCI group and the control group presented with moderate to severe PTSD at both time points. There was a significant gender difference (χ^2 =4.640, p=0.031) in PTSD of the SCI group at T_1 with a much higher percentage of females presenting with PTSD than males.

Table 7: *Depression & PTSD in categories of SCI*

	SCI Group n (%)			
	Time 1		Time 2	
BDI II				
Minimal or no depression (score <10)				
Paraplegia n (% within paraplegia)	21	(32.8)	18	(50.0)
Paraparesis n (% within paraparesis)	5	(31.3)	3	(37.5)
Quadriplegia (% within quadriplegia)	6	(46.2)	4	(66.7)
Quadriparesis (% within quadriparesis)	5	(41.7)	2	(40.0)
Total n (% within medical diagnosis)	37	(35.2)	27	(49.1)
Mild to severe Depression (score >10)				
Paraplegia n (% within paraplegia)	43	(67.2)	18	(50.0)
Paraparesis n (% within paraparesis)	11	(68.8)	5	(52.5)
Quadriplegia (% within quadriplegia)	7	(53.8)	2	(33.3)
Quadriparesis (% within quadriparesis)	7	(58.3)	3	(60.0)
Total n (% within medical diagnosis)	68	(64.8)	28	(50.9)
PDS				
Minimal or no PTSD (score <10) (PTSD -)				
Paraplegia n (% within paraplegia)	35	(53.8)	20	(55.6)
Paraparesis n (% within paraparesis)	2	(12.5)	3	(37.5)
Quadriplegia (% within quadriplegia)	2	(15.4)	2	(33.3)
Quadriparesis (% within quadriparesis)	5	(41.7)	4	(66.7)
Total n (% within medical diagnosis)	44	(41.5)	29	(51.8)
Moderate to severe PTSD (score >10) (PTSD +)				
Paraplegia n (% within paraplegia)	30	(46.2)	16	(44.4)
Paraparesis n (% within paraparesis)	14	(87.5)	5	(62.5)
Quadriplegia (% within quadriplegia)	11	(84.6)	4	(66.7)
Quadriparesis (% within quadriparesis)	7	(58.3)	2	(33.3)
Total n (% within medical diagnosis)	62	(58.5)	27	(48.2)

Table 7 shows the differences in depression and PTSD amongst SCI individuals with paraplegia, paraparesis, quadriplegia and quadriparesis at both time points. At T_1 more individuals with paraparesis (n=11, 68.8%) and paraplegia (n=43, 67.2%) presented with depression compared to individuals with quadriparesis (n=7, 58.3%) and quadriplegia (n=7, 53.8%). With time (T_2) higher percentages of individuals with paraparesis (n=5, 62.5%) and quadriparesis (n=3, 60.0%) presented with depression compared to those with paraplegia (n=18, 50.0%) and quadriplegia (n=2, 33.3%). There was no significant difference between the groups at T_1

(χ^2 =1.173, p=0.76) and T_2 (χ^2 =1.349, p=0.72). Although the trend reveals that more individuals with paraplegia and paraparesis present with depression, depression is prevalent amongst all the groups in individuals with SCI.

Higher percentages of individuals with paraparesis (n=14, 87.5%) and quadriplegia (n=11, 84.6%) presented with moderate to severe PTSD compared to individuals with quadriparesis (n=7, 58.3%) and paraplegia (n=30, 46.2%) at T_1. There was a significant difference between the groups (χ^2 =13.275, p=0.004). With time (T_2) a higher percentage of individuals with quadriplegia (n=4, 66.7%) and paraparesis (n=5, 62.5%) presented with moderate to severe PTSD compared to those with paraplegia (n=16, 44.4%) and quadriparesis (n=2, 33.3%). However, the difference between the groups is not statistically significant (χ^2 =2.209, p=0.53).

The results here reveal that there is no significant difference in the occurrence of depression and PTSD amongst the different categories of SCI such as paraplegia, paraparesis, quadriplegia and quadriparesis.

The PDS also provided valuable information on general satisfaction with life. At T_1, of those who said 'yes' when asked if their condition impacted on their general satisfaction with life, 66 (65.3%) were from the SCI group and 35 (34, 7%) were from the control group. Of those who said 'no' to the same question, 40(56.3%) were from the SCI group and 31 (43.7%) were from the control group.

At T_2, of those who said 'yes' when asked if their condition impacted on their general satisfaction with life, 33 (60%) were from the SCI group and 22 (40%) were from the control group, whilst those who felt that it had not interfered with their general satisfaction with life were split evenly between the two groups (50% from the SCI group and 50% from the control group). With time both the SCI group and control group were more satisfied with life.

5.3 Social Support

A Cronbach's coefficient alpha of 0.96 was obtained which indicates high reliability in the SSQ. The percentages of the main source of support at T_1 and T_2 are listed in Table 8.

Table 8: *Social Support Questionnaire (SSQ) items between SCI and Control groups*

		Sample Source %		Control Group Source %	
		Time 1	Time 2	Time 1	Time 2
1. Who can you really count on to listen to you when you need to talk?	m	31.3	10.7	13.6	8.6
	p	10.7	3.6	19.8	7.4
	s	10.7	8.0	22.2	14.8
	se	8.0	8.9	12.3	1.2
	f	8.0	4.5	6.2	2.5
	c	0.0	0.0	0.0	6.2
2. Who could you really count on to help you in an emergency or crises?	m	33.0	15.2	14.8	13.6
	p	14.3	4.5	14.8	7.4
	s	17.0	6.3	19.8	9.9
	se	8.0	8.0	7.4	1.2
	f	2.7	0.9	4.9	4.9
	c	1.8	0.0	9.9	4.6
3. Who helps you feel that you are a good and worthwhile person?	m	23.2	11.6	9.9	7.4
	p	19.6	8.9	23.5	9.9
	s	8.0	2.7	16	9.9
	se	9.8	6.3	11.1	6.2
	f	7.1	6.3	0.0	1.2
	c	0.9	0.0	8.6	3.7
4. Who can you really go to when you are worried and/or under pressure?	m	22.3	8.9	16.0	7.4
	p	15.2	7.1	14.8	9.9
	s	12.5	4.5	17.3	14.8
	se	9.8	8.9	9.9	4.9
	f	10.7	5.4	6.2	1.2
	c	0.0	0.0	7.4	2.5
5. Who can you count on when you generally need help for reasons other than an emergency or crises?	m	28.6	8.9	14.8	8.6
	p	14.3	5.4	11.1	9.9
	s	13.4	5.4	19.8	9.9
	se	7.1	7.1	12.3	3.7
	f	9.8	4.5	4.9	3.7
	c	0.0	0.9	8.6	4.9

		Sample Source %		Control Group Source %	
		Time 1	Time 2	Time 1	Time 2
6. Who can you really count on to help you if things go wrong, you have a mishap or run out of luck? (e.g. fired from a job, meet with an accident, etc.)	m	27.7	9.8	12.3	4.9
	p	13.4	7.1	13.6	12.3
	s	11.6	4.5	19.8	11.1
	se	10.7	4.5	11.9	6.2
	f	5.4	3.6	4.9	2.5
	c	0.9	0.9	6.2	2.5
7. Who can you really count on to give you useful advice, guidance or suggestions that would help to avoid making mistakes?	m	25.0	8.0	11.1	9.9
	p	13.4	5.4	9.9	4.9
	s	9.8	6.3	19.8	9.9
	se	16.1	8.9	0.0	7.4
	f	5.4	2.7	4.9	4.9
	c	0.0	0.9	8.6	3.7
8. Who do you feel would help if a family member or someone close to you died?	m	17.9	12.5	8.6	6.2
	p	11.6	6.3	12.3	8.6
	s	12.5	6.3	19.8	12.3
	se	19.6	7.1	12.3	4.9
	f	4.5	3.6	2.5	4.9
	c	1.8	0.0	4.9	12.5
9. Who do you feel truly loves you deeply?	m	30.4	14.3	13.6	8.6
	p	14.3	4.5	19.8	12.3
	s	6.3	4.5	18.5	7.4
	se	5.4	4.5	6.2	2.5
	f	3.6	2.7	0.0	2.5
	c	3.6	0.9	12.3	7.4
10. Who can you count on to comfort or console you when you are very upset?	m	25.0	7.1	11.1	7.4
	p	21.4	8.9	18.5	14.8
	s	8.9	6.3	8.9	9.9
	se	7.1	5.4	7.4	3.7
	f	8.0	6.3	6.2	2.5
	c	0.9	0.9	6.2	4.9
11. Who can you really count on to support you in major decisions or plans you make?	m	23.2	9.8	14.8	7.4
	p	13.4	7.1	14.8	13.6
	s	11.6	6.3	19.8	11.1
	se	11.6	8.0	8.6	3.7
	f	8.9	2.7	4.9	2.5
	c	0.9	0.9	7.4	3.7
12. Who would you trust with a secret or information that could get you into trouble?	m	19.6	12.5	8.6	8.6
	p	18.8	4.5	16	11.1
	s	18.8	8.9	19.8	11.1
	se	9.8	7.1	11.1	3.7
	f	8.0	5.4	4.9	3.7
	c	0.0	0.0	6.2	4.9
13. Who do you count on when you are ill?	m	35.7	14.3	14.8	11.1
	p	14.3	4.5	18.5	9.9
	s	6.3	7.1	22.2	9.9
	se	9.8	4.5	6.2	7.4
	f	1.8	2.7	2.5	1.2
	c	0.0	0.9	0.0	4.9

		Sample Source %		Control Group Source %	
		Time 1	Time 2	Time 1	Time 2
14. Who can you really count on when you get into trouble?	m	30.4	14.3	14.8	8.6
	p	12.5	5.4	19.8	11.1
	s	7.1	6.3	16.0	9.9
	se	9.8	3.6	8.6	6.2
	f	2.7	2.7	1.2	2.5
	c	0.9	0.9	7.4	4.9
15. Who do you think will come to you if they had a need or a problem?	m	10.7	8.9	8.6	6.2
	p	10.7	3.6	12.3	7.4
	s	17.0	5.4	19.8	11.1
	se	8.0	6.3	12.3	6.2
	f	8.0	4.5	3.7	3.7
	c	4.5	5.4	9.9	8.6

Note. m = mother, s = sibling, p = partner, se = self, f = friend, c = child

Mothers provided the greatest amount of support to the SCI group at T_1. Although this was evident for T_2 as well, the amount of support provided by mothers diminished and the SCI group relied more on themselves as a source of support with time. The SCI group also relied on their partners and siblings as a source of support. The control group, however, relied on their siblings as the greatest source of support at $T_1$and T_2. Here again, the amount of support provided by siblings decreased with time. The control group also depended more on their partners and mothers as a source of support and less on themselves.

The Mann-Whitney Test was used to compare the level of satisfaction between the SCI group and the control group for each item on the SSQ. The differences are presented in Table 9.

Table 9: *Comparisons of levels of social satisfaction (SSQ items) between groups*

	SCI Group (%)		Control Group (%)		Differences U(*p*) SCI Group & Control Group	
	Time 1	Time2	Time 1	Time2	Time 1	Time2
1. Who can you really count on to listen to you when you need to talk?						
Very satisfied	76.4	84.0	72.1	52.8		
Satisfied	20.8	16.0	27.9	41.7		
Dissatisfied	1.9	0.0	0.0	0.0		
Very dissatisfied	0.9	0.0	0.0	5.6		
					3120 (0.618)	611.00 (.001)**
2. Who could you really count on to help you in an emergency or crises?						
Very satisfied	75.5	90. 0	52.8	70.3		
Satisfied	22.6	10. 0	41.7	27.0		
Dissatisfied	0.9	0.0	0.0	0.0		
Very dissatisfied	0.9	0.0	5.6	2.7		
					2825 (0.67)	740.00 (0.02)*
3. Who helps you feel that you are a good and worthwhile person?						
Very satisfied	76.9	78.0	77.8	59.5		
Satisfied	21.2	22.0	20.4	32.4		
Dissatisfied	1.0	0.0	1.9	2.7		
Very dissatisfied	1.0	0.0	0.0	5.4		
					2783(.902)	737.00 (0.04)*
4. Who can you really go to when you are worried and/or under pressure?						
Very satisfied	68.9	72.0	80.0	63.9		
Satisfied	28.3	28.0	20.0	30.6		
Dissatisfied	1.9	0.0	0.0	0.0		
Very dissatisfied	0.9	0.0	0.0	5.6		
					2574(0.117)	813.00 (0.35)
5. Who can you count on when you generally need help for reasons other than an emergency or crises?						
Very satisfied	76.2	78.0	76.8	54.3		
Satisfied	20.0	22.0	21.4	40.0		
Dissatisfied	2.9	0.0	0.0	2.9		
Very dissatisfied		0.0	1.8	2.9		
					2910 (0.887)	656.50 (0.02)*

