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Psychological Variables Associated with Pain Perceptions Among Individuals with Chronic Spinal Cord Injury Pain

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Structural equation modeling was used to examine the relationships between selected psychological variables and pain perceptions in 103 individuals experiencing chronic pain following traumatic spinal cord injury (SCI). Previous studies have suggested strong relationships between psychological variables and chronic SCI pain, but further delineation of such relationships is needed in order ultimately to develop more effective pain management strategies for individuals afflicted with such pain. Anger was found to be significantly related to perceptions of pain ($p < .05$)*, but neither guilt nor anger suppression was significantly associated with perceived pain. Internal health locus of control was associated with decreased pain perceptions* ($p < .05$)*, but there was no significant relationship between internal health locus of control and anger. Punishing responses from significant others to pain complaints were related to feelings of guilt* ($p < .05$) *and perceived pain* ($p < .05$)*, but this relationship was not mediated by guilt.*

KEY WORDS: chronic pain; spinal cord injury; anger; structural equation modeling.

INTRODUCTION

Prior to World War II, at least 80% of individuals with spinal cord injuries (SCI) died within 2 weeks of sustaining the injury, due primarily to complications such as urinary sepsis and decubital ulcerations (Tribe,

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1963). An additional 10% of persons with such injuries died within the first five years following the injury (Felice, Muthard, & Hamilton, 1976). With such a poor prognosis, those consequences of the injury that posed a direct threat to life seemed of much greater significance than matters affecting quality of life. Due to advances in medical technology and techniques, individuals who have incurred a SCI can now expect to live an almost normal life span (Tunks, 1986). With the average postinjury life expectancy of a person with a SCI now measured in decades rather than days, sequelae of the injury that can have an adverse impact on long-term adjustment merit considerable attention. One such problem is the presence of persistent, intractable pain.

Chronic SCI pain appears to affect a significant number of individuals with SCIs, with estimates of the incidence of chronic SCI pain ranging from 11 to as high as 94% (Davidoff, Roth, Guarracini, Sliwa, & Yarkony, 1987). A history of severe pain has been found to be significantly related to a reduction in perceived quality of life (Lundqvist, Siosteen, Blomstrand, Lind, & Sullivan, 1987) and to diminished vocational and social functioning (Rose, Robinson, Ells, & Cole, 1988). In addition, research suggests that chronic SCI pain does not generally dissipate with time (Rose *et al.*, 1988). For many individuals with chronic SCI pain, neither pharmacological nor surgical interventions result in a significant reduction in perceived pain (Balazy, 1992; Woolsey, 1986).

It is certain that chronic SCI pain has multiple causes and, like all pain, is multidimensional (Mariano, 1992; Richards, 1992). Pain cannot be adequately conceptualized as either a purely physiological or a purely psychological phenomenon (Mariano, 1992). Nociceptive transmissions do not occur in isolation. Upon entering the central nervous system, they are subject to modulation by and integration with other information such as memories, emotions, interpretations of meaning, and personality variables (Melzack & Katz, 1992; Melzack & Loeser, 1978). Thus, although an organic basis for chronic SCI pain is generally thought to exist, it appears that psychological factors may account for at least some of the variance in the pain experience of individuals with SCIs. Three studies have directly examined the relative importance of physiological versus psychosocial variables for chronic SCI pain (Dew, Lynch, Ernst, Rosenthal, & Judd, 1985; Richards, Meredith, Nepomuceno, Fine, & Bennett, 1980; Summers, Rapoff, Varghese, Porter, & Palmer, 1991). The results of these studies suggest that psychosocial variables are more strongly associated with aspects of the pain experience than are physical variables such as the level or extent of the lesion.

One possible mechanism for the relationship between psychological variables and perceptions of pain in spinal cord-injured individuals may be the endogenous opioid system. Reductions in the efficiency of this system have been associated with chronic stress and negative affective states (Beutler, Engle, Oro'-Beutler, & Daldrup, 1986; Cohen, Pickar, & Dubois, 1983). In SCI, the functioning of this system already may be compromised due to the deprivation of input to the brain and spinal cord. In this regard, research has suggested the existence of postinjury changes in neurotransmitters thought to play an integral role in pain transmission such as Substance P, 5-hydroxytrytophan, and leu-enkephalins (Meyer & Fields, 1972). These alterations then may be exacerbated by the changes associated with chronic negative affective states.

