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Psychosocial adaptation to spinal cord injury as a function of time since injury

Hanoch Livneh^{1,*} and Erin Martz²

The literature on the relationship between time since injury (TSI) and the clinical unfolding of psychosocial adaptation to disability has yielded mixed results. In this exploratory study we have attempted to compare two groups of people who sustained spinal cord injury (SCI) – namely, short-term TSI versus long-term TSI – on the patterns of psychosocial reactions to their medical condition. Using the initial pool of participants ($n=317$), two ‘extreme’ TSI groups were created (short-term TSI, composed of people whose injuries occurred within the last 4 years, and long-term TSI, comprising people whose injuries occurred 20 or more years ago). A two-group discriminant function analysis (DFA) applied to the eight subscales of the Reactions to Impairment and Disability Inventory (RIDI) yielded a significant function that was most closely associated with reactions of denial, shock and generalized anger, suggesting a non-acceptance of the condition among the more recently injured. Further analyses were then separately applied to the two groups of civilians and veterans with SCI. The resultant DFAs yielded functions suggesting somewhat different group patterns from the original one. Results are discussed within the context of the literature drawn from the fields of post-traumatic stress disorder (PTSD) and related traumatic experiences.

Die Literatur zum Zusammenhang zwischen der Zeit seit der Verletzung (time since injury, TSI) und der klinischen Entfaltung der psychosozialen Adaptation an die Behinderung führte zu gemischten Ergebnissen. In dieser explorativen Studie haben wir versucht, zwei Gruppen von Menschen, die unter einer Rückenmarksverletzung litten, nämlich kurze TSI vs. lange TSI, im Hinblick auf psychosoziale Reaktionen auf ihre Erkrankung zu vergleichen. Auf der Basis des initialen Pools von Teilnehmern ($n=317$) wurden zwei “extreme” TSI-Gruppen gebildet (kurze TSI mit Personen, deren Verletzungen in den letzten 4 Jahren auftraten, und lange TSI, mit Personen, deren Verletzungen 20 oder mehr Jahre zurücklagen). Eine Zwei-Gruppen-Diskriminanzfunktionsanalyse, die auf die 8 Subskalen des Reactions of Impairment and Disability Inventory (RIDI) angewandt wurde, ergab eine signifikante Funktion, die sehr eng mit Reaktionen von Verleugnung, Schock und allgemeiner Angst einherging, was eine Nichtakzeptanz der Erkrankung bei den Personen nahelegt, bei denen die Verletzung noch nicht so lange zurückliegt. Weitere Auswertungen wurden separat auf die Gruppe von Zivilen

und Veteranen mit Rückenmarksverletzung angewandt. Die resultierenden Diskriminanzfunktionsanalysen ergaben Funktionen, die auf Gruppenmuster schließen lassen, die sich von den ursprünglichen etwas unterscheiden. Die Ergebnisse werden im Zusammenhang mit der Literatur aus dem Bereich der akuten Belastungsreaktionen und damit zusammenhängenden traumatischen Erlebnissen diskutiert.

Los estudios publicados sobre la relación entre el tiempo desde la lesión (TDL) y la manifestación clínica de la adaptación psicosocial a la discapacidad han dado resultados diversos. En este estudio exploratorio hemos intentado comparar dos grupos de personas que sufrieron lesión medular (LM) (es decir, con TDL corto y TDL largo) en los patrones de reacciones psicosociales a su situación médica. Utilizando la población inicial de participantes ($n=317$), se crearon dos grupos de TDL “extremos” (TDL corto, compuesto por personas cuyas lesiones ocurrieron en los últimos 4 años, y TDL largo, compuesto por personas cuyas lesiones databan de 20 o más años). Se realizó un análisis funcional discriminante (AFD) de los dos grupos aplicado a las 8 subescalas del Inventario de Reacciones a la Deficiencia y la Discapacidad (RIDI), obteniéndose una función significativa que se asociaba más estrechamente a las reacciones de negación, shock y cólera generalizada, lo que sugiere que los participantes con lesiones más recientes no aceptaban su situación. A continuación se realizaron otros análisis por separado de los dos grupos de civiles y excombatientes con LM. Los AFD realizadas dieron funciones que sugieren patrones de grupo algo diferentes de los originales. Los resultados se comentan en el contexto de la literatura publicada sobre el Trastorno por Estrés Postraumático (TEPT) y otras experiencias traumáticas afines.

La littérature sur le lien entre le temps depuis le traumatisme (TDT) et le déroulement clinique de l'adaptation psychosociale à l'invalidité a produit des résultats variables. Dans cette étude exploratoire, nous avons tenté de comparer deux groupes de sujets ayant subi un traumatisme médullaire (TM) (à savoir TDT court terme v. TDT long terme) selon le schéma de leurs réactions psychosociales à leur état pathologique. En utilisant le groupe initial de patients ($n=317$), deux groupes ‘extrêmes’ de TDT ont été créés (TDS court-terme, composé de sujets dont le traumatisme était survenu dans les 4 dernières années et TDT long terme, composé de sujets dont le traumatisme remontait à 20 années ou plus). Une