	SCI Group (%)		Control Group (%)		Differences U(*p*) SCI Group & Control Group	
	Time 1	Time2	Time 1	Time2	Time 1	Time2
6. Who can you really count on to help you if things go wrong, you have a mishap or run out of luck? (e.g. fired from a job, meet with an accident, etc.)						
Very satisfied	79.2	79.6	74.5	58.3		
Satisfied	17.0	20.4	24.5	36.1		
Dissatisfied	2.8	0.0	0.0	2.8		
Very dissatisfied	0.9	0.0	0.0	2.8		
					2806 (0.592)	684.50 (0.03)*
7. Who can you really count on to give you useful advice, guidance or suggestions that would help to avoid making mistakes?						
Very satisfied	78.3	84.0	66.7	56.8		
Satisfied	18.9	16.0	22.8	35.1		
Dissatisfied	0.9	0.0	7.0	2.7		
Very dissatisfied	1.9	0.0	3.5	5.4		
					2632 (0.076)	661.00 (0.004) **
8. Who do you feel would help if a family member or someone close to you died?						
Very satisfied	73.3	80.0	71.4	63.9		
Satisfied	22.9	20.0	25.0	27.8		
Dissatisfied	1.9	0.0	0.0	2.8		
very dissatisfied	1.9	0.0	3.6	5.6		
					2886 (0.805)	740.00 (0.07)
9. Who do you feel truly loves you deeply?						
Very satisfied	83.0	88.0	82.5	73.0		
Satisfied	15.1	12.0	15.8	21.6		
Dissatisfied	0.0	0.0	0.0	0.0		
Very dissatisfied	1.9	0.0	1.8	5.4		
					3005 (0.932)	780.00 (0.06)
10. Who can you count on to comfort or console you when you are very upset?						
Very satisfied	79.2	80.0	77.2	67.6		
Satisfied	18.9	20.0	19.3	24.3		
Dissatisfied	0.9	0.0	1.8	2.7		
Very dissatisfied	0.9	0.0	1.8	5.4		
					2950 (0.729)	795.00 (0.14)

	SCI Group (%)		Control Group (%)		Differences U(p) SCI Group & Control Group	
	Time 1	Time2	Time 1	Time2	Time 1	Time2
11. Who can you really count on to support you in major decisions or plans you make?						
Very satisfied	76.2	82.0	75.9	66.7		
Satisfied	25.5	16.0	19.0	27.8		
Dissatisfied	0.9	2.0	3.4	2.8		
Very dissatisfied	0.9	0.0	1.7	2.8		
					3004 (0.753)	758.00 (0.09)
12. Who would you trust with a secret or information that could get you into trouble?						
Very satisfied	70.3	72.0	79.6	59.5		
Satisfied	26.7	28.0	26.8	32.4		
Dissatisfied	1.0	0.0	1.8	0.0		
Very dissatisfied	2.0	0.0	1.8	8.1		
					2805 (0.819)	788.00 (0.15)
13. Who do you count on when you are ill?						
Very satisfied	80.0	86.0	72.4	69.4		
Satisfied	16.3	14.0	24.1	25.0		
Dissatisfied	1.0	0.0	0.0	0.0		
Very dissatisfied	1.9	0.0	3.4	5.6		
					2767 (0.229)	744.00 (0.05)
14. Who can you really count on when you get into trouble?						
Very satisfied	77.0	86.0	75.0	61.8		
Satisfied	21.0	14.0	21.4	32.4		
Dissatisfied	1.0	0.0	0.0	2.9		
Very dissatisfied	1.0	0.0	3.6	2.9		
					2734 (0.742)	637.00 (0.009)**
15. Who do you think will come to you if they had a need or a problem?						
Very satisfied	75.0	78.0	69.6	58.3		
Satisfied	22.9	22.0	26.8	27.8		
Dissatisfied	1.0	0.0	0.0	5.6		
Very dissatisfied	1.0	0.0	3.6	8.3		
					2536 (0.452)	695.50 (0.03)*

CI (.95) * $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

Table 9 shows that there was no significant difference between the SCI group and the control group in terms of their satisfaction with the level of support they received at T_1. Both groups were generally very satisfied with the social support they received.

However, with time there were significant differences between the SCI group and the control group with more than half of the items of the SSQ (Table 9). Unlike the SCI group, the control group became significantly less satisfied (Table 9) with time with the social support they received. The means and standard deviations of the participants' responses at T_1 and T_2 for each item on the SSQ are presented in Tables 10 and 11.

Table 10: *Means and standard deviations of SSQ items by group at time point 1*

Item No.	Time 1			
	SCI Group		Controls	
	Mean	Standard Deviation	Mean	Standard Deviation
SSQ1	3.73	.54	3.72	.45
SSQ2	3.73	.53	3.69	.54
SSQ3	3.74	.52	3.76	.47
SSQ4	3.65	.57	3.80	.40
SSQ5	3.71	.57	3.73	.56
SSQ6	3.75	.55	3.75	.44
SSQ7	3.74	.57	3.53	.78
SSQ8	3.68	.61	3.64	.67
SSQ9	3.79	.53	3.79	.53
SSQ10	3.76	.51	3.72	.59
SSQ11	3.70	.54	3.69	.63
SSQ12	3.68	.65	3.64	.62
SSQ13	3.76	.57	3.66	.66
SSQ14	3.74	.52	3.68	.66
SSQ15	3.72	.54	3.63	.68

Table 10 shows that both the SCI group and the control group were generally satisfied with the level of social support they received at T1. The mean score of three refers to "satisfied" on the Likert scale of the SSQ.

Table 11: *Means and standard deviations of SSQ items by group at time point s*

Item No.	Time 2			
	SCI Group		Control Group	
	Mean	Standard Deviation	Mean	Standard Deviation
SSQ1	3.84	.37	3.42	.77
SSQ2	3.90	.30	3.65	.63
SSQ3	3.78	.42	3.46	.80
SSQ4	3.72	.45	3.53	.77
SSQ5	3.78	.42	3.46	.70
SSQ6	3.80	.41	3.50	.70
SSQ7	3.84	.37	3.43	.80
SSQ8	3.80	.40	3.50	.81
SSQ9	3.88	.33	3.62	.76
SSQ10	3.80	.40	3.54	.80
SSQ11	3.80	.45	3.58	.69
SSQ12	3.72	.45	3.43	.87
SSQ13	3.86	.35	3.58	.77
SSQ14	3.86	.35	3.53	.71
SSQ15	3.78	.42	3.36	.93

Table 11 indicates that both groups were generally satisfied with the level of social support they received at $T_{2;}$ however, the SCI group were more satisfied with the level of support over time than the control group. A mean score of four refers to "very satisfied" on the Likert scale of the SSQ.

The SCI group indicated almost maximum satisfaction with the level of social support at T_2, as seen in Table 11. There was only a slight variation in the responses.

5.4 Neuropsychological Functioning

Neuropsychological test results for the SCI group and the control group are presented in Table 12.

Table 12: *Means and standard deviations of neuropsychological test performance*

	SCI Group	**Control Group**	**Differences**	**Adjusted Differences**[y]
	t *(p)*	**t *(p)***		
	Mean (SD)	Mean (SD)		
RTCFT [a, b]				
Copy	30.78 (4.334)	34.06 (2.261)	-4.080 (0.000) ***	5.52 (.000) ***
I Recall	22.67 (7.292)	24.01 (6.728)	-0.853 (0.396)	2.67 (.009) **
D Recall	21.33 (8.493)	21.61 (8.189)	-0.152 (0.879)	2.63 (.010) **
Narrative Prose Memory [c, d]				
Recall	11.25 (4.448)	10.07 (5.160)	0.496 (0.621)	-.37 (.709)
Delayed	10.76 (4.658)	9.76 (4.639)	0.490 (0.625)	-.04 (.967)
Total	21.32 (9.123)	20.53(9.073)	0.798 (0.689)	-.208 (.836)
Trail Making Test [e, f]				
TMT A	73.13 (64.226)	89.46 (59.696)	-1.168 (0.246)	.92 (.356)
TMT B	163.77 (129.410)	185.12 (153.164)	-0.666 (0.508)	-.56 (.578)
Finger Tapper Test [g, h]				
Dominant Hand	33.871 (8.584)	32.535 (11.824)	0.563 (0.575)	.59 (.553)
Non Dominant Hand	32.812 (8.572)	31.630 (8.613)	0.591 (0.556)	.29 (.766)
Grooved Pegboard [i, j]				
Dominant Hand	94.03 (45.635)	91.49 (28.858)	0.286 (0.776)	-1.76 (.081)
Non Dominant Hand	97.66 (28.393)	90.56 ((21.892)	1.194 (0.236)	-1.70 (.092)
COWA [k, l]				
FAS Total	26.02 (13.914)	23.03 (9.395)	1.116 (0.268)	.19 (.844)
Animal Total	13.08 (5.324)	11.03 (3.738)	2.118 (0.037)*	-.92 (.358)
SDMT [m, n]				
Total	33.29 (11.673)	26.86 (11.296)	2.565 (0.012)*	-.28 (.780)
Seashore Rhythm Test [o, p]				
Total	26.69 (11.008)	22.21 (5.313)	2.205 (0.030)*	-1.38 (.171)
Stroop (t score) [q, r]				
Word	32.84 (10.547)	34.18 (10.481)	-0.569 (0.571)	.87 (.384)
Colour	29.24 (12.913)	26.58 (12.525)	0.933 (0.354)	.22 (.825)
Colour Word	38.33 (13.041)	36.58 (9.731)	0.657 (0.513)	-.50 (.618)

RAVLT [s, t]				
Immediate Memory (T1)	5.59 (7.720)	3.94 (1.644)	1.242 (0.218)	.38 (.700)
Total Learning (T1-T5)	8.87 (2.532)	9.03 (2.332)	0.643 (0.522)	.95 (.340)
Delayed Recall (T8)	9.77 (2.676)	9.31 (2.587)	0.797 (0.428)	.10 (.921)
Recognition (T9)	33.95 (6.060)	29.69 (8.105)	2.846 (0.006)**	-2.17 (.032)*
SPM [u, v]				
Total	26.92 (9.643)	23.00 (8.48)	0.537 (0.601)	-.10 (.918)
WAIS III [w, x]			**U (*p*)**	**U (*p*)**
VIQ	78.7 (12.3)	72.5 (8.6)	489.5 (0.021)*	-1.02 (.309)
PIQ	78.8 (15.0)	69.7 (8.8)	448.5(0.009) **	-.48 (.629)
FSIQ	76.9 (13.5)	68.8 (8.4)	410.5(0.003) **	-.78 (.434)
VCI	76.5 (12.1)	70.0 (9.4)	457.0(0.008) **	-1.44 (.154)
POI	79.7 (13.9)	70.1 (7.9)	410.5 (0.003) **	-.85 (.395)
WMI	84.5 (12.4)	78.4(7.8)	464.5 (0.014)	-.69 (.487)
PSI	87.1 (13.7)	80.9 (11.5)	456.0 (0.016)*	-.547 (.586)

Note. [a] SCI Group n=47; [b] controls n=35; [c] SCI Group n=55; [d] controls n=34; [e] SCI Group n=46; [f] controls n=35; [g] SCI Group n=41; [h] controls n=33; [i] SCI Group n=46; [j] controls n=34; [k] SCI Group n=53; [l] controls n=35; .[m] SCI Group n=51; [n] controls n=36; [o] SCI Group n=51; [p] controls n=34; [q] SCI Group n=54; [r] controls n=35; [s] SCI Group n=56; [t] controls n=35; [u] SCI Group n=12; [v] controls n=2; [w] SCI Group n=43; [x] controls n=33; [y] Adjusted for age, education and income using multiple linear regression.
CI (.95) * $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

Performance on the RTCFT indicates that both the SCI group and the control group presented with possible visuographic memory deficits. The norm scores for the RTCFT are as follows: 33.6 for copy, 26.1 for immediate recall and 25.7 for delayed recall (Delaney et al., 1992 cited in Mitrushina et al.). South African (SA) norms for ages 31 to 40 years are as follows: 34.21 (2.25) for copy and 26.82 (5.96) for recall (Pillay, 2004). Mean scores for Black South African college students (age 23-40 years) is 36.00 for copy, 24.12 for recall and 27.12 for delayed recall (Pillay, 2006). The SCI group scored below the norm for copy, immediate recall and delayed recall. The controls performed better than the SCI group with copy and recall. There was a statistically significant difference (t=-4.080, p=0.000) between the SCI group and control group for the copy, with the SCI group scoring below the norm and the control group scoring almost within the local norms. This reveals that the SCI group, unlike the control group, presented with impaired visuospatial constructive ability. Males, of both the SCI group and the control group, performed better than the females on all three cognitive tasks.