Psychological variables with a more positive valence, such as perceived control over pain, have also been associated with changes within the endogenous opioid system. Specifically, Bandura, O'Leary, Taylor, Gauthier, and Gossard (1987) reported that perceived control over pain is associated with increased endogenous opiates, which may then serve to reduce pain perceptions. Consequently, it appears important further to explore and delineate the relationships between various psychological variables and pain perceptions in individuals with chronic SCI pain.

Psychological Moderators of Pain Experience

Empirical investigations with various pain populations have demonstrated that certain psychological variables are significantly associated with the pain experience. For example, anger and frustration have been reported to be significantly predictive of the affective component of pain in individuals diagnosed with low back pain, myofascial pain dysfunction, causalgia (Wade, Price, Hamer, Schwartz, & Hart, 1990), arthritis, and fibromyalgia (Gaskin, Greene, Robinson, & Geisser, 1992). Marcussen and Wolf (1949) found that they could induce headaches in migraine sufferers by placing them in anger-provoking situations, suggesting that anger may lead to the experience of pain. In a sample of spinal cord-injured individuals, anger-hostility was found to account for 33% of the variance in pain severity and 21% of the variance in pain-related interference after partialling out interference arising from the spinal cord injury (Summers *et al.*, 1991). Thus, high levels of anger may be related to greater perceived pain in individuals with SCIs.

The relationship between anger and pain may be mediated in part by factors such as the mode of anger expression and guilt. Numerous theorists have suggested that unexpressed anger can be converted into pain (Breuer & Freud, 1895/1956; Engel, 1959; Merskey & Spear, 1967) or can increase the unpleasantness of the pain experience (Pilowsky, 1986). Empirical investigations have suggested that the suppression of anger is significantly related to a multitude of health problems (Holt, 1970), including the development of cancer (Cox & Mackay, 1982), arthritis (Achterberg-Lawlis, 1982; Blumer & Heilbronn, 1982), hypertension (Spielberger *et al.*, 1985), asthma (Hollaender & Florin, 1983), and pain-prone disorder (Blumer & Heilbronn, 1982). Furthermore, researchers have speculated that diminished emotional expressivity could lead to increased pain intensity (Dalton & Feuerstein, 1989). However, the relationship between anger suppression or inhibition and pain has not yet been explored in a spinal cord-injured population.

Guilt has also been considered to be a form of internalized anger. Psychoanalytic authors have presented the hypothesis that pain provides the means for expiating feelings of guilt (Engel, 1959; Rangell, 1953). Despite the prominent place accorded to guilt in psychoanalytic theories of pain, it has received little empirical attention in the pain literature. However, the few studies that do exist suggest that guilt is significantly associated with low back pain (Sivik, 1991) and musculoskeletal pain (Svebak, Ursin, Endresen, & Hjelman, 1991).

In theoretical psychoanalytic discussions, one frequently mentioned guilt-provoking stimulus is the experience of feelings of anger toward significant others (Engel, 1959). Research with nonclinical populations has suggested that guilt is related to interpersonal sensitivity (Harder, Cutler, & Rockart, 1992). On the basis of these theoretical and empirical discussions, it is possible that interpersonal interactions that are perceived as punishing may elicit feelings of guilt, and the increased guilt could then be associated with perceptions of greater pain.

The latter hypothesis runs contrary to the operant model of chronic pain. This model predicts that responses by significant others to pain behaviors that either distract the pain patient or express solicitous concern for the patient would tend to reinforce such behaviors, thereby resulting in an increase in these behaviors (Fordyce, 1986). This hypothesis has been supported by research with chronic low back pain, but inverse relationships between solicitous responses and certain dimensions of pain have been reported in other pain populations such as individuals with arthritis or sickle cell anemia (Anderson & Rehm, 1984). Summers *et al.* (1991) examined the relationship between significant others' responses and pain severity in a sample of spinal cord-injured individuals. These authors reported that distracting and solicitous responses were unrelated to pain severity, whereas punishing responses accounted for 17% of the variance in this variable. Furthermore, punishing responses were significantly correlated with anger. The latter finding supports the hypothesis that punishing responses may exercise at least some of their effect on pain severity indirectly through anger.