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analyse discriminante à deux groupes, appliquée aux 8 sous-échelles du RIDI (Reactions to Impairment and Disability Inventory) a donné une fonction significative plus étroitement associée à des réactions de déni, de choc et de colère généralisée, suggérant une non-acceptation de la pathologie parmi les traumatisés les plus récents. D'autres analyses ont ensuite été appliquées séparément aux deux groupes de civils et d'anciens combattants souffrant d'un TM. L'analyse discriminatoire résultante a donné des fonctions suggérant des schémas de groupe quelque peu différents du schéma original. Les résultats sont discutés dans le contexte de la littérature dans les domaines de

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Introduction

The possibility of a linear and predictable process of adaptation being discerned following the onset of disability has long been debated in the rehabilitation and disability studies literature. Psychosocial adaptation to the onset of a sudden disability has been conceived by many to reflect a largely segmented process in which clinical phases could be observed and recorded (Dunn, 1975; Weller and Miller, 1977; Krueger, 1981–2). By contrast, others (Wortman and Silver, 1987, 1989; Trieschmann, 1988) have argued that searching for an orderly sequence of post-disability clinical reactions is futile, if not outrageously naïve. Proponents of the former view, representing mostly clinicians and theorists largely of psychodynamic persuasions (Parkes, 1975; Shontz, 1975; Siller, 1976; Horowitz, 1986), have posited that the experienced reactions (i.e. observed clinical phases) represent typical human reactions to adversity and loss. They further argued that these reactions could be considered universal and most likely trans-situational (i.e. they possess common elements that transcend the specific type of loss and contextual features). Advocates of the latter view, representing mostly researchers and behaviourally oriented empiricists (Westbrook and Viney, 1982; Wortman and Silver, 1989), have disagreed vehemently with these notions. According to them, no irrefutable evidence has yet been aggregated to support the validity of a phase-like process of adaptation following human experience of bodily, functional or other loss. Moreover, they have argued that efforts to collapse diverse and situation-specific reactions following disability onset into coherent, broad categories (e.g. depression, denial) represents careless generalizations, if not amounting to scientific sacrilege.

A third, 'in-between', school of thought has emerged more recently and its proponents (Rodin *et al.*, 1991; Livneh and Antonak, 1997; Smart, 2001) have maintained that although the clinical unfolding of psychosocial adaptation to disability could be theoretically conceptualized along broad yet undeniably overlapping phases, it

might be impossible to verify empirically the existence of any 'pure' phase of adaptation. This conclusion has been based on several factors, including: (i) the interaction of assumed disability-triggered psychological reactions with a wide range of sociodemographic variables, pre-disability personality characteristics, disability-linked features (e.g. severity of condition, level of functional loss, degree of pain experienced) and environmental conditions (i.e. physical, social, and attitudinal); (ii) the availability of coping skills and resources to attenuate disability impact; and (iii) the fact that, when aggregating data for group analysis purposes, the uniqueness of the individual's psychosocial process of adaptation is lost and is subjugated to group means and sample-based correlation matrices.

With these conceptual and empirical caveats in mind, the review of literature on the relationship between duration of disability (i.e. time since onset of spinal cord injury; SCI) and psychosocial indices of adaptation to disability has yielded conflicting findings. The disability studies literature can be roughly divided into three broad approaches to examining these relationships. First, there is the body of clinical findings. This largely anecdotal source of information relies heavily on clinical observations and inferences about what is regarded as post-injury (i.e. SCI) set of experiences or reactions. These clinician-observed and client-reported experiences are often said to follow a phase-like sequence and are therefore typically anchored within a temporal framework (Kerr and Thompson, 1972; Lipowski, 1970; Katz and Florian, 1986–7). Much of the existing clinical literature supports the assertion of an identifiable relationship between duration of disability (e.g. SCI) and: (i) a decrease in psychosocial distressing reactions (e.g. anxiety, depression); as well as (ii) increase in psychosocial adaptive reactions (e.g. acceptance, adjustment) (for a review, see Livneh, 1986; Livneh and Antonak, 1997).

The second group of studies is empirical in nature and typically relies on cross-sectional and correlational

research designs that seek to examine the association between duration of SCI and specific psychosocial measures (i.e. reported experiences or reactions, as manifested in scale scores). The rationale underlying this group of studies stems from the notion that, to establish some empirical (e.g. correlational) evidence of a link between time since injury (TSI) and psychosocial adaptation, the magnitude or frequency of certain reactions (e.g. anxiety, depression) should diminish with time, whereas those of other reactions (e.g. acceptance, global adjustment) should increase with time. Two studies reported significant positive correlations between duration of SCI and measures of adaptation. Woodrich and Patterson (1983), in a sample of 432 clients with SCI, found a positive correlation ($r = 0.32$) between duration of condition and acceptance of disability. Dijkers (1999), in a sample of 2183 persons with SCI, ranging in duration of condition from 1 to 20 years, reported a positive correlation ($r = 0.21$) between TSI and subjective quality of life. The latter is typically regarded as a measure of life satisfaction or a global estimate of psychosocial adaptation to disability.

However, others have failed to find any, or have found only weak, associations between TSI and measures of psychosocial adaptation to SCI. Included in the latter studies were measures such as: (i) a summated psychosocial adjustment score derived from the Psychosocial Adjustment to Illness Scale (Alfano *et al.*, 1993); (ii) psychological distress as measured by the Symptom Checklist-90-Revised (Buckelew *et al.*, 1991); (iii) life satisfaction (Crisp, 1992); (iv) depression (Crisp, 1992; Fuhrer *et al.*, 1993); and (v) emotional distress as derived factorially from the Life Satisfaction Questionnaire (Krause and Crewe, 1990).