Both the SCI group and the control group performed poorly on the Narrative Prose Memory Test. With this test, individuals with a Grade 11 education with a total score of 6 fall within the 1st percentile, a score of 22 falls within the 20th percentile whilst a score of 33 falls within the 80th percentile. Performance for both groups is within the 20th percentile, which indicates possible memory impairment. However, the SCI group performed better than the control group on this memory task. In addition, males of the SCI group performed better than the females, whilst males and females of the control group performed almost equally.

The Trail Making Test score interpretation is provided by Reitan & Wolfson, 1985 cited in Mitrushina et al. (2005). These authors provided score interpretation guidelines in the form of test completion times (in seconds), which correspond with severity ranges for part B only, as follows: 0–60 seconds is better than average, 61–72 seconds is normal, 73–105 seconds is mildly impaired, and greater than or equal to 106 seconds is seriously impaired. Performance significantly below the norms (Reitan & Wolfson, 1985 cited in Mitrushina et al., 2005) on the Trail Making Test, Part B, of both the SCI group and the control group indicate that both the groups present with deficits in scanning and visuo-motor tracking, divided attention, and cognitive flexibility. The significant impairments are also evident when the scores are compared to South African norms (age group 31-40 years), which are as follows: 38.04 (14.23) for trail A and 59.28 (18.88) for trail B (Pillay, 2004). However, the SCI group performed better on TMT A and TMT B than the control group and made fewer errors on TMT B. Females of the SCI group performed better than the males on TMT A and TMT B and made fewer errors on both A & B. Males of the control group performed better than females on TMT A; however, females performed better on B and made fewer errors. This indicates greater cognitive inflexibility in males of the control group.

Ruff & Parker, 1993 cited in Strauss et al. (2006) provided normative data for 358 adult volunteers for the Finger Tapping Test. Women in the age range 25–39 years had a mean score of 49.0 (standard deviation of 4.1) on the dominant hand and 44.6 (4.6) on the non-dominant hand, whilst those aged 40–54 had a mean score of 47.0 (5.6) on the dominant hand and 43.5 (5.2) on the non-dominant hand. Men in the age range 25–39 years had a mean score of 52.7 (6.8) on the dominant hand and 48.7 (5.7) on the non-dominant hand whilst those aged 40–54 had a mean score of 54.3 (5.7) on the dominant hand and 48.9 (5.8) on the non-dominant hand. Males and females of both the SCI group and the control group performed two standard deviations below the mean (Ruff & Parker, 1993 cited in Strauss et al., 2006) on the Finger Tapper Test, indicating possible impairment in manual motor speed as well as subtle motor and other cognitive impairments. This is also apparent when the scores are compared locally (Black SA college students age between 23-40 years) which are as follows: 39.52 (6.86) for the dominant hand and 34.84 (9.34) for the non-dominant hand (Pillay, 2006). The control group performed better than the SCI group on both the dominant hand and non-dominant hand. Performance was higher in females than males of both the SCI group and the control group on both dominant and non-dominant hands.

The SCI group and control group performed below the norms (Stuss et al., 1998 and Dikmen et al., 1999 cited in Mitrushina et al., 2005) as well as below the SA norms (Pillay, 2004, 2006) on the Controlled Oral Word Association Test (FAS), indicating possible deficits in word fluency for both groups. Stuss et al., 1998 cited in

Mitrushina et al. (2005) provided normative data for the FAS total score stratified by age and gender. The mean score for males was 53.2 (13.1) and females was 48.4 (10.3) for those in the age group 21–39. With those in the age group 40–64, the mean score for males was 44.1 (10.2) and females was 42.7 (11.0). Dikmen et al., 1999 cited in Mitrushina et al. (2005) also provided FAS data for a group of normal, neurologically stable adults. Those aged 28.5 obtained a FAS total mean score of 43.25 (10.75). SA Norms for the FAS total mean score provided by Pillay (2004) for ages 30-39 years are as follows: 34.00 (12.45) for females and 35.40 (12.72) for males. Black college students (age 23-40 years) obtained a FAS total mean score of 32.25 (3.40), (Pillay, 2006). The SCI group obtained a higher FAS total score (26.02) than the control group (23.03), showing better word fluency ability. In addition, the SCI group performed significantly higher (t=2.118, p=0.037) on the animal naming task compared to the control group.

There was a significant difference (t=2.565, p=0.012) between the SCI group and the control group on the SDMT test performance, with the SCI group performing better than the control group. However, the scores for both groups are significantly below the mean (Centofanti, C.C cited in Lezak et al., 2004; Pillay, 2004), which indicates possible impairment in scanning and visual tracking as well as divided attention, memory, perceptual speed and motor speed for both groups. Studies by Centofanti provided normative data for the SDMT for ages 18–74 years. The mean score was 53.6 (6.6) for ages 25-34 and 51.1 (8.1) for ages 35–44 for the written administration. Similar norms are provided by Pillay (2004) for participants in KwaZulu Natal. A mean score of 51.88 (14.78) was obtained for ages 21-30 years and 52.93 (17.69) for ages 31-40 years. Females of both the SCI group and the control group performed better than the males, signifying important gender differences between the groups.

The SCI group performance on the Seashore Rhythm Test was equivalent to the mean (> 26) (Gilandes, 1984) whilst the control group was significantly below the mean (t=2.205, p=0.012). According to the scoring guidelines of the Seashore Rhythm Test, a score of 21–25 indicates borderline impairment, 16–20 is mild impairment and less than 15 is indicative of severe impairment (Gilandes, 1984). This suggests that the SCI group presented with no deficits in non-verbal auditory perception whilst the control group presented with borderline impairment. The females in the SCI group showed no deficits in non-verbal auditory perception, whilst the females of the control group showed deficits. Males of both the SCI group and control group presented with deficits.

With the Stroop Colour and Word Test, both the SCI group and control group presented with t-scores less than 40 for Word, Colour, and Colour-Word. This indicates impairment in cognitive control, selective attention and cognitive flexibility for both groups. According to Golden and Freshwater (2002), a t-score of less than 40 is indicative of deficits in cognitive processes. The control group performed better than the SCI group with the word task; however, the SCI group performed better on the Colour and Colour-Word tasks. Females of the control group performed higher than females of the SCI group with the word task and colour task. There was no gender differences in the word task with the SCI group; however, males showed greater performance than females with colour and Colour-Word tasks. With the control group, females performed higher than males on all three tasks. This indicates that males of the control group probably presented with greater cognitive deficits than females.

The SCI group and the control group performed below the norms (Schmidt, 1996 cited in Groth-Marnat, 2003 and Pillay, 2004) for the RAVLT which indicates clinically significant deficits in immediate memory, total learning and delayed recall. According to the norms (Schmidt, 1996 cited in Groth-Marnat, 2003) for the standard administration of the RAVLT, the mean for immediate memory (T1) is 7.0 (1.8), total learning (Trials 1–5) is 56.1 (7.3), delayed recall (T8) is 11.3 (2.8) and recognition (T9) is 14.3 (1.1) for ages 20–29. The mean for ages 40–49 is 6.6 (1.7) for immediate memory, 51.1 (8.6) for total learning, 10.2 (2.8) for delayed recall, and 14.0 (1.4) for recognition. RAVLT norms provided by Pillay (2004) for Black South Africans for trail 1 is as follows: 8.00 (1.64) for ages 21-30 years and 6.50 (1.88) for ages 31-40 years. Although both the SCI group and the control group responses are in keeping with normal functioning on the recognition trial, there was significant difference ($t=2.846$, $p=0.006$) between the two groups, with better performance by the SCI group. Males of the SCI group performed higher than females on all trials. However, with the control group, the females performed better than the males on all trials, with almost similar performance on delayed recall and recognition trial.

The SCI group and the control group performed below the mean (Trites, 1977 and Pillay, 2006) on the Grooved Pegboard for both dominant hand and non-dominant hand. The mean score for ages 20–29 is 63.40 (7.90) for the dominant hand and 69.10 (18.70) for the non-dominant hand and for ages 40–49 is 63.50 (7.20) for the dominant hand and 69.05 (9.80) for the non-dominant hand (Trites, 1977). Normative data provided by Pillay (2006) for Black SA college students aged 23 to 40 years is as follows: 67.40 (8.85) for the dominant hand and 89.20 (22.64) for the non-dominant hand. This indicates possible difficulties with hand-eye co-ordination and motor functioning for both groups, as they took longer to complete the task than the norm.

Females of the SCI group performed worse than males for both dominant and non-dominant hands; however, males of the control group performed worse than females on both tasks.

In terms of intellectual functioning measured by the SPM, both the SCI group and control group fell in the 10th percentile (Grade 4) (Raven, Court and Raven, 1983) which is definitely below average in intellectual capacity. Individuals who are 30 years old and obtain a raw score of 26 fall in the 10th percentile, which is Grade IV. Those that are 40 years old and obtain a raw score of 23 also fall within the 10th percentile. A score at or below the 25th percentile is regarded 'definitely below average' in intellectual capacity (Raven, Court and Raven, 1983). With those measured by the WAIS III, both the SCI group and control group performed below the South African norms (Claassen, Krynauw, Paterson and Mathe, 2001) on all domains. The means for the South African norm group is as follows: verbal IQ (96.09), performance IQ (93.87), full scale IQ (94.79), verbal comprehension index (96.46), perceptual organisation index (96.60), working memory index (97.88), and processing speed index (91.51), (Claassen et al., 2001). There was a significant difference in the performance of the SCI group and control group in verbal IQ (U=489.5, p=0.021), working memory (U=464.5, p=0.014), processing speed (U=456.0, p=0.016), and a highly significant difference in performance IQ (U=448.5, p=0.001), full scale IQ (U=410.5, p=0.003), verbal comprehension (U=457.0, p=0.008), and perceptual organisation (U=410.5, p=0.003), with the SCI group performing better on all domains. Males of the SCI group performed better than females on all domains of the WAIS III. Similar results were found with the control group, except for working memory where there was almost equivalent performance with the males and females.

However, statistical analysis controlling for the effects of confounders such as age, education and income revealed significant changes after adjustment for the WAIS III (Table 12). Hence, it can be concluded that age, education and income have affected the outcome of the WAIS III to some extent. The validity of the current South African norms for the WAIS III is considered questionable. The WAIS III may need validation for the South African population.

Individuals with impaired upper-limb functioning, such as those with quadriplegia or upper limb amputations, were exempt from tests that required full use of hands, such as the Finger Tapper Test, due to the physical limitations. As discussed in Chapter 4, where possible, tests that measured similar constructs but were administered differently were given to those with limited hand function, such as the SPM instead of the WAIS III. This is part of the reason for the variations in the number of participants as indicated in the footnote below Table 12.

The statistically adjusted differences (adjusted p values) for the effects of variables which varied significantly between the SCI group and control group, such as age, education and income, are presented in Table 12 for the neuropsychological tests. There was a change in significance after adjustment for the following tests: RTCFT (Immediate Recall), RTCFT (Delayed Recall), COWA (Animal), SDMT, Seashore Rhythm Test, and the WAIS III. Hence it may be concluded that age, education and income have affected the outcome of these tests to some extent. However, most of the other neuropsychological tests, such as the Narrative Prose Memory, Trail Making Test, Finger Tapper Test, Grooved Pegboard, Stroop, RAVLT, and SPM, were not significantly influenced by differences in age, education and income between the groups.

5.5 Comparisons of Demographic, Psychological and Neuropsychological Variables with PTSD

Psychological and neuropsychological variables associated with PTSD (PTSD+) and without PTSD (PTSD-) for the SCI group and the control group are presented in Tables 13 and 14.

Table 13: *Comparisons of PTSD and psychological variables for the SCI group and control group*

	SCI Group			Control Group		
	PTSD-	PTSD+		PTSD-	PTSD+	
	Mean (SD)	Mean (SD)	Differences t (*p*)	Mean (SD)	Mean (SD)	Differences t (*p*)
HADS						
Anxiety T_1	6.86 (3.89)	9.04 (4.93)	-6.39 (.000)***	4.05 (3.52)	8.85 (4.49)	-2.99 (.004)**
Depression T_1	5.55 (3.26)	7.38 (3.93)	-3.99 (.000)***	6.47 (4.33)	8.30 (3.40)	-1.49 (.140)
Anxiety T_2	4.28 (3.31)	8.58 (4.18)	-4.02 (.000)***	3.22 (3.28)	8.70 (4.40)	-3.84 (.000)***
Depression T_2	5.16 (3.70)	8.46 (3.84)	-3.03 (.004)**	3.06 (3.69)	9.15 (4.09)	-4.35 (.000)***
GHQ-28						
Total T_1	18.17 (9.32)	32.50 (21.61)	-6.60 (.000)***	17.58 (13.68)	30.15 (16.50)	-4.16 (.000)***
Total T_2	13.41 (11.39)	25.88 (17.08)	-3.05 (.004)**	14.28 (10.31)	31.15 (16.69)	-3.05 (.004)**
BDI II T_1	10.11 (9.79)	21.46 (12.93)	-4.61 (.000)***	9.56 (9.93)	17.50 (11.87)	-3.63 (.001)**
BDI II T_2	5.52 (5.77)	19.65 (12.05)	-5.46 (.000)***	6.83 (7.62)	16.68 (13.84)	-5.46 (.000)***

CI (.95) * $p < 0.05$. ** $p < 0.01$. ** $p < 0.001$.