Health locus of control has long been considered an important factor in psychosocial adjustment following spinal cord injury. Several studies have suggested an inverse relationship between internal health locus of control and emotional distress in spinal cord-injured individuals. In this population, greater internal health belief attributions have been reported to be associated with less depression, reduced negative life stress, and decreased psychological distress (Frank & Elliott, 1989; Frank *et al.*, 1987; Shadish, Hickman, & Arrick, 1981). Although health locus of control appears to have been an important variable in post-SCI adjustment, its possible relationship to pain in this population has not been explored. However, the relationship of internal health locus of control to pain has been examined in other populations. A national survey conducted as part of the Nuprin Pain Report indicated that individuals with high internal health locus of control were less likely to experience all kinds of pain, including headaches, backaches, muscle or joint pains, stomach pains, menstrual pains, and dental pains (Sternbach, 1986). In addition, studies have reported an inverse relationship between pain and internal health locus of control in patients undergoing autologous bone marrow transplantation (Gaston-Johansson, Franco, & Zimmerman, 1992), student nurses with low back pain (Klaber-Moffett, Hughes, & Griffiths, 1993), low back pain patients (Harkapaa, 1991), and individuals with rheumatoid arthritis (Brown & Nicassio, 1991).

In addition to the reported inverse relationship with pain, internal health locus of control may also be associated with reductions in anger. Although this possibility has received limited attention within health-related settings, the results of one study suggested that trait anger is negatively correlated with internal health locus of control in a sample of dental outpatients (Ludenia & Donham, 1983). Thus, the relationship between internal health locus of control and pain perceptions may be mediated by its relationship with anger.

The purpose of the current investigation is to delineate the relationships among anger, anger suppression, guilt, internal health locus of control, punishing responses from significant others to pain complaints, and perceptions of pain in individuals experiencing chronic SCI pain. The hypotheses to be tested include the following: (1) greater anger will lead to increased perceptions of pain; (2) a stronger tendency to suppress feelings of anger will result in greater perceived pain; (3) a stronger tendency to experience feelings of guilt will also lead to increased perceptions of pain; (4) greater perceived control over health will lead to reduced anger and perceptions of pain; and (5) punishing responses from significant others will lead to greater perceptions of pain, but this variable will exert its effect indirectly by increasing anger and guilt. These hypothesized relationships

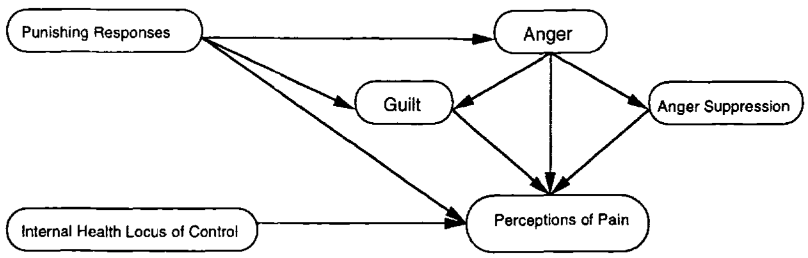

Fig. 1. Hypothesized relationships between psychological variables and perceptions of pain in individuals with chronic spinal cord injury pain.

are presented in Fig. 1. A structural equation modeling approach is used to generate parameter estimates for the pathways and to assess the degree to which the model is consistent with the obtained sample data.

The primary importance of the present study lies in its potential use in the development of more effective chronic pain management techniques for individuals afflicted with chronic SCI pain. Previous research has suggested that certain psychological variables may be strongly associated with the pain experience. Further specification of the relevant variables as well as an examination of the possible causal relationships among them may indicate areas toward which therapeutic intervention efforts can be more productively directed. For example, by encouraging the constructive expression of anger and facilitating the development of different marital or interpersonal interaction styles, rehabilitation professionals may be able to help individuals with SCI pain better manage their pain. It may become possible to alleviate chronic SCI pain or prevent it from becoming disabling, thereby substantially improving the quality of life that can be attained by individuals with SCI pain.