The third group of studies is also empirical in nature but reports findings from longitudinal research designs (i.e. collecting data on at least two separate occasions). In these studies, a cohort of people who sustained SCI is followed over a time period and is administered a battery of psychosocial measures at an initial point (t_1), and at later times (t_2, \dots, t_n). Reported reactions are then examined for any temporal changes in their magnitude. As seen with correlational studies, findings obtained from longitudinal research are also mixed. Whereas some researchers failed to find an association between the passage of time and changes (i.e. improvement) in adaptation to SCI (e.g. Craig *et al.*, 1994, using a 2-year follow-up on measures of anxiety and depression), others did provide evidence to indicate temporal changes in psychosocial adaptation (e.g. Crewe and Krause, 1990; Krause and Crewe, 1991; Krause, 1992).

In a series of longitudinal follow-up studies spanning a range of 9 to 15 years, Krause (1992) and Krause and

Crewe (1991) reported that self-rated adjustment and life satisfaction increased over time, the latter mostly in the areas of satisfaction with employment and finances. Furthermore, when analyzing present adjusted ratings (at the time of follow-up), significant increase in adjustment ratings was obtained at an 11-year follow-up. Krause and Crewe (1991, p. 98) concluded that 'the more time since injury the more positive the adjustment'. Lundqvist *et al.*, (1991) in a 4-year longitudinal study of 98 Swedish patients with SCI, obtained data that supported a significant positive correlation between TSI and: (i) several aspects of emotional balance including pleasantness, activation, and calmness (as measured by the Mood Adjective Checklist); (ii) decrease in scores of anxiety and depression (as measured by the Hospital Anxiety and Depression Scale); (iii) increase in overall psychosocial functioning (as measured by the Sickness Impact Profile); and (iv) increase in perceived quality of life.

These findings, however, are tempered by other research that yielded mixed results on the association between TSI and psychosocial adaptation. For example, Hancock *et al.*, (1993) measured levels of anxiety and depression in a sample of 41 people with SCI over a 1-year period (at 2–4 months, 6–8 months and 12-months post-injury). Although scores on both measures decreased with each consecutive administration, they failed to reach statistical significance. In a sample of 53 individuals with SCI, Reidy and Caplan (1994) measured levels of depression during rehabilitation at 1–2 months following injury and at 18–24 months post-rehabilitation. Using the cognitive–affective and somatic–behavioral subscales from the Beck Depression Inventory (BDI), they reported that whereas scores (greater depression) on the cognitive–affective subscale increased appreciably between the two occasions, scores on the somatic–behavioral subscale decreased significantly over time. Scores on the total BDI for the same time failed to reach statistical significance.

Tate *et al.*, (1994) studied a sample of 163 SCI outpatients, in two consecutive years, who were between 2 and 7 years post-injury (a mean of 4.5 years post injury). TSI, although negatively correlated with both subscales of depression and the global severity index (a measure of overall psychological distress) of the Brief Symptom Inventory (Derogatis and Spencer, 1982), failed to reach statistical significance.

Finally, two studies yielded findings that could be interpreted as suggesting that the process of psychosocial adaptation to SCI might not necessarily be a linear one. Krause (1997), continuing an earlier series of longitudinal studies, reported that declines in several subjective aspects of well-being were observed when persons with

SCI ($n = 235$) were surveyed over a 9-year period (approximately 12 to 21 years since the initial study and with an average of 23.4 years post-injury). Specifically, and in contrast to earlier longitudinal follow-ups of the same sample, participants inexplicably reported significant decline in general satisfaction with family relationships, social life and control over life, as well as in self-rated adjustment. At the same time, they reported increase in health problems, dependency and experiencing of pain (the latter might all have been associated with ensued medical complications and/or the aging process). More recently, Kennedy *et al.*, (2000) conducted a longitudinal analysis of 87 Englishmen who survived SCI. In this study psychosocial measures were obtained over nine observational periods (the first four while the subjects were inpatients and the remaining five from 1 month to 2 years post-discharge). Results indicated that scores on both measures of depression and anxiety demonstrated non-linear trends. Scores on both measures decreased initially, increased sharply prior to discharge and showed some decrease – albeit inconsistent – after release into the community. Similar trends were also observed in scores on the Psychological Distress scale of the psychosocial adjustment to illness scale (PAIS). The results of Kennedy *et al.*'s (2000) study suggest, then, that additional life events such as the stress engendered by the prospects of discharge from the hospital, the uncertainty of successful community integration and the unpredictability of medical prognosis (e.g. level of experienced pain, degree of permanent functional limitations), might play a critical role in attenuating the link between TSI and adaptation to SCI.

In this exploratory cross-sectional study, we seek to expand upon previous research in two important ways. First, previous studies focused mostly on SCI among civilians. In this study, we have expanded the SCI population to include both civilian and veteran populations. Our research, we hope, would allow us to compare the two groups and, furthermore, would permit us to examine population-specific associations between TSI and psychosocial adaptation to SCI. Second, previous research focused almost exclusively on measures of anxiety, depression and generic life satisfaction (or perceived well-being), often ignoring the multidimensionality of SCI-triggered psychosocial experiences. In this study, we will be examining the effects of eight disability-specific sets of psychosocial reactions as delineated by the Reactions to Impairment and Disability Inventory (RIDI; Livneh and Antonak, 1990). More specifically, we first intend to explore the relationships between TSI and adaptation to SCI in a combined sample of participants (i.e. civilians and veterans) and, second, to examine if these relationships can be replicated in each sample separately.