Comparisons between PTSD and other demographic, psychological and neuropsychological variables of the SCI group and control group were done using bivariate analysis. There was not a statistically significant association between PTSD and any one of the medical diagnosis of paraplegia, quadriplegia, paraparesis or quadriparesis. This implies that PTSD can occur in SCI regardless of the type of SCI. In addition there was no significant correlation between PTSD and any of the demographic variables for both the SCI group and the control group. However, high levels of PTSD were positively correlated with psychological variables of anxiety (HADS) and depression (BDI II) for both groups. PTSD was also associated with psychological distress (GHQ-28) at both time points (Table 13). The groups with PTSD (PTSD+) showed poorer performance (higher scores) on most psychological measures when compared to the group without PTSD (PTSD-). Significant differences between the group with PTSD and the group without PTSD can be seen for both the SCI group and for the control group on almost all psychological measures (Table 13).

Table 14: *Comparisons of PTSD and neuropsychological variables for the SCI group and control group*

	SCI Group			Control Group		
	PTSD-	PTSD+		PTSD-	PTSD+	
	Mean (SD)	Mean (SD)	Differences t (*p*)	Mean (SD)	Mean (SD)	Differences t (*p*)
RTCFT						
Copy	31.71 (3.41)	28.98 (4.85)	2.188 (0.03)*	33.92(2.61)	34.53(1.94)	-0.73(0.47)
I Recall	24.25 (6.33)	19.13 (6.68)	2.607 (0.01)*	24.75(8.68)	23.94(5.93)	0.29(0.77)
D Recall	22.15(8.24)	18.45(7.56)	1.54 (0.13)	22.46(9.33)	22.24(7.83)	0.70(0.95)
NPM						
Recall	11.12(4.40)	11.20(4.64)	0.75(0.95)	11.92(5.33)	10.69(3.93)	0.51(0.49)
Delayed	10.69(5.27)	9.20(4.97)	0.80(0.30)	10.92(5.44)	9.44(4.20)	0.19(0.42)
Total	21.81(9.12)	20.40(9.18)	0.93(0.59)	22.83(10.56)	20.12(7.87)	0.27(0.44)
TMT						
TMT A	64.82(47.54)	86.32(82.39)	0.28(0.28)	90.75(87.69)	86.47(44.50)	0.17 (0.86)
TMT B	144.02(104.92)	203.48(152.32)	0.07(0.14)	137.45 (117.68)	196.81(186.11)	0.36(-59.35)
FINGER TAPPER TEST						
Dominant hand	35.76(9.21)	31.31(7.47)	1.65(0.11)	31.92(10.26)	33.86(14.58)	-0.39(0.70)
Non dominant hand	33.69(8.83)	32.51(6.92)	0.46(0.65)	29.96(11.31)	32.47(7.30)	-0.70(0.49)
GROOVED PEGBOARD						
Dominant hand	86.30 (41.83)	92.12 (37.76)	-0.48 (0.64)	88.67 (22.26)	92.29 (32.04)	-0.34 (0.74)
Non dominant hand	92.83 (21.23)	101.89 (35.50)	-0.48 (0.63)	96.82 (23.31)	85.41 (17.31)	1.46 (0.16)
COWA						
FAS total	27.04(10.50)	21.40(10.28)	1.92(0.06)	25.50 (10.10)	20.82 (8.99)	1.31 (0.20)
SDMT	36.92 (9.61)	28.14 (11.15)	2.93(0.005) **	28.83(13.79)	25.41(8.59)	0.82(0.42)
SRT	27.20(8.69)	26.43(14.50)	0.22(0.83)	23.00(5.43)	21.13(5.35)	0.91(0.37)

STROOP						
Word	35.58(9.96)	29.86(11.48)	1.81(0.07)	37.64(9.85)	32.31(10.05)	1.37 (5.32)
Colour	32.16(13.65)	26.14(12.06)	1, 59(0.12)	25.64(13.12)	24.88(12.10)	0.16(0.88)
Colour-Word	42.63 (14.94)	32.76 (8.67)	2.66(0.01)*	38.55(8.01)	34.19(9.39)	1.26(0.22)
RAVLT						
Immediate memory	6.23(9.51)	5.28(6.39)	0.42(0.68)	3.17 (1.03)	4.18 (1.88)	-1.69 (0.10)
Delayed recall	10.04(22.76)	9.20(2.58)	1.12(0.27)	9.25(2.18)	9.41(2.60)	-0.18(0.86)
Best learning	9.68 (2.54)	7.76 (2.296)	2.801 (0.007) **	9.00 (2.70)	9.12 (2.34)	-0.13 (0.90)
Total learning	38.65 (12.87)	31.60 (9.51)	2.219 (0.03)*	32.75 (7.54)	33.24 (7.84)	-0.18 (0.87)
Proactive learning	4.72 (1.969)	3.76 (1.128)	2.115 (0.04)*	3.64 (1.50)	3.69 (1.25)	-0.10 (0.92)
Recognition	30.50 (8.36)	28.00 (8.507)	2.215 (0.03)*	30.50 (8.36)	28.00 (8.51)	0.79 (2.5)
WAIS III						
VIQ	83.63 (13.78)	73.16 (9.78)	2.702 (0.01)*	77.09 (8.42)	68.76 (6.57)	2.932 (0.007)*
PIQ	86.26 (14.85)	69.94 (11.38)	3.74 (0.001) **	73.73 (11.76)	68.00 (6.38)	1.67 (0.11)
FSIQ	83.58 (14.42)	69.17 (9.57)	3.560 (0.001) **	73.64 (10.00)	65.65 (5.35)	2.757 (0.01)*
VCI	81.00 (12.52)	71.63 (11.63)	2.30 (0.02)*	74.73 (10.89)	66.59 (6.46)	2.237 (0.04)*
POI	84.47 (13.72)	73.28 (12.22)	2.62 (0.01)*	73.73 (9.68)	68.41 (6.41)	1.75 (0.09)
WMI	89.21 (11.87)	78.00 (11.34)	2.93 (0.006) **	80.27 (5.68)	75.94 (8.53)	1.48 (1.15)
PSI	95.16 (13.82)	79.88 (9.64)	3.80(0.001)**	83.18(10.76)	77.29 (6.91)	1.77 (0.09)

Note: CI (.95) * $p<0.05$ $p<0.01$** $p<0.001$ *** T = time

Table 14 reveals that PTSD was significantly associated with some neuropsychological variables in the SCI group and control group. Significant differences between the groups with PTSD (PTSD+) and the group without PTSD (PTSD-) can be seen for the RTCFT (copy and immediate recall), SDMT, Stroop (Colour Word), RAVLT, and WAIS III for the SCI group. Hence, in the SCI group, PTSD was significantly associated with lower verbal IQ, performance IQ, verbal comprehension, perceptual organisation, working memory, processing speed, learning, concentration, and attention, which are variables measured by these tests.

In the control group there were significant differences between the PTSD+ and PTSD- groups only for the WAIS III. PTSD was also associated with poorer cognitive functioning on the WAIS III: viz., verbal comprehension index, perceptual organisation index, working memory index, processing speed index, verbal IQ, and performance IQ for the SCI group. Those with PTSD performed poorer (lower scores) than those without PTSD on the WAIS III for the SCI group. Significant differences between the PTSD+ and PTSD-groups can be seen for all measures of the WAIS III for the SCI Group (Table 14). However, with the control group there were only three variables of the WAIS III, viz., verbal IQ, full scale IQ and verbal comprehension index, that showed significant differences between the PTSD+ and PTSD-. The group with PTSD also performed poorer (lower scores) than the group without PTSD on the WAIS III for the control group.

Tables 13 and 14 highlight the negative impact of high levels of PTSD on psychological and cognitive functioning in patients with trauma. PTSD showed greater impact on psychological and especially neuropsychological functioning in SCI group than on the control group.

5.6 Summary

At the beginning of this thesis various hypotheses were stated which this study set out to test. In the light of these results the following may be concluded:

The first null hypothesis (H_{01}) states that SCI has no impact on cognitive functioning. The results of the study indicate that both the SCI group and the control group presented with impaired cognitive functioning on almost all cognitive domains following their trauma. Thus, although the SCI group presented with cognitive deficits following the SCI, the controls also presented with such deficits, indicating that maybe other factors such as a trauma-related medical condition could impact on brain functioning. Hence, we fail to reject the first null hypothesis.

The second null hypothesis (H_{02}) states that patients with SCI have no associated psychological conditions. The results of the study indicate that patients with SCI presented with depression, anxiety and PTSD at both time points. Therefore we reject this null hypothesis and accept the alternate hypothesis that patients with SCI have associated psychological conditions.

The third null hypothesis (H_{03}) of this study stated that patients with SCI have no associated neuropsychological deficits. Neuropsychological assessment results revealed impaired functioning in the cognitive domains of perceptual organisation/visuospatial functioning, memory, attention and concentration, processing/motor speed, verbal comprehension, language functioning, learning and intellectual functioning. Hence, the third null hypothesis was also rejected and the alternate hypothesis that patients with SCI have associated neuropsychological deficits is accepted.

5.7 Conclusion

The results of this study provide a rich description and understanding of behaviour, psychological and cognitive functioning following SCI. In addition, the results provide an explicit understanding of the relationship between SCI and cognitive functioning and the resulting psychological conditions. The findings have significant implications for treatment, intervention and rehabilitation and are discussed further in the next chapter.

Chapter 6
Discussion

6.1 Introduction

The results of this study underline the psychological and neuropsychological consequences of SCI and the relationship between SCI and cognitive functioning. This knowledge can be utilized to improve psychological treatment and intervention following SCI, which is the aim of this study. In addition this information can be used to inform policy making.

6.2 Demographics

6.2.1 Gender, Age and Marital Status

There were more male than female participants for both the group with SCI and the control group. The large gender differences among the SCI group are in keeping with findings in the literature and other studies reported locally (Marais, 1993; Colley, 1997) and internationally (Webster & Kennedy, 2007; Kennedy & Rogers, 2000). In the study by Marais (1993), 28 (82%) of the sample of SCI patients were male and 6 (18%) female. In the study by Colley (1997), nearly three quarters of the respondents (n=37) were male, and 13 were female. The sample in the study by Kennedy and Rogers (2000) comprised 104 SCI patients, of whom 19 were women and 85 men. According to Webster and Kennedy (2007), for every female spinal cord injury, there are four male injuries.

Zigler & Capen (1998) state that "Spinal cord injury is predominantly a disease of young men." p.3. The gender and age differences can be attributed to younger males being higher risk takers. As discussed further below, the majority of SCIs are caused by road traffic accidents and acts of violence. Younger males are more likely to engage in risky behaviour such as racing while driving or getting into fights, which can result in severe injury such as SCI. According to Zigler and Capen (1998), risk-related activities are associated with young males. These risk-related SCIs in younger men are in keeping with the aetiology of the majority of spinal cord injuries in South Africa (road traffic accidents, gunshot wounds, etc.) as evidenced by the current study.

There was a significant difference in age ($p<0.001$) between the SCI group and the control group (Table 1). The SCI group was much younger, with a mean age of 29 years, whilst the control group were older, with a mean age of 42 years. The findings with regard to the age of individuals with traumatic SCIs are similar internationally, where the mean age is 28 (Webster & Kennedy, 2007). The age differences between the groups may be attributed to the differences in aetiology of spinal cord injury and amputations. The SCI in this study was related mainly to accidents resulting from risky behaviour which are usually associated with younger individuals. However, amputations, although traumatic events in themselves, resulted mainly from medical causes such as gangrene. The significant differences in age between the groups may have influenced some of the results of the study. However, after statistically adjusting for the effects of the differences in age on test performance, age did not impact on the performance on most psychological tests. However, age influenced the performance of a few neuropsychological tests viz. RTCFT, RAVLT, COWA, SDMT, Seashore Rhythm Test and WAIS III.

A significant difference ($p<0.01$) was found in the marital status between the SCI group and the control group. The majority of participants (67.0%) from the SCI group were single whilst in the control group 45.6% were single (Table 1). There was a higher percentage of married individuals in the control group (31.6%) than in the SCI group (19.6%). The SCI group was a much younger group than the control group, thus it is to be expected that more individuals in the younger group will be single. It is more likely that younger individuals engage in risky behaviour that leads to traumatic SCI. Younger individuals who are unmarried and without children have fewer responsibilities in life, and it is likely that such individuals, not yet breadwinners, would tend to seek fun and excitement by engaging in dangerous activities such as illegal drag racing or diving into shallow pools under the influence of alcohol.