METHOD

Participants and Procedure

Spinal cord-injured individuals with chronic SCI pain were recruited either from an outpatient SCI clinic or through advertisements placed in the publications of several organizations that serve spinal cord-injured individuals. In order to ensure that sufficient healing of the acute injury had occurred, only those persons who were at least 1 year postinjury were asked to participate. Also, the pool of potential participants was limited to those individuals who acquired their SCI as a result of an accident rather than disease or illness. The latter criterion was intended to exclude those who might be experiencing pain due to an underlying disease process rather than the SCI. The methods and procedures used in this study were approved by the University's Human Subjects Review Board.

One hundred fifty-six spinal cord-injured individuals meeting the inclusion criteria responded to the recruitment efforts. Of these, 118 (75.6%) returned the questionnaires. However, because 15 of the participants did not complete at least one of the relevant instruments, their responses could not be used in the analyses, thereby reducing total effective sample size to 103. The 15 respondents who failed to complete all relevant questionnaires did not significantly differ from the remaining 103 participants in terms of age, education, gender, race, time since injury, time since the onset of pain, or the level or extent of the injury. Of the 103 participants who completed all of the necessary questionnaires, 66% were male, which is generally consistent with the gender distribution of the SCI population found by others (Trieschmann, 1988). The sample was predominately Caucasian (89.3%), with other ethnicities represented to a much lesser extent (7.8% African-American, 0.8% Asian, 0.8% Native American, and 0.8% responding to all categories). The mean age of the sample was 42 (SD = 11.7), with participants ranging from 21 to 76 years of age. Overall, the sample was relatively well educated (M = 14.24, SD = 2.49). The majority of individuals in the sample (74.8%) were employed at the time of injury, but only 30.1% were employed at the time of the study.

The mean time since injury was 11.96 years (SD = 9.44 years) with the most recent injury occurring 1 year ago and the oldest injury taking place 54 years ago. The onset of the pain for most occurred within the first 2 years postinjury, with the mean number of years since onset falling at 10.32 (SD = 7.85 years). The majority of individuals experienced pain at multiple sites in the body, primarily located at or below the trunk (Table I).

Each participant was asked to complete several questionnaires including the following: the State-Trait Anger Expression Inventory (Spielberger, 1988), the Harder Personal Feelings Questionnaire-2 Guilt scale (Harder & Zalma, 1990), the Multidimensional Health Locus of Control-Internal scale (Wallston, Wallston, & DeVellis, 1978), the first two sections of the West Haven-Yale Multidimensional Pain Inventory (Kerns, Turk, & Rudy, 1985), and a personal data questionnaire. To control for possible carryover and fatigue effects, the order of the six instruments was counterbalanced. The personal data form was always completed last.

Table I. Injury Characteristics of the Sample

	Frequency	Percentage
Cause of injury		
Motor vehicle accident	51	49.5
Falls	18	17.5
Gunshot wound	11	10.7
Diving accident	9	8.7
Level of injury		
C_1–C_8	49	47.6
T_1–T_6	16	15.5
T_7–L_1	33	32.0
L_2–S_5	3	2.9
Extent of injury		
Complete	56	54.4
Incomplete	46	44.7
Location of pain		
Neck	1	1.0
Upper extremities	4	3.9
Trunk	3	2.9
Abdomen	7	6.8
Location of pain		
Hips and buttocks	3	2.9
Lower extremities	9	8.7
Multiple sites above trunk	11	10.7
Multiple sites at or below trunk	47	45.6
Multiple sites throughout body	18	17.5

Instruments

Personal Data Questionnaire. This instrument is comprised of questions designed to elicit basic demographic information as well as the date, cause, level, and extent of injury.

State-Trait Anger Expression Inventory (STAXI). The STAXI (Spielberger, 1988) is a 44-item, self-report instrument comprised of six scales. Although all six scales were administered, only the Trait Anger (T-Anger) and Anger-in (AX/In) were used in the present study. The T-Anger measures dispositional tendency to experience state anger. AX/In is intended to assess the frequency with which angry feelings are suppressed or not given overt verbal or physical expression. The STAXI scales exhibit an acceptable level of internal consistency, with Cronbach's α's of .87 and .81 for T-Anger and AX/In, respectively. The construct validity of these scales has been demonstrated as well.