Materials and method

Participants

A total of 979 individuals with SCI were mailed a survey packet and a letter inviting them to participate in this research project. All individuals who utilized SCI services in Dallas, Texas at the Spinal Cord Injury Center of the Veteran's Administration North Texas Health Care System ($n = 542$; veterans) or the University of Texas Southwestern Medical Center Spinal Cord Injury Program ($n = 437$; civilians) were invited to participate in this survey. The Spinal Cord Injury Center of the Veteran's Administration North Texas Health Care System offers comprehensive, multidisciplinary care to veterans with SCI. At the University of Texas Southwestern Medical Center Spinal Cord Injury Program, a multidisciplinary team assists individuals who have sustained SCI with acute medical problems and require long-term services upon returning to the community. Both SCI programs include inpatient and outpatient components.

Of the 979 individuals invited to participate, 317 (32.4%) returned survey packets; 61 (6.2%) additional packets were returned labeled as 'no forwarding address' or 'deceased'. Slightly more veterans ($n = 182$; 33.6% of the veteran group) than civilians ($n = 135$; 30.9% of the civilian group) responded to the study's materials. Data from four respondents were dropped from this analysis because the cause of injury was reported to be congenital. Hence, the total number of participants in this study was 313: 132 (42.2%) civilians and 181 (57.8%) veterans.

This sample consisted mainly of men (86.6%), which is typical among SCI populations (Krause and Crewe, 1991; Hancock *et al.*, 1993; Craig *et al.*, 1994). The average age of participants ranged from 16 to 87 years (mean = 50.7, $sd = 14.8$). The formal education of this sample ranged from 3 to 22 years (mean = 13.6, $sd = 2.9$). The majority reported a marital status of married (50.8%), followed by single (21.6%), divorced (19.3%), separated (5.6%), or widowed (2.7%). The participants of this study described themselves as White (65.1%), African-American (22.4%), Hispanic (7.2%), Native American (4.6%), or Asian-American (0.7%). The work status reported by participants was: full-time (11.6%), part-time (4.3%), volunteer (2.6%), student (4.0%), retired (33.1%) and unemployed (44.4%).

The causes of the SCI were reported as: motor vehicle accidents (29.4%), falling (17.4%), gun-shot wound (11.4%), military combat (6%), tumor (2.7%), diving (2.7%) and other causes (22.1%). The age of onset of SCI ranged from 12 to 86 years (mean = 36.7, $sd = 16.0$). The duration of the disability ranged from 0 to 56 years (mean = 14.1, $sd = 13.0$). A majority (82.3%) reported that they had not had a pressure ulcer in the past month.

The mean of the reported daily pain level, on a scale of 1 to 10, where 1 reflects no pain and 10 reflects the worst pain imaginable, was 5.04 ($sd = 2.86$). This indicated that, on average, a moderate level of pain was experienced daily, even with medication. Severity of disability was based upon four questions from the American Spinal Injury Association (ASIA) Impairment Scale (Marino, 2000): (i) What is your level of spinal cord injury?; (ii) Do you have any feeling on your buttocks?; (iii) Do you have any movement in your feet/toes?; and (iv) Are you able to walk? A medical doctor, specializing in spinal cord injuries, scored the level of SCI for each participant. These four questions were used to categorize spinal cord injuries into paraplegia and quadriplegia with A, B, C and D categories, for which A represented the most severe and D the least severe impairments (Michael Priebe, personal communication, 9 October 2001). Clinical diagnosis could not be assigned to 12 participants. In this sample, severity of injury was scored as follows: level A (32.3%), level B (12%), level C (18.3%) and level D (37.5%).

Procedure

After Institutional Review Board approval, names and addresses of participants were obtained from the two SCI clinics. A letter was then sent to all participants inviting them to take part in the study, explaining informed consent and providing them with the study's instrument packet. This packet consisted of a socio-demographic form and several psychological instruments, only one of which was utilized in this study. A pre-addressed, stamped, return envelope and a coupon for free food, as an incentive to encourage response, were included in the packet. Two follow-up postcards encouraging response were sent to all participants 1 week and 2 weeks after the mailing of the initial packet. To ensure anonymity, reminder postcards were sent to all individuals.

Instruments

Adaptation to disability was measured by the Reactions to Impairment and Disability Inventory (RIDI; [Livneh and Antonak, 1990](#)), a 60-item, multidimensional measurement instrument that seeks to measure experienced reactions to the onset of a medical condition with the following 8 subscales: shock (7 items), anxiety (8 items), denial (7 items), depression (8 items), internalized anger (8 items), externalized hostility (7 items), acknowledgment (7 items) and adjustment (8 items). Cronbach's coefficient alpha values for the eight subscales have been reported as: 0.75, 0.73, 0.69, 0.78, 0.74, 0.79, 0.77 and 0.85, respectively ([Livneh and Antonak, 1997](#)). In the present study, Cronbach's alpha values were: 0.77, 0.81, 0.66, 0.84, 0.80, 0.69, 0.75 and 0.76, respectively. Higher scores on the first six subscales represent greater symptomatology of reactions to disability (e.g. increased anxiety), whereas higher scores on the two remaining

subscales reflect greater acknowledgment of and adjustment to disability.