6.3 Cultural and Language Diversity

In terms of ethnicity the majority of participants in the SCI group (77.7%) and control group (73.1%) were Blacks (see Table 1). The second largest ethnic group were Indians, followed by Whites and Coloureds. IsiZulu was the spoken language for the majority of participants in both the SCI group (73.0%) and the control group (62.0%), which is to be expected considering that the KZN is historically the home of the Zulu nation and monarchy. The ethnic and language ratio is in keeping with the population for KZN as outlined by Census 2001 (Statistics South Africa, 2010).

6.4 Socio-economic Status

A highly significant difference in education ($p<0.01$), occupation ($p<0.001$) and income ($p<0.001$) was found between the groups (Tables 1 & 2). The SCI group were more highly educated, performed more skilled and professional work and were higher income earners. There were fewer individuals in receipt of a disability grant in the SCI group (7.2%) than in the control group (30.8%). Persons with SCI need to be assisted with disability grants as soon as possible after their injury, since loss of income and financial burden are precipitating factors in maladjustment following SCI. Because survival needs will have to be met first, SCI patients living in poverty are less likely to take initiatives such as seeking further education to improve their quality of life, even though it will be difficult for an uneducated person with SCI to find employment in South Africa in the prevailing climate of high unemployment, retrenchments and economic recession. This makes it all the more crucial for the state to provide such individuals with the support they need simply to stay alive, let alone improve the quality of their lives.

The significant differences in age, marital status, education, occupation, income and physical ability between the SCI group and the control group may have influenced the results of this study in systematic ways. Some of the differences in psychological and neuropsychological functioning found between these groups may be attributable to the differences in demographics between the groups. Statistical analysis adjusting for the effects of some of these confounding variables have indicated which tests have been influenced by the differences in the groups (Tables 4, 5, & 12). Hence some of the results of the study, viz. RTCFT, RAVLT, COWA, SDMT, Seashore Rhythm Test and WAIS III, which are neuropsychological measures, must be interpreted with caution.

However, due to this study being based on the available sample at that time, the significant differences in demographics of the two groups with almost similar medical conditions, as a result of the loss of limb, are an interesting finding. The results of this study reveal that SCI is most likely to occur significantly earlier in life than an amputation.

A majority of participants in the SCI group (64.3%) and the control group (63.2%) were from urban/semi-urban areas (Table 1). Since the SCI group were more skilled, with higher education and income (Table 2 & 3), it would be expected that they will be more urbanised. Zigler and Capen (1998) state that rural areas do not experience SCI as frequently as urban areas, and they indicate as a contributing factor a higher incidence of urban violence. This pattern is also evident in South Africa, where high levels of unemployment especially amongst the youth contribute to heightened alcohol abuse, crime and violence in more affluent communities.

A possible explanation for the control group also having an urban/semi-urban background could be that they are accessing the services of an urban hospital close to where they live. Because of the regional disparities in healthcare in South Africa that originate from the apartheid period when rural areas were poorly supported with health services, patients were forced to travel long distances to access specialised health services located in urban areas. Many, especially Black Africans who were previously disadvantaged, have chosen to migrate to urban areas where they have access to healthcare and better jobs.

An interesting finding in this study is that almost two-thirds of the SCI participants were Black South Africans of low income (household income of less than R3000 per month). This finding substantiates the particular social issues in relation to health care in South Africa, a point made in the introduction and literature review.

The effects of racial segregation of the health system under the previous apartheid regime, as well the disparity in healthcare, have not been addresses and is seriously impacting on the lifes of many, particularly the disenfranchised. The point that healthcare in South Africa favours those that are wealthy is substantiated by the fact that mainly individuals with low income may only access the under-resourced public sector hospitals.

6.5 Aetiology and Severity of SCI

A majority (56.5%) of spinal injuries in this study were caused by road traffic accidents (RTA), followed by violence and crime-related gunshot wounds (16.1%), as presented in Table 3. This is to be expected considering the high rates of RTA and crime in South Africa. This aetiological trend in traumatic SCI is much the same internationally, where approximately half (47%) of SCI are caused by RTAs, and in the USA, where 15% are caused by criminal assault (Webster & Kennedy, 2007). However, the percentage of RTA and violence-related SCI found in this study, conducted in KZN, South Africa, is slightly higher compared to international figures. This could be related to weaker legislation and poor law enforcement in South Africa. According to Hope (2005), individuals who are paralysed because of violence-related gunshot injury are affected by multiple traumatic physical and psychosocial losses and may need psychological and emotional assistance throughout their adjustment.

More than half (60.7%) of the SCI participants presented with paraplegia (Table 3), most of whom (46.4%) sustained injury at the thoracic vertebra level. These participants presented most often (42.9%) with severe physical injury (Frankel Grade A). Understanding the grading system of completeness in SCI is fundamental for psychologists working with such individuals, since it provides an idea of the patient's prognosis for recovery of motor function following SCI and is crucial in helping the patient with acceptance of and adjustment to their condition from early stages.

In the USA there appear to be more individuals with quadriplegia than paraplegia. According to Eismont (1998), approximately 47% of SCIs result in paraplegia and 53% in quadriplegia. In addition, a greater number of penetrating wounds of the spine, such as gunshot wounds, result in complete injuries (more severe than incomplete injuries) and there is a greater shift towards thoracic spine injuries (Eismont, 1998). Complete injuries of the spine, as explained in Chapter 2, refers to complete paralysis, where there is a complete loss of sensation and voluntary movement below the level of injury, whereas with incomplete injuries there is some degree of sensory or motor function present. As mentioned above, this study has found that a high percentage of traumatic SCI was related to gunshot wounds. Eismont predicts that gunshot wounds of the spine will continue to increase in incidence and severity in the civilian population.

In the USA legislation against alcohol use and laws requiring seat belt use have reduced the incidence of vehicle-related spinal trauma (Zigler & Capen, 1998). In addition, safety programs for water sports (e.g., scuba diving) and contact sports (e.g., rugby) seeking to reduce the risk of SCI (Zigler & Capen, 1998) have been implemented internationally for more than a decade. South Africa needs to follow suit and rigorously adopt such measures, with safety programs and stricter laws regarding crime and gun control, in order to reduce trauma-related SCI in this country. The new Firearms Control Act, introduced in July 2009, which seeks to curb the use and possession of illegal firearms and ensure competency in the use of firearms is a step in the right direction for South Africa. However, the theft of firearms, especially from places likes police stations, remain a huge problem. There is an urgent need to address corruption as well as safety and security in this country.

The findings of this study are in keeping with previous research (Colley, 1997; McGill, 1997; Van Niekerk, 1995) on the psychological impact of SCI in South Africa (indicating poor outcome) as well as international studies (Kennedy & Rogers, 2000; Krause et al., 2000; Nielsen, 2003). Colley (1997) found that SCI patients reported high frequencies of social and affective elements (depression, low-self esteem, suicidal responses and partner relationship problems). In a study of coping behaviour and social support in Black patients with paraplegia, McGill (1997) found that patients have a relatively poor outcome compared to Western outcome studies. Van Niekerk (1995) found considerable psychological difficulties and poor adjustment following SCI. A longitudinal study by Kennedy and Rogers (2000) revealed that large numbers of patients with SCI scored above clinical cut-off scores for anxiety and depression These authors emphasize the need for appropriate psychological care in SCI rehabilitation settings. Krause et al. (2000) found that symptoms of depression are highly prevalent after SCI. A study by Nielsen (2003) showed that individuals with recent onset SCI are at increased risk of having PTSD and co-morbidities such as depression and other symptoms of emotional distress.

6.6 The Impact on Cognitive Functioning of Injury to the Spinal Cord

According to Kolb and Wishaw (2003), the tracts of the spinal cord carry information to and from the brain. Hence, the brain and the spinal cord are intricately linked. Therefore it can be assumed that damage to the spinal cord will have some impact on the brain. Also, a complete spinal cord injury results in loss of motor and sensory function, as well as pulmonary, genitourinary, and skin systems (Zigler & Capen, 1998). In addition, diseases of the spinal cord are associated with reactive changes in cerebral cortex activation (Cramer et al., 2001). It has also been found that the motor cortical system is reorganized in humans after traumatic quadriplegia (Levy Jr. et al., 1990) Considering multi-system impairment, reactive changes in cerebral cortex activation, and the reorganization of the motor cortical system following SCI, this study set out to investigate whether injury to the spinal cord impacts on cognitive functioning. However, we failed to reject the null hypothesis which stated that SCI has no impact on cognitive functioning. This conclusion was reached on the grounds that both the SCI group and the control group presented with impaired cognitive functioning on almost all cognitive domains following their trauma. This may be attributed to other factors such as a trauma-related medical condition. However, the SCI could have also contributed to cognitive impairment. According to Kolb and Wishaw (2003), severe behavioural impairments may follow SCI because the spinal cord depends on the brain in controlling both simple and complex behaviour. The impact of SCI on cognitive functioning needs to be further investigated by using a non-trauma-related control group. Understanding the effects of injury to the spinal cord on cognitive functioning is critically important for spinal rehabilitation, where patients are required to learn and adapt to new skills such as manoeuvring a wheelchair. Some of the more complex skills such as driving an adapted vehicle require intact cognitive functioning.

6.7 Psychological Functioning and Adjustment

The levels of depression, anxiety and PTSD were found to be high at T_1 (immediately following the SCI) and T_2 (after a period of a month). This finding has strong implications for the psychological management of both acute and rehabilitative phases of SCI. According to the Transactional Model of Stress and Coping discussed in Chapter 3, treatment compliance can be influenced by emotional reactions such as worry, depression and denial. Psychological intervention needs to commence soon after the injury and progress to the end of rehabilitation for these psychological symptoms to be alleviated.

6.8 Depression and Anxiety

High GHQ-28 scores (Table 4) for both the SCI and control group indicate that both groups present with clinically significant levels of psychological difficulty initially following their injuries. The SCI group presented with higher scores than the control group, indicating higher levels of distress. According to Kennedy and Evans (2001), the greater severity of SCI and the necessity for such patients to undergo rehabilitation for lengthy periods post trauma is likely to influence the expression of trauma-related distress in the SCI population relative to other accident victim populations. Hence a higher percentage of participants in the SCI group (65.3%) compared to the control group (34.7%) felt that the disability impacted on their general satisfaction with life. However, although both groups show improvement with time, the SCI group showed greater improvement than the control group (see Figures 10, 11 & 13).

Females with SCI presented with higher GHQ-28 scores (see Tables 4 & 5) than males at both time points. This indicates that females had greater levels of psychological distress than males following SCI. According to Krause et al. (2000), women with SCI are more likely than men to report sadness and display overt signs of depression such as tearfulness. However, according to the gender vulnerability theories of mental illness, women are twice as likely to develop depressive illnesses than men. These theories, as discussed in Chapter 2, range from biological theories and social theories to psychological theories. Hence, factors such as hormonal differences, the effects of childbirth, learned helplessness, etc. may contribute to making women in general, irrespective of country, culture or physical illness, more vulnerable, than men, to psychological distress.

Clinically significant BDI II scores, indicating moderate levels of depression, were found in the SCI patients at both time points (see Tables 4 & 5). However, there is a slight improvement in depression over time. The findings are similar to a study by Krause et al. (2000), which demonstrated that 48% of participants in their study reported clinically significant symptoms of depression. Palmer, Kriegsman and Palmer (2000) state that depression in individuals with SCI can become a fatal illness as the risk of suicide is more than five times greater for people with SCI than for the general population.

According to the diathesis-stress model (Boekamp et al., 1996), the factors that can increase an individual's risk of depression following SCI include biochemical factors, chronic pain and the frequency of stressful life events. The Copenhagen-Medici Model in Positive Psychology and Positive Health proposes that a lack of meaning is not merely a symptom but actually a cause of depression, which means that building interventions will aid in relieving depression (Seligman et al., 2006). The high rates of depression following SCI found in this study highlight the need in South Africa for intensive psychological intervention throughout the adjustment process. Depressive disorders are highly responsive to treatment with psychotherapy and antidepressant medication (Palmer et al., 2000). Clinical psychologists should be employed at all spinal units and spinal rehabilitation centres. In addition they should be specifically trained to work with individuals with SCI and to implement psychological rehabilitation and mental health promotion programmes.