Harder Personal Feelings Questionnaire-2 Guilt Scale (PFQ2 Guilt). The PFQ2 Guilt scale (Harder & Zalma, 1990) is a six-item, self-report measure intended to assess an individual's tendency to experience feelings of guilt. Each item presents an affective descriptor term, and an individual is asked to respond to the item by indicating the frequency at which he or she experiences the emotion on a 5-point scale. In the current study, this instrument was used as an indicator of guilt. For the PFQ2 Guilt scale, Harder and Zalma (1990) reported an internal consistency reliability coefficient (Cronbach's α) of .72 and a 2-week test–retest reliability estimate of .85. The convergent and discriminant validity of the PFQ2 Guilt scale also has been demonstrated (Harder & Zalma, 1990).

Multidimensional Health Locus of Control-Internal Scale (MHLC-I). The MHLC-I (Wallston *et al.*, 1978) is a self-report measure designed to assess an individual's belief in his or her ability to control health outcomes. For the present study, both Form A and Form B of the MHLC-I were administered because combining the two equivalent forms has been reported to increase the alpha reliability of the scale (Cooper & Fraboni, 1988; Wallston *et al.*, 1978). For the 12 items comprising the combined-form MHLC-I, respondents are asked to indicate the extent to which they agree with each statement using a 6-point Likert scale. Cronbach's α coefficients ranging from .86 to .88 have been reported for the combined-form MHLC-I (Cooper & Fraboni, 1988; Wallston *et al.*, 1978). Convergent and predictive validities of the MHLC-I have also been documented (Wallston *et al.*, 1978).

West Haven-Yale Multidimensional Pain Inventory (WHYMPI). The WHYMPI (Kerns *et al.*, 1985) is a self-report measure that assesses several different aspects of an individual's pain experience. The Pain Severity, Interference, and Punishing Responses scales were used in the current study. The first two scales were used as indicators for pain perceptions, and, for these scales, individuals are asked to rate their responses on 6-point Likert scales, the anchors of which differ by question. For the Punishing Responses scale, respondents use a 6-point scale to indicate the frequency with which others respond to their pain behaviors in a punishing manner. In the present study, the Punishing Response scale was used as an indicator of punitive responses from significant others. For the Pain Severity, Interference, and Punishing Responses scales, Kerns and colleagues (1985) reported internal consistency α's of .72, .90, and .84, respectively, and 2-week test–retest reliability coefficients of .82, .86, and .84. The convergent and divergent validity of the WHYMPI Pain Severity, Interference, and Punishing Responses scales has also been demonstrated (Kerns *et al.*, 1985).

Analysis of the Data

The LISREL 8.03 computer program (Joreskog & Sorbom, 1993) was used to examine the hypothesized model. The linear structural relations analysis provided estimates of the parameters in the model, several indices of the goodness of fit between the hypothesized causal model and the obtained sample data and modification indices for the parameters. The analysis proceeded as follows: (1) a series of equations and matrices describing the hypothesized structural and measurement models was generated; (2) a determination was made as to whether the model was identified; (3) the sample covariance matrix was compared to the estimated population covariance matrix of the model to determine the degree of fit; (4) parameter estimates were generated using the generally weighted least-squares method of estimation; (5) the modification indices were examined; (6) limited modifications to the model were considered when substantively meaningful, theoretical justifications for such changes could be provided; and (7) the modified model(s) were reanalyzed (Fassinger, 1987). The generally weighted least-squares method of estimation was selected as this method is asymptotically distribution free and may be the best method to use in instances of suspected deviation from multivariate normality (Bollen, 1989; Joreskog & Sorbom, 1993).

The goodness-of-fit measures to be presented in the current model include the chi-square test, for which the null hypothesis states that the model holds exactly in the population, and the Test of Close Fit, for which the null hypothesis states that the model is a close rather than an exact fit with the population. The latter hypothesis is tested by calculating the probability that the root mean square error of approximation (RMSEA) is less than .05. Several descriptive measures of fit were used as well, including the goodness-of-fit index (GFI), the adjusted goodness-of-fit index (AGFI), the normed fit index (Δ_1), the incremental fit index (Δ_2), the relative fit index (ρ_1), and the nonnormed fit index (ρ_2). For these measures, values in the low to middle .90s suggest a good fit. Of these measures, the nonnormed fit index tends to be the least sensitive to sample size, whereas the relative fit index may tend to give an excessively pessimistic view of the model's fit with small sample sizes (Bollen, 1989).