Sociodemographic and disability-related data were obtained via a one-page questionnaire included in the packet. Duration of SCI was assessed by one item that asked the time in months or years since the onset of the spinal condition. The answer provided by the participant to the duration question was validated by checking it against answers to age and age at onset of the spinal injury. For this study's purposes, duration of SCI was categorized into three groups: (i) short-term duration (0–4 years; $n = 93$; 29.7%); (ii) medium-range duration (5–19 years; $n = 130$; 41.5%); and (iii) long-term duration (20–56 years; $n = 90$; 28.8%).

Analysis

Discriminant function analysis (DFA) is a statistical procedure for predicting group membership from a set of predictors ([Tabachnick and Fidell, 2001](#)). In DFA, groups (i.e. assigned categories of duration of SCI) are posited as the dependent variables, whereas predictors (i.e. scores on the eight RIDI subscales) are considered to be independent variables. Hence, DFA seeks to answer the question of whether the eight sets (i.e. subscales) of reactions to disability can be combined to significantly predict group membership (i.e. duration of SCI).

In this study we sought to compare the two groups that differed most on time since injury, namely the short-term and long-term duration groups. The rationale for this often-adopted practice is based on the notion that by creating groups that offer a sharper contrast, the variance of the measured variable (i.e. duration) is maximized ([Kerlinger, 1986](#); [Duarte-Silva and Stam, 1995](#)).

Results

Before conducting the DFA, three outliers were identified and eliminated from further analysis because they exceeded accepted Mahalanobis distance values. Next, the independent variables were examined for normal distributions. According to Glass and Hopkins (1996), square-root transformations reduce positive skewness and power transformations reduce negative skewness. Hence, square-root transformations were applied to six positively skewed subscales – shock, anxiety, denial, depression, internalized anger and externalized hostility. Square (power of two) transformations were applied to the two negatively skewed subscales – acknowledgment and adjustment, and the resultant scores divided by 100 to calibrate subscale variances. These transformations proved successful, and kurtosis and skewness values now fell within acceptable limits ([Tabachnick and Fidell, 2001](#)).

The first DFA was conducted on the combined SCI samples, with the eight reactions to disability (shock, anxiety, denial, depression, internalized anger, externalized hostility, acknowledgment and adjustment) as predictors of membership in the two extreme groups of duration of disability (recent-onset or long-term duration). Box's M test indicated that the homogeneity of covariance matrices was not significantly different between the two groups: Box's $M = 41.66$, $F(36, 91580.64) = 1.098$, $P = 0.315$.

Because the analysis focused upon two groups (recent-onset or long-term duration), only one discriminant function was extracted, Wilk's $\lambda = 0.795$, $\chi^2(8, n = 167) = 36.84$, $P < 0.001$, suggesting that the function of predictors significantly differentiated between the short- and long-term TSI groups. The correlations between the predictors and the discriminant function (i.e. the structure matrix) and the standardized discriminant function coefficients were examined. As recommended, structure coefficients below 0.30 were not interpreted (Pedhazur, 1997). For the combined scale (Table 1), the predictors most associated with the function (based on both their correlations with the function and standardized coefficients) were: denial, shock, internalized anger and externalized hostility. This function could, therefore, be interpreted as portraying a global attitude of denial, disbelief and generalized anger. Put differently, this function essentially reflects non-acceptance of one's disabling condition. Further evidence supporting group differentiation was obtained from the discriminant function's means (i.e. group centroids). Those in the short-term TSI group had a function mean of 0.50, whereas those in the long-term TSI group had a function mean of -0.51 . Of the original grouped data, 72.5% were correctly classified (70.2% correctly predicted to be in the recent-onset group and 74.7% correctly predicted to be in the long-term duration group).

In this combined sample, individuals with recent-onset SCI had higher levels of denial (mean = 11.86, sd = 3.92)

Table 1 Correlational coefficients and standardized function coefficients for the eight RIDI subscales

RIDI subscales ^a	Correlational coefficients ^b with function	Standardized ^b function coefficients
Denial	0.72 (0.42, 0.80)	0.74 (0.68, 0.86)
Shock	0.41 (0.49, 0.19)	0.72 (0.56, 0.65)
Internalized anger	0.32 (0.35, -0.05)	-0.17 (-0.74 , -0.23)
Externalized hostility	0.31 (0.54, -0.01)	0.31 (0.71, 0.16)
Acknowledgement	0.18 (0.03, 0.18)	0.23 (0.38, -0.03)
Depression	0.14 (0.52, -0.16)	-0.12 (0.29, -0.12)
Anxiety	-0.10 (0.10, -0.22)	-0.77 (-0.64 , -0.76)
Adjustment	-0.09 (-0.31 , 0.04)	-0.34 (-0.69 , -0.07)

^aDenial, shock, internalized anger, externalized hostility, depression and anxiety scores are expressed as square roots of original subscale scores. Acknowledgement and adjustment scores are expressed as squared scores/100 of original subscale scores.

^bFirst entry in parenthesis shows values for the civilian group; second entry shows values for the veteran group.

than individuals with long-term TSI (mean = 9.46, sd = 2.62). They also scored higher on shock (mean = 13.92, sd = 5.04 versus mean = 11.86, sd = 3.80) and internalized anger (mean = 15.06, sd = 5.62 versus mean = 13.23, sd = 4.75), than those with longer TSI. Finally, individuals with recent-onset SCI reported higher levels of externalized hostility (mean = 12.53, sd = 4.37) than individuals with long-term TSI (mean = 11.16, sd = 3.28).