Both the SCI group and the control group were found to be presenting with clinically significant levels of anxiety at time point 1 (see Table 4.) Females of the control group presented with higher anxiety and depression than the males. The SCI group showed little improvement in anxiety and depression with time. As mentioned earlier by Kennedy and Evans (2001), this is most probably related to the SCI group having to spend lengthier periods in rehabilitation, which is likely to influence the expression of trauma related distress. An interesting point made by Palmer et al. (2000) is that SCI is unlike most acute medical crises, such as a broken leg or appendicitis, as it cannot be "fixed" and its consequences do not end when the immediate medical crisis is over. The severity and chronic nature of a SCI can precipitate poor emotional adjustment following the injury. According to the Transactional Model of Stress and Coping, a person is likely to experience anxiety and situation-specific distress when a stressor is appraised as having a high impact on their goals or concerns. Individuals with SCI who have become confined to a wheelchair are faced with re-examining their goals and life ambitions. In addition, this model also emphasizes that guilt and depression, rather than anxiety, are generated if the person perceives himself or herself as responsible for the stressor. This may occur in SCI cases where the injury may be the result of negligent or high-risk-taking behaviour, such as a car accident caused by speeding.

An interesting finding is that Figures 8 and 14 show the levels of depression on the HADS and BDI II at T_1 are at variance. The SCI group scored higher on the BDII and the control group scored higher on the HADS. The differences found may be attributed to the differences in the instruments themselves. As mentioned in

Chapter 4, HADS excludes physiological symptoms confounded by injury and illness (Turner & Lee, 1998) whilst the BDI II is a cognitive measure and may inflate estimates because of the items with a somatic base, such as pain, weight loss, etc. Considering the substantial degree of physiological damage and impairment that occurs in SCI (Duff & Kennedy, 2003), it may be possible that the BDI II results are inflated, hence showing higher levels of depression. Hence the HADS is likely to be a more reliable instrument in assessing depression in individuals with SCI.

6.9 PTSD

Patients with SCI presented with high levels of posttraumatic stress symptoms at both time points (see Figures 16 & 19). In addition, moderate to severe levels of PTSD were found at both time points (see Figures 18 & 19). Females presented with higher levels of PTSD at both time point one and two. Trauma related distress was found to be significantly higher in female patients or patients with high levels of anxiety or depression (Kennedy, 2007). Palmer et al. (2000) state that symptoms of posttraumatic stress are common after any emotionally overwhelming situation. Individuals with recent onset SCI are at an increased risk of having PTSD, comorbidities such as depression and other symptoms of emotional distress (Nielsen, 2003). According to Kennedy and Evans (2001), trauma-related distress can jeopardize a person's ability to cope with their injury and will impact further on their quality of life. The sooner individuals with severe posttraumatic stress reactions talk about their experience and associated fears, and the more detail they are able to give, the less anxiety they are likely to experience in the future (Palmer et al., 2000). However, owing to the sensitive nature of posttraumatic stress and the dangers of re-traumatisation, intervention from a specially trained mental health practitioner is required. This once again highlights the role of clinical psychologists in the acute and rehabilitative phases of SCI.

6.10 Social Support and Social Functioning

The SCI group were generally satisfied with the level of social support they received (see Table 9). Even though social support diminished over time, they were still satisfied with the level of support as they relied more on themselves as a source of support, and did not look outwards for support. The diminished social support over time could be related to the stress and burden of caring for a chronically disabled person. The SCI group, being a younger group that are mainly single, still relied on their mothers as a main source of support. The control group, being older with more married individuals, received support mainly from siblings and spouses, and to a lesser extent from mothers. This could be due to their mothers being older and possibly sickly or deceased. Also, it is evident that social support does not remain static as there are many factors that can impact on the support. The Conceptual Model of the Relationship of Social Networks and Social Support to Health, discussed in detail in Chapter 3, postulates that social support is the main "protective" factor that makes individuals less vulnerable to the adverse effects of stress on health. Thus, considering the importance of social support in the adjustment to SCI, multiple sources of social support should be encouraged.

The SCI group showed significantly more social dysfunction ($p<0.01$) than the control group at time point one (see Table 4). Social support also plays an instrumental role in facilitating social functioning, coping and adjustment following SCI. According to the diathesis-stress model (Boekamp et al., 1996), adjustment following SCI may be strained by poor social support and the presence of family conflict. Hope and Botha (2005a) found that persons with paraplegia who have good social support during their hospital rehabilitation cope better with their traumatic ordeals. In addition, social activities and a support network, such as church and peer groups are important sources of social support, health and wellness (Putman, Geenen & Powers, 2003). The Conceptual Model of the Relationship of Social Networks and Social Support to Health further emphasizes that supportive ties can play a role in improving wellbeing and health, irrespective of stress levels, if the basic human need for companionship, intimacy, a sense of belonging, and reassurance of one's worth as a person, are met. The PSRC located in KZN has recognised the importance of social support and networking in the adjustment and rehabilitation following SCI. Regular social activities, such as visits to shopping malls, sporting activities, and support by religious groups and disability organisations such as QASA are planned as part of the rehabilitation program. The Leisure and SCI Adjustment Model, described in Chapter 3, emphasizes that activities that include leisure provides an opportunity for people to develop their skills and abilities, self concept and self-esteem. In addition leisure may indirectly influence adjustment to SCI through the generation of social support. The KZN Department of Health and faith leaders have recently forged partnerships in the fight against HIV and AIDS and health promotion (Ndaliso, 2010). According to the Department of Health, religious denominations, irrespective of their teachings, have a role to play in fighting HIV and other infections. This ideology needs to be adopted in other areas of health, such as the rehabilitation of patients with SCI, where faith and finding meaning are fundamental aspects for adjustment.

It is important to note that the normative data or cut-off scores used to determine whether psychological tests scores were high/low or clinically significant are based mainly on international studies as there are limited available South African norms for these tests. Hence, the results of these tests have to be interpreted with caution. However, despite there being limited local norms available, clinical use and experience suggest that the international norms are useful. However since these psychological instruments are widely used both in clinical practice and research the current study provides useful data to establish local norms. It is important that the limitations of using such tests with our population however be acknowledged.

6.11 Psychological Adjustment

An important finding of this study is the greater rate of improvement in psychological functioning in SCI patients compared to the control group (see Figures 10, 11, 12, 13, 16 and 18). The demographic differences between the groups, more especially the higher socio-economic status of the SCI group, may possibly be the major contributing factor to the SCI group showing a greater rate of improvement with time. Higher socio-economic status could mean access to better resources for coping and engaging in more leisurely activities, as well as less financial burden. According to the Leisure and SCI Adjustment Model, leisure has a positive influence on adjustment in individuals with SCI. However, the Cognitive Behavioural framework emphasizes that cognition is the prime catalyst in adjustment. According to this model, cognitive distortions, where cognitive tendencies in information processing distort the perception of the situation, impact negatively on adjustment. Hence, treatment is focused on changing the individuals' thinking.

However, as seen in Figure 8, there is a genuine "cross-over" in time trends between the groups. In addition there are also divergent time trends (Figure 9), where one group distinctively improves and the other group distinctively declines. When such patterns of cross-overs and divergence in time trends exist, then the acknowledged demographic differences can be considered to recede. The argument for this is that although initial or terminal levels may in partly be in relic of demographic differences, such an explanation does not so easily “reach” the differences in time trends when there is a crossover. Hence, the demographic differences between the groups alone may not be fully accountable for the different rates of adjustment between the groups. This is also substantiated by the statistical adjustment for the effects of the significant demographic differences between the groups. Following adjustment for confounding variables, it was found that there was no change in significance for most psychological variables (Tables 4 & 5).

6.12 Neuropsychological Functioning

Neuropsychological assessment revealed impaired functioning in the cognitive domains of perceptual organisation/visuospatial functioning, memory, attention and concentration, processing/motor speed, verbal comprehension, language functioning, learning, intellectual functioning as well as motor functioning. However, auditory perception remained intact. According to the theory of neocortical control of movement, as discussed in Chapter 3, the areas of the brain responsible for motor planning and sequencing involve the prefrontal cortex, the premotor cortex, and the primary motor cortex. Considering that deficits in motor functioning were found in this study, two things may be inferred. The first is that the motor areas of the brain may be affected in SCI and the second is that the loss of limb functioning in individuals with SCI may be related to injury or damage to the spinal cord as well as injury/damage to the brain. The results on neuropsychological functioning following SCI are similar to the findings by Hess et al. (2003) who showed that more than half of the SCI patients performed in the impaired range on 25% or more of the neuropsychological measures.

Poor performance on the copy of RTCFT (see Table 12) revealed significant deficits in visuo-spatial constructive ability in SCI groups. There was a highly significant difference ($p<0.001$) between the group with SCI and the control group, with the SCI group performing below the norm. Males in both groups performed better than females, indicating better visuo-spatial constructive ability in males. Men tend to score higher than women on Block Design, which is a visuospatial construction task (Snow and Weinstock, 1990, cited in Lezak et al., 2004).

Performance on the perceptual organisation index of the WAIS-III (see Table 12) revealed deficits in perceptual organisation in the SCI and the control group. However, a significantly better performance ($p<0.01$) was seen in the SCI group. Males of both groups had better perceptual organisational ability than females.

Performance on the working memory index of the WAIS-III (Table 12) also revealed deficits in working memory in the SCI and the control group. However, a significantly better performance ($p<0.05$) was seen in the SCI group. Age and education are factors that that can influence performance on memory tasks. The SCI group was a younger group with higher education. These factors may have contributed to the SCI group's higher performance on the memory tasks. However, statistical adjustment for the effects of confounders such as age, education and income (Table 12) indicated no change in significance with the Working Memory Index of the WAIS III. Hence, it can be concluded that the WMI was not influenced by age, education and income. Males of the SCI group performed better than females on this cognitive task. However, females presented with higher levels of depression and

PTSD. These psychological factors could have impacted on memory functioning in females.

Visuographic memory deficits were found in patients with SCI. Memory difficulty, as shown by poor immediate recall and poor delayed recall on the RTCFT (see Table 12), and memory impairment using the NPMT (Table 12) were also found. Deficits in memory functioning were also seen in poor performance on the SDMT (Table 12). Clinically significant deficits in immediate memory and delayed recall, as revealed by the performance on the RAVLT, were also found in patients with SCI. . This may be attributed to the high levels of psychological distress experienced following trauma. In addition, PTSD has been linked to physiological and structural changes within the brain. According to De Bellis et al. (2009), prefrontal cortex dysfunction has been associated with stress, as the stress response involves increased secretion of neurotranmitters which leads to symptoms of inattention, and impairments in executive functions, new learning and memory. The theoretical background that substantiates this viewpoint is the stress and coping model which describes the asymmetry of dopamine efferents in the in the prefrontal cortex, where a strong association between stress (and anxiety) and cognitive dysfunction is emphasized. Thus, high levels of PTSD may have contributed to cognitive dysfunction such as memory impairment.

Performance on the Grooved Pegboard (Table 12) indicated possible difficulties with hand-eye co-ordination and motor functioning for both groups. However, Hess et al. (2003) found that cognitive impairment in SCI patients were most common on measures of motor functioning with an attentional component. The lack of attention in SCI patients resulting in impaired motor functioning can be attributed to psychological distress following SCI, such as PTSD and depression.

Poor performance on the TMT and SDMT (Table 12) indicated deficits in scanning, visuo-motor tracking, divided attention and cognitive flexibility in SCI patients. Performance on the Stroop Test (Table 12) also revealed deficits in cognitive control, selective attention and cognitive flexibility. Poor attention and concentration are also symptoms of psychological distress. Considering the high levels of PTSD and depression found, it can be expected that attention and concentration will be impacted on.

Poor performance on the FTT (Table 12) indicates impairment in manual motor speed in males and females of both the SCI and the control group. The control group performance was better than the SCI group, indicating greater manual motor speed in people with amputations. Performance on the SDMT (Table 12) also revealed deficits in motor speed and perceptual speed in both groups. Deficits in information processing speed, attention and memory following SCI have also been found in other studies (Dowler et al., 1997; Hess et al., 2003). Performance on the WAIS-III (Table 12) further revealed deficits in processing speed in the SCI group. Males of both groups had faster processing speed than females. However, females presented with higher levels of PTSD. This could have also negatively impacted on processing speed of the females.

High levels of PTSD in this study was associated with deficits in intellectual functioning (IQ), verbal comprehension, perceptual organisation, working memory, processing speed, learning, concentration and attention in patients with SCI. Weniger et al. (2008) found that trauma-exposed subjects with PTSD were significantly impaired on all intellectual and mnemonic measures except verbal memory. However, the major findings of a study on the longitudinal effects of PTSD on memory functioning (Samuelson et al., 2009) was that participants with PTSD showed a significant decline in measures of delayed visual recall and recognition; this study also showed that decline in delayed facial recognition was significantly greater for veterans with PTSD compared to veterans without PTSD.

According to the memory model described by Andrewes (2001), working memory is used for learning and is closely related to attention. The other important cognitive skills that are important for learning processes include visual and auditory perception, executive functioning and language processing. According to the Wernicke-Geschwind model of language, the two areas of sensory input are the visual areas for reading and the auditory areas for analysing auditory input. The Supervisory Attentional System, a model of executive functioning, explains how a breakdown of planning, reasoning and organisation occurs when the prefrontal cortex is dysfunctional. The results of this study revealed that these cognitive systems maybe impaired in individuals with SCI. Considering that these cognitive systems are crucial elements of learning, it is likely that learning may be impaired in traumatic SCI. However, learning is fundamental for individuals with SCI acquiring new skills for adaptation to a new way of life. It is important that the difficulty with learning in individuals with SCI is not misunderstood by the rehabilitation team as a lack of motivation.