RESULTS

Correlational analyses indicated that, as expected, the strongest correlation was found between the two indicators of pain perceptions, but significant positive correlations also existed between trait anger and the pain perception measures and between the measures of guilt and pain-related interference. In addition, there was a significant negative correlation between the measures of internal health locus of control and pain severity (Table II).

When the model was analyzed, the results indicated that the model did not fit the data sufficiently well. The chi-square measure of goodness

Table II. Zero-Order Correlations Among and Means and Standard Deviations of Variables in the Model

	T-Anger	PFQ-2	AX/In	Severity	Interfer	Punish	IHLC
T-Anger	—						
PFQ-2	0.35[b]	—					
AX/In	0.29[b]	0.42[b]	—				
Severity	0.24[a]	0.07	−0.02	—			
Interfer	0.35[b]	0.25[a]	0.18	0.45[b]	—		
Punish	0.21[a]	0.24[a]	−0.02	0.07	0.21[a]	—	
IHLC	0.12	−0.06	−0.01	−0.24[a]	−0.02	0.08	—
M	17.84	9.19	16.48	3.90	3.35	1.69	45.12
SD	4.89	4.08	4.51	1.20	1.48	1.55	10.00

Note. T-Anger, STAXI Trait Anger; PFQ-2, PFQ-2 Guilt; Ax/In, STAXI Anger In; Severity, WHYMPI Pain Severity; Interfer, WHYMPI Pain-Related Interference; Punish, WHYMPI Punishing Responses; IHLC, Internal Health Locus of Control.
[a] $p < .05$.
[b] $p < .01$.

of fit with 8 degrees of freedom was 27.36 ($p = .00061$). Thus, the hypothesis that the specified model holds exactly in the population was rejected. The RMSEA is .15, and the test of close fit also suggested a poor fit ($p = .0044$).

Overall, the descriptive measures provided further support for the conclusion that the model does not fit the data well. The majority of these measures did not reach the low to middle .90s. In addition, the matrix of standardized residuals contained numerous large residuals (greater than 2.58), and some moderately large modification indices were noted as well, both indicative of a poor fit. For one of the paths, there appeared to be sufficient theoretical justification for freeing the parameter. This pathway led from anger suppression to guilt. Numerous theorists (Blumer & Heilbronn, 1982; Breuer & Freud, 1895/1959; Engel, 1959; Rangell, 1953) dating back to and including Freud have linked these two constructs, as it appears that anger held inside may then be turned inward. Harburg and colleagues (1973) actually consider guilt following the expression of anger to be an aspect of suppressed hostility. Consequently, based on these theoretical arguments, this parameter was freed, resulting in a model exhibiting significantly better fit.

The chi-square value [$\chi^2(7, N = 103) = 12.35, p = .090$] of the modified model no longer led to the rejection of the hypothesis that the model holds exactly in the population. In addition, although the RMSEA value of .087 was greater than .05, the results of the test of close fit suggested that this difference was not statistically significant (RMSEA = .087, p = .20). The descriptive measures increased as well, and with the exception of the relative fit index, they were all in the .90s. The lower value of the relative fit index was not unexpected as it was the most likely to be adversely affected by a small sample size.

Five of the 21 parameters remained nonsignificant. Three of these pathways, those from anger suppression to pain, internal health locus of control to anger, and guilt to pain, were sequentially fixed to zero. The removal of these parameters resulted in minor improvements in the fit of the model and small increases in the sizes of the remaining parameters. The pathway from punishing responses to anger was still nonsignificant, but, with a *t* value of 1.85, it was approaching significance and could have potentially reached significance with a larger sample. The squared multiple correlations for the indicators of pain perceptions were .63 (WHYMPI Pain Severity) and .58 (WHYMPI Pain-Related Interference), which indicated that a significant amount of their variance was accounted for by the latent variable. The remainder of the measured variables were equivalent to the latent variables. The squared multiple correlations for the structural equations generally were much lower, suggesting that a significant amount of variance, particularly in anger and anger suppression, was unaccounted for by the variables in the model. Their values were .02 for anger, .30 for guilt, .09 for anger suppression, and .27 for pain.