The eight predictor variables were next examined for differences between the civilian and veteran groups. Three variables demonstrated significant differences between the groups: denial, $t(285) = 2.50$, $P = 0.013$; internalized anger, $t(286) = 3.93$, $P < 0.001$ and acknowledgment, $t(284) = 2.93$, $P = 0.004$. Because of these differences, as well as interest in whether the DFA results were replicable in the civilian and veteran groups separately, two additional DFAs were conducted on the split sample, using the same duration groups (i.e. the recent onset group of 0–4 years and the long-term duration group of 20–56 years). The Box's M test indicated that the homogeneity of covariance matrices was not significantly different between the two TSI groups in the civilian sample: Box's $M = 49.73$, $F(36, 6337.79) = 1.16$, $P = 0.24$. The Box's M test of the homogeneity of covariance matrices, although substantially larger when applied to the difference between the two TSI groups in the veteran sample, failed to reach the recommended level of $P < 0.001$ (Mertler and Vannatta, 2001); Box's $M = 72.38$, $F(36, 24922.16) = 1.83$, $P = 0.002$. Again, because only two groups were compared (recent-onset versus long-term duration), a single discriminant function was extracted per sample (civilians or veterans). The function was significant for both the civilian sample, Wilk's $\lambda = 0.737$, $\chi^2(8, n = 65) = 18.01$, $P = 0.02$ and the veteran sample, Wilk's $\lambda = 0.825$, $\chi^2(8, n = 102) = 18.42$, $P = 0.02$.

These findings indicate that, for both groups, the function of predictors successfully differentiated between the short- and long-term TSI groups. The two sets of coefficients (see Table 1, first set of values in parentheses) indicated that, for the civilian group, the best predictors for distinguishing between recent-onset and long-term duration were: externalized hostility, depression, shock, denial and adjustment. Adjustment was loaded negatively on this function, thus suggesting that the function measures a global non-adaptive tendency among the civilian group. For the veteran group, the only consistent predictor for distinguishing between the two TSI groups was denial (see Table 1, second set of values in parentheses), with a partial contribution of shock (the latter appearing only on the standardized function coefficients). This function can, therefore, be regarded as indicating a generalized denial

tendency among the veteran group. For the civilian group, 75.7% were correctly classified into short and long TSI, using the classification function coefficients. For the veteran group, only 61.9% were correctly classified. To compensate for resultant smaller sample sizes following the division into civilian and veteran groups, we attempted several additional splits (e.g. shortest 33.3% versus longest 33.3% groups on TSI; shortest 40% versus longest 40% groups on TSI). The results remained virtually unchanged with the same five to six RIDI predictors loading on the structure matrix for civilians and the single predictor (denial) for the veteran group.

Discussion

In this study we sought to examine the relationships between duration of SCI and a set of measures of psychosocial adaptation. To this end, we contrasted two groups of people who sustained SCI, namely, those whose injuries occurred within the past 4 years (short-term duration group) and those whose injuries were at least 20 years old (long-term duration group). It was reasoned, based on prior research findings, that a different pattern of adaptation would emerge in each group.

Results obtained from a two-group DFA indicated that the derived discriminant function successfully differentiated between the two duration groups. The resultant function was comprised of reactions that included shock (feelings of disbelief, confusion, and poor concentration), denial and generalized anger (oriented both internally and externally). This function, accordingly, was viewed as reflecting mostly a non-adaptive reaction (i.e. non-acceptance of condition). Individuals in the short-term TSI group scored higher on this function than those in the long-term TSI group, suggesting that TSI is indeed associated with an overall psychosocial pattern of adaptation to SCI. Also of interest is the finding that both adjustment and anxiety reactions loaded negatively on this function. Whereas the negative loading of adjustment on this function supports the nature of this mostly non-adaptive pattern of reactions, it is not immediately apparent why anxiety has shown a similar trend. It could be argued that an elevated level of anxiety, as manifested in increased feelings of apprehension and also including physiological indicators of nervousness signals awareness of the existence of the disability, thus contrasting it with feelings of denial and anger, which typically suggest; (i) lack of awareness of the condition and its implications; (ii) unwillingness to admit to consciousness disability reminders; or (iii) attempts to further distance oneself from disability-reminding situations and projecting frustration when unsuccessful (i.e. anger).

Although shock could be viewed as a non-adaptive reaction, the finding that it contributed significantly to this function is, at first glance, troublesome. Shock is