6.13 PTSD and Psychological/Neuropsychological Functioning

PTSD was significantly associated with depression at time point 1 ($p<0.01$), depression at time point 2 ($p<0.001$), and psychological distress at time point 2 ($p<0.05$) (Table 13) in the SCI group. These findings are similar to those of Nielsen

(2003), who found that SCI patients with PTSD have higher levels of depression and emotional distress than SCI patients without PTSD.

In addition, PTSD was also significantly associated with lower verbal IQ ($p<0.05$), performance IQ ($p<0.01$), full scale IQ ($p<0.01$), verbal comprehension ($p<0.05$), perceptual organisation ($p<0.05$), working memory ($p<0.01$), processing speed ($p<0.01$), learning ($p<0.01$), and attention and concentration ($p<0.01$) (see Table 14). De Bellis et al., (2009) had similar findings in a study on neglected children with PTSD. This study found that total PTSD and cluster B symptoms (where the traumatic event is persistently reexperienced through intrusive images, distressing dreams, etc.) were negatively and significantly related to poorer language, visual-spatial and attention/executive functions, and poorer reading and mathematics achievement, while PTSD severity was negatively related to lower IQ. Twamley, Allard, Thorp, Norman, Cissell, Berardi, Grimes and Stein (2009) also found that more severe PTSD symptoms were associated with slower processing speed. According to these authors, cognitive slowing seen in PTSD can be attributed to reduced attention due to the allocation of resources to cope with psychological distress or unpleasant internal experiences.

There were similar findings in this study of correlations between PTSD and both psychological and neuropsychological functioning in the control group. PTSD was associated with deficits in verbal IQ ($p<0.01$), full scale IQ, and verbal comprehension ($p<0.01$). According to Weniger et al. (2008), traumatic stress itself exerts adverse effects on the brain. These authors found that PTSD symptoms and cognitive deficits were significantly related to small amygdala and hippocampal size, suggesting that damage to these structures may be a powerful indicator for the severity and chronicity of PTSD. Samuelson et al. (2009) state that findings of cognitive decline in patients with chronic PTSD may be associated with neuroanatomical changes in the prefrontal cortex and hippocampus. This would result from prolonged neurotransmitter dysfunction, and thus greater memory impairment. The Model on Stress and Coping: Asymmetry of Dopamine Efferents in the Prefrontal Cortex discussed in Chapter 3, lends support for this viewpoint. According to this model, stress strongly activates certain neurotransmitters such as cerebral dopamine (DA) and other monoamines within the prefrontal cortex. The prefrontal cortex plays an important role in fostering adaptation to challenging situations such as SCI.

Considering that PTSD was significantly associated with poorer psychological and neuropsychological functioning, it may be deduced that poor emotional and neurocognitive functioning following SCI and amputations may possibly be related to high levels of PTSD. These findings are best explained using the Stress and Coping Model (Berridge et al., 2003) which emphasizes the strong association between stress (as well as anxiety) and physiological, cognitive and affective dysfunctions. This finding once again highlights the significant implications for psychological management following traumatic SCI. After reviewing the literature on adjustment to SCI, Abdinor (2004) points out that, increasingly, the importance of psychological aspects of adjustment and rehabilitation has come to be recognized as a vital part of facilitating a higher quality of life for people living with SCI and their families. Mothabeng (1997) also emphasizes the importance of psycho-emotional issues in the rehabilitation of individuals with SCI. Intensive psychological management immediately following SCI as well as during rehabilitation will reduce emotional distress following SCI, which will result in improved neurocognitive functioning and hence improve outcomes for people with SCI.

6.14 Summary

The results of this study have demonstrated the following:

1. Single young males were found to be at greatest risk of sustaining traumatic SCI.
2. Traumatic SCI affects mainly young and single males who appear to be high risk takers. Those affected by traumatic SCI are largely low to average income, urban to semi-urban dwellers with mainly high school and tertiary education. A large number of such individuals are students or are employed and performing skilled or professional work.
3. High incidents of road traffic accidents and soaring crime rates are contributing factors to traumatic SCI and the occurrence of PTSD amongst such patients. This has resulted largely in severe injuries, mainly paraplegia.
4. High levels of depression and anxiety found in individuals with SCI at time point one reveals that such individuals may be highly emotionally distressed immediately following their injuries. Although there is some improvement over time, the levels are still clinically significant. High levels of emotional distress were also found in individuals with amputations at time point one which indicates that those with amputations may also be highly emotionally distressed following their amputations. However, individuals with amputations showed a slower rate of improvement compared to those with spinal cord injury.
5. High levels of emotional distress impacts significantly on overall level of functioning and general satisfaction with life in patients with SCI.
6. Individuals with SCI presented with poor cognitive functioning on most neuropsychological measures. There was a significant difference in the cognitive functioning of the control group, whose performance on such measures was worse. This may be attributed to lower educational levels, poor improvement in PTSD, and poor psychological adjustment.
7. A moderate level of acute stress symptoms and PTSD was found in individuals with SCI at time point one. Here again, although there was some improvement with time, there are still clinically significant symptoms present. The control group also presented with moderate levels of acute stress and

PTSD initially; however their symptoms have worsened with time. Females were found to be at a greater risk of developing PTSD.

8. High levels of psychological distress and poor adjustment may have contributed to poor neuropsychological functioning.

Chapter 7
Conclusion

The results of this study highlight the need for clinical psychologists to work closely with individuals with SCI, an acquired physical disability, from the time of onset of their disabilities and through inpatient and outpatient rehabilitation. This liaison will not only facilitate adjustment to their disability but will also preserve vital cognitive abilities which are fundamental to persons with SCI benefiting from rehabilitation, becoming productive members of society, and improving their quality of life.

The study also emphasizes the importance of and the need for rehabilitation psychology in South Africa, to cater for the needs of individuals with SCI and other acquired physical disabilities. The findings of this study have important implications for provincial and national health policies for persons with disabilities, such as the National Rehabilitation Policy (2000) and the KZN Disability and Rehabilitation Policy (2008), which do not adequately acknowledge the role of psychology in the rehabilitation of persons with disabilities.

The study concludes with a proposed psychological intervention model for the treatment of SCI. Further recommendations for treatment are provided below, followed by an indication of the limitations of the study and recommendations for further research.

7.1 Recommendations for Treatment

7.1.1 Towards a Bio-psycho-social-cultural Intervention Model of Adjustment to SCI

The aim of this study, as mentioned in Chapter 1, is to understand the relationship between SCI and brain functioning and the resulting psychological consequences of SCI with the intention of improving treatment and intervention. Hence, recommendations are made for the psychological management of individuals with SCI, which forms part of rehabilitation.

Some of the available clinical intervention programmes for the psychological management of individuals with SCI, such as the coping effectiveness training programme (CETP), are based on cognitive behaviour therapy (CBT). The CETP, initially developed for use with persons with HIV, was adapted by Kennedy et al. (2003) for use with traumatic spinal cord injured patients (Elfström, 2007). This programme is based on the transactional theory of stress and coping and emphasizes cognitive behaviour therapy techniques. It consists of brief group-based psychological interventions for improving psychological adjustment and enhancing adaptive coping (Elfström, 2007). Hope (2005) endorses a holistic, person centred model of rehabilitation with ongoing emotional and social support.

Based on the findings of this study, an intervention model of psychological adjustment following SCI, grounded mainly in positive psychology and CBT, is proposed. CBT-based intervention approaches such as the CETP discussed above are important, since cognitive restructuring is a fundamental aspect of adjustment to SCI. In addition, the theoretical underpinnings of the Conceptual Model of the Relationship of Social Networks and Social Support to Health, the Leisure and SCI Adjustment

Model and the Copenhagen-Medici Model in Positive Psychology discussed in Chapter 3, are emphasized in the proposed intervention model.

Following SCI there is a plethora of psychological and neuropsychological symptoms present. These symptoms are regulated by variables such as biochemical factors, social support, and spiritual, religious and cultural aspects (traditional healers, churches, temples, etc.). Hence these factors should be incorporated into rehabilitation: for example faith leaders should be invited to be part of the rehabilitation programme, and family members should be allowed to spend weekends with SCI patients during rehabilitation. The results of this study revealed that family play a pivotal role in helping patients with SCI maintain their self esteem. When asked "*Who helps you feel that you are a good and worthwhile person?*", the majority of participants responded that it was their mothers, partners or siblings.

A group-based intervention such as the CETP, discussed above, together with individual therapy should be implemented. Positive psychological factors such as hope, wisdom, perseverance, and creativity should be introduced by the psychologist together with the rehabilitation team to alleviate the symptoms. The individual can then move towards positive health (adjustment and acceptance) and happiness by adopting positive emotion, engagement (leisure), and purpose (meaningful life). These aspects are components of the Copenhagen-Medici Model in Positive Psychology and Positive Health (Seligman, 2008) which aims to improve the quality of life and prevent pathological reactions when life seems empty and meaningless. This study has revealed that pathological reactions such as clinically significant levels of depression and anxiety are prevalent immediately following the SCI and even a month later. Thus, adopting positive emotion, engaging in leisure, and striving for meaning will assist in not only alleviating but also preventing such reactions.

Psychological intervention at this stage should involve skills acquisition to improve the intensity and duration of positive emotion about the present, past and future. In addition, the individual's signature strengths and talents should be identified. These strengths and talents, which can be identified by using psychological and neuropsychological testing such as those performed in this study, should be used to engage the individual in activities such as work and leisure. The final stage is the pursuit of meaning where the person's strengths and talents are used to embrace a purpose that is believed to be larger than the self, such as religion, politics, etc.

The facilitation of positive health must be multi-sectorial. Health workers, faith leaders, disability organisations, government departments (such as labour and welfare) and business leaders should function together in helping an individual with SCI realize their potential and reintegrate back into society.

Considering the significant levels of psychological distress in the adjustment to SCI, as well as the associated neuropsychological deficits, further recommendations for treatment and rehabilitation are highlighted:

1. All SCI patients should be psychologically assessed soon after their injury and again later once rehabilitation commences.
2. Patients should be assessed for neurocognitive deficits once medically stable. Such deficits can be easily misunderstood as lack of motivation (Hess et al., 2003). Rehabilitation treatment programs must take into consideration patients' neurocognitive strengths and weaknesses. Hess et al. (2003) suggest that rehabilitation professionals should carefully assess and consider patients' strengths and limitations when designing treatment programs relevant to work and community reintegration. Strategies such as simplifying instructional material, monitoring comprehension, using compensatory strategies such as visual aids, and increasing the emphasis of rehearsal and repetition should be employed to increase the efficiency and benefit of rehabilitation (Hess et al., 2003).

3. Individual psychotherapy, group psychotherapy, and psycho-educational programs should be available to all patients with SCI to facilitate the adjustment process and prevent regression in psychological functioning.
4. Peer support or mentorship from well-adjusted individuals living with SCI in the community or organisations such as the QuadPara Association of South Africa should be built into spinal rehabilitation programs to promote coping and adjustment.
5. Psychologists should be specifically trained in rehabilitation psychology to equip them to work with individuals presenting with acquired physical disabilities such as SCI as well as in physical rehabilitation settings. In a study by Hope (2005) in a rehabilitation hospital in Johannesburg, it was found that persons with paraplegia described positive and negative experiences of the psychotherapeutic interventions offered. The negative experiences were associated with an absence of psychosocial and psychotherapeutic interventions by psychologists or social workers skilled in psychotherapy. This further highlights the need for specific training of rehabilitation psychologists.

7.2 Limitations of the Study

1. One limitation of the study is the relatively small sample size. A larger sample may have improved the statistical power. However, there were many difficulties encountered in obtaining and maintaining the sample. Owing to the stringent inclusion criteria, many patients, more especially from the control group, were not included in the study. In addition, many of the participants who agreed to participate in the study were lost along the way as the study progressed, for reasons such as being transferred to other hospitals far away or being discharged to their homes in remote areas with no telephonic contact, or because they developed complications and died.
2. This study has not explored two other areas that are also important following a SCI, namely sexuality and family adjustment. However, these areas were not within the scope of this research

3. The study is also limited in terms of generalisability as it was conducted in only one province in South Africa and is not representative of all ethnic groups. A further limitation is that children were excluded from the study. The design of the study and the instruments used allowed for only adults to be assessed. This limits the understanding of adjustment following SCI to only adults.
4. The significant differences in demographics between the SCI group and the control group may have influenced some of the results of the study.