commonly believed to be a rather ephemeral reaction to traumatic events (Krystal and Petty, 1961; Horowitz, 1986; Livneh, 1986). Similar arguments can be raised regarding trauma-triggered anxiety reactions. This reaction is normally associated with incipient stages of recovery from life-threatening injuries (Shontz, 1975; Bray, 1978; Livneh, 1986). Although defying a simple explanation, these findings acquire particular significance when viewed within the context of the literature on post-traumatic stress disorder (PTSD). It could be argued that shock is no longer a clinically coherent reaction (or a viable phase of the adjustment process), years after the injury. However, symptom-like shock features might still be operative years after the onset of SCI. Intrusive thoughts and periodic repetitions of some aspects of the traumatic experience are still evident years later (Freud, 1920/1959; Horowitz, 1986). Put differently, the prominence of shock-like reactions and physiologically experienced, intense anxiety symptoms, reflect at this later stage, residual-like, intrusive, repetitive and unresolved issues that continue to affect the psyche. As has been theorized for individuals diagnosed with PTSD, the presence of trauma-related intrusive thoughts and physiological symptoms reflects an impairment in cognitive and emotional processing of the traumatic events (Foa *et al.*, 1989). Moreover, these initial reactions to a traumatic event might also interrupt normal psychological development and result in the person becoming cognitively 'stuck' in the earlier traumatic experience (van der Kolk and van der Hart, 1989; Holman and Silver, 1998). The resultant trauma memory therefore includes elements of chronic anxiety and cognitive (i.e. memory) disruption, as seen in the pattern of responses (i.e. discriminant function) observed in this study. The unexpected finding that shock was positively loaded on the resultant function (scores on shock were significantly lower for longer TSI) and that anxiety was negatively loaded on the function (scores on anxiety were higher, but not significantly, for the longer TSI group) is not immediately reconcilable with most clinical findings and theoretical models. It might be that whereas the cognitive disruptions associated with shock-like reactions (disbelief, confusion, intrusive memories) decrease gradually over time, the emotional-physiological symptoms associated with anxiety follow a different pattern and require more time to abate. Longitudinal research is needed to address this conjecture and examine possible parallel, independent or opposing trends among the various psychosocial reactions to traumatic injury. A likely explanation for the opposing temporal trends of shock and anxiety might be found in the latter's close affinity to the physiological concomitants of SCI. Close inspection of the RIDI's anxiety subscale reveals a wide range of physiological correlates (e.g. muscle tremor, body temperature fluctuations, cardiovascular overactivity, breathing difficulties), many of which are experienced as inherent symptoms of SCI (Crewe and Krause, 2002; Heffner, 1995). As such, these symptoms could be

regarded as independent of the mostly cognitive-affective reactions that loaded on the psychosocial function. It could, then, be argued that whereas most psychosocially non-adaptive reactions to SCI gradually diminish with time, experiencing and becoming aware of the bodily (i.e. physiological) symptoms triggered by SCI increase, at least for a period of time, following the injury. Finally, another possible explanation for the divergent trends of the shock/denial and anxiety reactions might be derived from a psychodynamic perspective. Because reactions of shock and denial, as well as other PTSD-related symptoms, involve active – even if unconscious – avoidance of thinking about the traumatic experience, the injured person might selectively attend to the physiological symptoms associated with the condition while minimizing cognitive reminders of it (McFarlane *et al.*, 1994; Zayfert *et al.*, 2002). Put differently, during the course of adaptation to SCI, the affected individual might shift to focusing selectively on internal (i.e. physiological) cues, while consciously avoiding thoughts that would be remindful of the traumatic experience, or thoughts that trigger an anxiety-provoking awareness of the permanency of the disability.

When examining the pattern of psychosocial reactions to SCI separately for each group of respondents (civilians and veterans), two sample-specific patterns of the function emerged. The resultant function, indicating differences in adaptation to SCI between civilians with longer and shorter duration of disability, was composed of several reactions traditionally regarded as non-adaptive in nature. Contributing reactions to this function included externalized hostility, denial, shock and depression. Adjustment and anxiety (the latter loading substantially only on the standardized function coefficient matrix), again, were negatively correlated with the function. Like the pattern of correlations for the entire sample (with the exception of depression replacing internalized anger), this function indicates a generalized non-adaptive reaction to the onset of SCI. Again, the two group centroids provided further evidence of the authenticity of the function (0.42 for the short-term versus -0.82 for the long-term TSI groups). It could be argued, therefore, that for the civilian sample the two duration groups differed along a broad range of non-adaptive reactions, including cognitive (i.e. lack of disability awareness, disbelief and confusion), affective or mood (i.e. depression) and behavioral (i.e. aggressiveness) reactions.

In contrast to its multifaceted structure in the civilian sample, the discriminant function in the veteran group reflected a much 'leaner' pattern of psychosocial reactions. In fact, only a single reaction (denial) consistently differentiated between the short-term and long-term TSI veteran groups. Loaded negatively on this function was anxiety. Adjustment no longer contributed to the function

in the veteran group. This bipolar, narrow-focused function appears to reflect a somewhat different pattern than that evident in the civilian group. Here, the function contrasts defensive efforts, even if unrealistic or consciousness-minimizing, to shield oneself against perception of painful reality (denial), with disorganized defenses or awareness-penetrating physiological and psychological reminders that the injury still looms large in one's life (anxiety).

Although the reasons for this different pattern of psychosocial reactions between the civilian and veteran groups requires further study, it could be related to certain variables, including: (i) demographic (e.g. age, marital status); (ii) disability-related (e.g. level of injury, course of injury, level of pain); and (iii) personality characteristics (e.g. selective use of coping strategies, degree of self-esteem), which might show differential profiles between the two groups. Indeed, in several *post-hoc* comparisons of the two groups (i.e. using a series of χ^2 and *t*-tests), the civilian group differed significantly from the veteran group on such variables as: heritage (a proportionately higher number of veterans were Caucasians, whereas there were more Hispanics in the civilian group); marital status (a higher percentage of civilians were single whereas more married people were represented among the veteran group); cause of injury (whereas more civilians were injured as a result of gunshots, more veterans were injured by falling accidents or reported unknown causes). Veterans were, on average, almost 13 years older than civilians, and they (veterans) were assessed as having significantly higher levels of injury than their civilian counterparts.

These findings, when viewed in their totality, strongly suggest that despite our efforts to control for group membership among respondents (civilians versus veterans), a host of other variables might have played a significant role in contributing to the differences found in the relationship of TSI and psychosocial adaptation to SCI between the two clinic populations.

Despite the encountered sample-specific concerns, when addressed within the broad context of people who have sustained SCI, the present findings are consistent with previous research. Two general themes are evident. First, acceptance of the reality of SCI (e.g. decreased use of denial) and self-reported life satisfaction (e.g. increased adjustment and mastery), appear to increase over time. Earlier research (Woodrich and Patterson, 1983; Krause and Crewe, 1991) reported similar findings, derived from cross-sectional and longitudinal studies. Second, although in our study anxiety was negatively loaded on the function capturing mostly maladaptive reactions to SCI, feelings of disbelief, confusion, depression and anger were more prevalent among those injured more recently.

These findings are generally consistent with trends reported in earlier research (Lundqvist *et al.*, 1991; Hancock *et al.*, 1993; Tate *et al.*, 1994). The inconsistencies found among reported earlier findings (e.g. whereas certain aspects of depression increase, others decrease over time; evidence of non-linear trends of reactions to SCI), although not directly addressed in this correlational study, nevertheless received some tentative empirical clarification. First, the opposing trends detected between anxiety and measures of depression, anger and shock suggest that psychosocial adaptation to SCI is a complex, multifaceted process that does not necessarily follow a linear, global or easily discernable trend (i.e. the various clinical clusters of non-adaptive reactions to SCI are not necessarily synchronized and do not follow parallel paths following injury). Second, attempts to verify the existence of a trans-situational, phase-linked, process of adaptation to SCI (or any other disabling condition) will most likely prove unsuccessful. The combined influences of: (i) demographic variables, such as chronological age, marital status, and ethnic background; (ii) disability-related factors, such as severity of condition, and cause of injury; and (iii) personality traits and coping strategies, exert a powerful and often 'chaotic' impact on adaptation to SCI, thus rendering any effort to document the existence of such a process, empirically futile.

Although a non-adaptive pattern (i.e. lower frequency of adaptive reactions among those whose injuries were of shorter duration) became apparent when the two TSI groups were differentiated, the findings of this study must be interpreted with caution because of several methodological and statistical limitations. First, the ratio of respondents-to-variables, following the sample split into civilian and veteran groups, was below the normally recommended ratio of 10-to-1 (Tabachnick and Fidell, 2001), thus jeopardizing the stability of the findings. Second, because of the relatively small sample size that resulted from contrasting two extreme groups (short versus long TSI), no cross-validation of findings was attempted. Despite additional contrasts (increasing each group size up to 40% of the total sample), which provided additional support for the earlier findings, these findings must be regarded as sample specific and in need of further validation.

Third, the crude differentiation of the two contrasted TSI groups (0–4 years versus 20+ years post-injury) does not provide sufficient empirical data to support the assumed relationship between TSI and psychosocial reactions to SCI. It could also be argued that if the process of adaptation to SCI reaches a certain psychosocial plateau several years after injury, then a more logical comparison would involve groups whose TSI is of shorter duration and are more narrowly defined (e.g. 0–1 years

versus 3–5 years versus 7+ years). Because of sample size constraints, such comparisons were not statistically possible in this study.

Fourth, DFA, despite its high degree of flexibility and adaptability to methodological considerations, as well as its robustness against statistical violations (Mertler and Vannatta, 2001; Tabachnick and Fidell, 2001), is geared mostly towards naturally occurring groups that are qualitatively different (e.g. gender, occupational categories, psychiatric diagnoses). In the present study, the division of a quantitative measure (i.e. TSI) into arbitrarily chosen groups might limit the generalizability and meaningfulness of the findings. Although our procedure of 'distancing' the two groups from one another, by contrasting two extreme TSI groups, might have attenuated some of this concern, it certainly has not dismissed it altogether.

Finally, the present study involved a cross-sectional research design. It would require a longitudinal design to help clarify the intricate relationship between TSI and unfolding psychosocial patterns of adaptation to SCI. In a similar vein, the findings of this study should not be interpreted as supportive of the existence of temporal progression of reactions to SCI. The present findings merely suggest that a differential pattern (e.g. profile, cluster) of reactions can be observed among people with SCI, at different points in time, following their injury.

Conclusion

This exploratory study yielded results suggesting that people with SCI whose injury occurred more recently (0 to 4 years) report a pattern of psychosocial reactions to their injury that differs from that reported by SCI survivors whose injury is of longer duration (20 years or more). However, these duration-associated patterns of responses exhibit moderately different internal structures and are influenced by various characteristics of the SCI population, including sociodemographic (e.g. civilians versus veterans, marital status, ethnicity), injury-related (e.g. cause of injury, severity of injury) and possibly other characteristics not addressed in this study. Future research should seek, through the adoption of a longitudinal design, to examine the more refined unfolding of psychosocial reactions, among SCI survivors, over time. Using a battery of psychometrically proven measures, ranging from self-reports, through clinical observations, to proxy reports, patterns and processes of psychosocial adaptation to SCI, and related traumatic experiences, could be more fruitfully deciphered.

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