7.3 Recommendations for Further Research

1. Future studies should combine neuroimaging, such as the fMRI, with neuropsychological testing to enhance understanding of brain functioning.
2. The two areas that are important in rehabilitation, but were not covered as they fell outside the scope of this research, are sexuality and family adjustment following SCI. There is a need for these fundamental aspects to be further researched, especially in South Africa.
3. This study should be replicated in the other provinces and also among a further variety of ethnic groups in order to gain insight into psychological and neuropsychological functioning following SCI in South Africa.
4. A similar study should also be done on children to understand their psychological and cognitive functioning following SCI.
5. Further prospective studies, using a matched control group, should be conducted in South Africa in order to gain a comprehensive understanding of adjustment to SCI in this country.

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Diagram illustrating the levels of spinal cord injury and the extent of paralysis. Source: Spinal Injuries Association. Accessed on 12/01/2010 from: www.spinal.co.uk/ spinal_injuries_association

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Appendix 1: Biographical Questionnaire

BIOGRAPHICAL QUESTIONNAIRE

Moodley, N (2005)

1. **RECORD NUMBER:** ☐
2. **DATE OF BIRTH:** Y/M/D) ☐☐☐
3. **AGE:** ☐
4. **GENDER:** Female ☐ Male ☐
5. **RACE GROUP:** Black ☐ Coloured ☐ White ☐ Asian ☐ Other ☐
6. **MARITAL STATUS:** Married ☐ single ☐ divorced ☐ widow ☐ widower ☐ separated ☐ living together ☐
7. **NUMBER OF YEARS WITH PRESENT PARTNER:** ☐
8. **NUMBER OF CHILDREN:** ☐
9. **AGE OF CHILDREN:** ☐
10. **NUMBER OF PEOPLE THAT LIVE WITH YOU:** ☐
11. **AREA** urban ☐ rural ☐
12. **EDUCATIONAL LEVEL:** None ☐ primary ☐ secondary ☐ tertiary ☐
13. **OCCUPATION:** ☐
14. **INCOME** (family total per month): ☐
15. **ARE YOU IN RECEIPT OF A DISABILITY GRANT?** YES ☐ NO ☐
16. **RELIGION:** ☐
17. **HOME LANGUAGE:** English ☐ Afrikaans ☐ Zulu ☐ Xhosa ☐ other ☐

18. LEVEL OF INJURY: C1 ☐ C2☐ C3 ☐ C4☐ C5 ☐ C6 ☐ C7 ☐

T1☐ T2 ☐T3☐ T4 ☐T5☐ T6 ☐T 7 ☐T8 ☐ T9 ☐T10 ☐T11 ☐T12

L1☐ L2 ☐L3☐ L4 ☐L5☐

19. MEDICAL DIAGNOSIS:

20. NATURE OF INJURY: gunshot☐ stab ☐ assault ☐ sport ☐

Recreation ☐ construction ☐ M.VA. (Specify: car ☐ taxi ☐ motorbike ☐

bicycle ☐bus☐) (specify: driver ☐ passenger ☐ pedestrian ☐ other (specify) ☐

21. DATE OF INJURY:

22. CURRENT MEDICATION:

23. ALCOHOL/ SMOKING/ DRUG HABITS: Current

Past

24. HAVE YOU BEEN ADMITTED TO A REHAB PROGRAMME FOR THE ABOVE?

Yes ☐ (specify)

No ☐

25. PSYCHIATRIC HISTORY: Current

Past

26. PATHOGNOMONIC SIGNS:
(OBSERVATIONS AND SYMPTOMS SINCE THE INJURY)

Appendix 2: Consent Document

CONSENT DOCUMENT

Dear, ________________________________

RE: Consent to Participate in Research

Study Title: Neuropsychological functioning and adjustment in spinal cord injured patients

(Ethics reference no.: H162/05)

You have been asked to participate in a research study. The length of time it will take to complete the interview as well as the assessments is approximately three hours. This will be conducted over three, one hour sessions.

You have been informed about the study by Ms Nancy Moodley.

You may contact me at (031) 5080700 if you have questions about the research or if you are injured as a result of the research.

You may contact the Biomedical Research Office at the University of KwaZulu-Natal at 031-260 4769 if you have questions about your rights as a research subject.

Your participation in this research is voluntary, and you will not be penalized or lose benefits if you refuse to participate or decide to stop.

If you agree to participate, you will be given a signed copy of this document and the participant information sheet which is a written summary of the research.

The research study, including the above information, has been described to me orally. I understand what my involvement in the study means and I voluntarily agree to participate.

__________________ ________________

Signature of Participant Date

____________________ ____________________

Signature of Witness Date
(Where applicable)

____________________ __________________

Signature of Translator Date
(Where applicable)

Appendix 3: Information Document

INFORMATION DOCUMENT

Study title: Neuropsychological functioning and adjustment in spinal cord injured patients.

(*Ethics reference no.: H162/05*)

Dear, ____

I, Ms Nancy Moodley, am doing research on spinal cord injury and psychology. Research is just the process to learn the answer to a question. In this study I want to learn about the impact of spinal cord injury on the brain. I also want to learn more about how a person adjusts to their spinal cord injury. This is a study involving research and may not necessarily be part of routine care. This study is being done with the aim of improving treatment methods and intervention.

I am inviting you to participate in this research study.

This study will include about 160 patients from the Mahatma Gandhi Memorial Hospital Complex, King George V hospital and Clairwood Hospital. During your stay or visit to the hospital/centres you will be asked to complete a few assessments. Most of the assessments are part of routine psychological treatment.

The assessments will be done over three one hour sessions. In the first session a clinical interview will be conducted. You will also be asked to complete a biographical questionnaire. In the second session a psychological and neuropsychological test battery will be conducted. An IQ assessment will be done in the third session. The psychological assessments will be repeated after a month. If you are an outpatient the sessions will be conducted on the days that you will be coming to the hospital/centres for other treatment.

There are no risks of being involved in the study. Any discomfort that may result from completing the assessments will be dealt with accordingly e.g. if you get tired easily you will be given sufficient time in-between assessments. However, from this study, you will benefit by learning more about your strengths and weaknesses. The assessments will enhance the quality of care that you will receive as a patient.

You will be given pertinent information on the study while involved in the project and the results will be made available to you at your request.

Your participation in this research is voluntary, and you will not be penalized or lose benefits if you refuse to participate or decide to stop.
Efforts will be made to keep personal information confidential. However, absolute confidentiality cannot be guaranteed. Personal information may be disclosed if required by law.

You can contact me for further information on the telephone number, (031) 5080700; fax. (031) 5078310; e-mail: nancy.moodley@kznhealth.gov.za

Any problems or complaints can be directed to the Biomedical Research Ethics Chair, Research Office, UKZN, Private Bag X54001, Durban, 4000. Tel.: (031) 2604769; Fax: 031 2604609, e-mail: BREC@ukzn.ac.za.

Appendix 4: Acknowledgements from KZN Dept of Health

DEPARTMENT OF HEALTH

PROVINCE OF KWAZULU-NATAL

HUMAN RESOURCE PROVISIONING

Natalia, 330 Longmarket Street, Pietermaritzburg, 3201
Private Bag X9051, Pietermaritzburg, 3200
Tel.: 033 395 2542, Fax.: 033 845 0312

ENQUIRIES: Miss NP Beeton
EXTENSION: 2542
REFERENCE: 9/2/3/R
2005 -09- 05

Ms Nancy Moodley
72A Fairview Drive
Brindhaven
VERULAM
4339

Dear Ms Moodley

REQUEST TO CONDUCT RESEARCH ON THE NEUROPSYCHOLOGICAL FUNCTIONING AND ADJUSTMENT IN SPINAL CORD INJURED PATIENTS.

Your letter dated 01 August 2005 refers.

Please be advised that authority is granted for you to conduct a research regarding **the Neuropsychological functioning and adjustment in spinal cord injured patients** at the Mahatma Gandhi Memorial Hospital Complex provided that;

(a) Confidentiality is maintained;

(b) Informed consent of the patients be obtained;

(c) The Department is acknowledged;

(d) The Department receives a copy of the report on completion;

(e) The staff of the hospital are not disturbed and/or inconvenienced in their work and that patient care is not compromised; and

(f) Full ethics committee approval is obtained.

Yours sincerely

01.09.05

SUPERINTENDENT-GENERAL
HEAD: DEPARTMENT OF HEALTH
NPB/ms nancy moodley research

Umnyango Wezempilo *Departement van Gesondheid*

DEPARTMENT OF HEALTH

PROVINCE OF KWAZULU-NATAL

SPECIAL SUPPORT SERVICES

Natalia, 330 Longmarket Street, Pietermaritzburg, 3201
Private Bag X9051, Pietermaritzburg, 3200
Tel.: 033 395 2813, Fax.: 033 345 4433

Enquiries: Ms A. Kopman
Extension: 2813
Reference: 9/2/3/R

11 JAN 2006

Ms Nancy Moodley
72A Fairview Drive
Brindhaven
VERULAM
4339

Dear Ms Moodley

REQUEST TO CONDUCT RESEARCH ON THE NEUROPSYCHOLOGICAL FUNCTIONING AND ADJUSTMENT IN SPINAL CORD INJURED PATIENTS

Your facsimile dated 10 January 2006 refers.

Please be advised that authority is granted for you to extend your research to include King George V Hospital, provided that :-

(a) Confidentiality is maintained;

(b) Informed consent of the patients be obtained;

(c) There is no disruption of service delivery and patient care is not compromised;

(d) The Department is acknowledged; and

(e) The Department is provided with a copy of the report on completion.

Yours sincerely

HEAD : DEPARTMENT OF HEALTH
KWAZULU-NATAL

AJK/n.moodley

Umnyango Wezempilo *Departement van Gesondheid*

Appendix 5: Permissions from Medical Managers of Hospitals

DEPARTMENT OF HEALTH

PROVINCE OF KWAZULU-NATAL

MAHATMA GANDHI MEMORIAL HOSPITAL

100 Phoenix Highway, Phoenix
Private Bag X13, Mount Edgecombe, 4300
Tel.:031-5021719, Fax.: 031-5021869
persadc@dohho.kzntl.gov.za

Imbuzo/Enquiries: Dr C. Persad **Usuku/Date: 26 SEPTEMBER 2006**

MS NANCY MOODLEY
C/O PHOENIX ASSESSMENT AND THERAPEUTIC CENTRE
PHOENIX

REQUEST TO CONDUCT RESEARCH ON THE NEUROPSYCHOLOGICAL FUNCTIONING AND ADJUSTMENT IN SPINAL CORD INJURED PATIENTS

Permission is granted for you to conduct the above mentioned study.

Please note that you may only commence your study after a copy of full ethics approval has been submitted to me.

C. PERSAD
MEDICAL MANAGER
CC MRS LANDERS

Umnyango Wezempilo *Departement van Gesondheid*

HEALTH
KwaZulu-Natal

CLAIRWOOD HOSPITAL
Postal Address Private Bag X04 Mobeni 4060
Physical Address: 1 Higginson Highway,Mobeni,4060
Tel.: 031 4515181 Fax : 031 4622882
Email.: cookie.naidoo2@kznhealth.gov.za

ENQUIRIES: DR D S DORASAMY
EXT : 5180

18 January 2007.

Ms Nancy Moodley
Clinical Psychologist
Phoenix Assessment & Therapy Centre

Dear Ms Moodley

RE : PERMISSION TO CONDUCT RESEARCH AT CLAIRWOOD HOSPITAL

With reference to your letter dated 17/01/2007, I hereby wish to inform you that permission is granted to conduct reasearch at Clairwood Hospital.

DR D S DORASAMY
ACTING HOSPITAL MANAGER

DATE : 18/01/2007

uMnyango Wezempilo . Departement van Gesondheid

Fighting Disease, Fighting Poverty, Giving Hope

DEPARTMENT OF HEALTH
PROVINCE OF KWAZULU-NATAL

KING GEORGE V HOSPITAL

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Enquiries	: Dr S Maharaj	Telephone Number Extension	: (031) 2087121 : 356	Fax Number	: (031) 2099586
Email	: h021299@dohho.kzntl.gov.za	Your Reference	:	Date	: 15 Decemberl 2005

Miss N Moodley
Behavioural Medicine
Nelson R Mandela School of Medicine
University of Kwazulu-Natal
4013

Dear Miss N Moodley

RE: REQUEST FOR PERMISSION TO CONDUCT RESEARCH AT KING GEORGE V HOSPITAL

1. Your letter dated 13/12/2005 refers.
2. Permission is granted for the above mentioned study.
3. Your attention is once again drawn to the maintenance of confidentiality as discussed.
4. Arrangements should be made for you to work with patients in the hospital.

S Maharaj

DR S B MAHARAJ
MEDICAL MANAGER

permission to conduct studies – ar- sbm

DR S. B. MAHARAJ
MEDICAL MANAGER
KING GEORGE V HOSPITAL