As shown in Table III, the more parsimonious model resulted in a slightly better fit because the increase in degrees of freedom was not met with a substantial increase in the chi-square value. The RMSEA also decreased leading to a more highly nonsignificant test of close fit. The descriptive measure thought to behave the best in small samples, the nonnormed fit index, was in the high .90s, as were the goodness-of-fit index and the incremental fit index. The relative fit index remained in the middle .80s, although it too showed some improvement. Again, this measure frequently provides an overly pessimistic estimate of fit in small samples. All standardized residuals were below 2.58, and there were no modification indices greater than 4.5.

Table III. Summary of Fit Measures for the Final Model

χ^2 (10, N = 103)	Δ_1	Δ_2	ρ_1	ρ_2	GFI	AGFI	RMSEA
12.68	0.93	0.99	0.86	0.97	0.98	0.94	0.051
p = .24							p = .43

Note. Δ_1, normed fit index; Δ_2, incremental fit index; ρ_1, relative fit index; ρ_2, nonnormed fit index; GFI, goodness-of-fit index; AGFI, adjusted goodness-of-fit index; RMSEA, root mean square error of approximation.

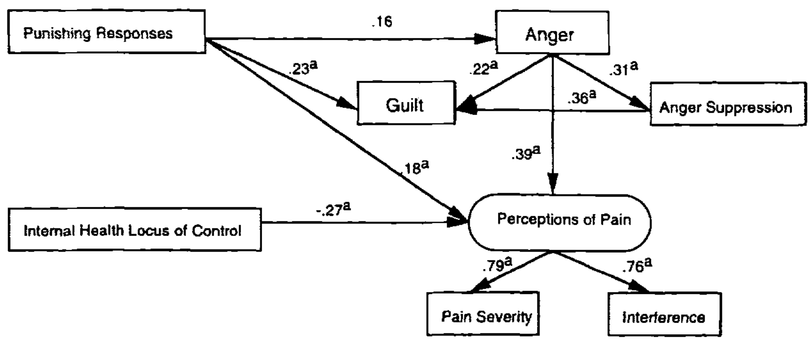

Fig. 2. Modified model with standardized regression coefficients.

The modified model with the standardized regression coefficients for each of the pathways is shown in Fig. 2. As hypothesized, punishing responses had significant positive direct effects on guilt and pain, and internal health locus of control had a significant negative direct effect on pain. Anger had a significant positive direct effect on guilt, anger suppression, and pain, and an indirect effect on guilt mediated by anger suppression. Pain perceptions had no hypothesized or observed effects on any other variable in the model. Contrary to the original hypotheses, guilt had no significant effect on any other variable in the model, and anger suppression had a direct effect only on guilt (Table IV).

DISCUSSION

The results of the present study suggest that psychological variables do play an integral role in the pain experience of individuals with chronic SCI pain. Consistent with the findings of Summers and colleagues (1991), anger and pain perceptions were found to be significantly related. Punishing responses from significant others to pain complaints were directly associated with increased feelings of guilt and pain perceptions, and the relationship between punishing responses and anger approached significance. Also, an internal health locus of control was associated with decreased perceptions of pain.

There were two main findings that were contrary to the hypotheses of the present study. The first of these was the failure to find significant pathways from guilt and anger suppression to perceived pain. Thus, in the present study, the psychoanalytic theories regarding the expiation of guilt and suppressed anger through pain (e.g., Engel, 1959) were not

Table IV. Standardized Direct, Indirect, and Total Effects of Both Endogenous and Exogenous Variables on Endogenous Variables

	Punishing responses			Internal health LOC			Anger			Anger suppression		
	Dir	Indir	Tot	Dir	Indir	Tot	Dir	Indir	Tot	Dir	Indir	Tot
Anger	.16	—	.16	—	—	—	—	—	—	—	—	—
Guilt	.23[a]	.05	.28[a]	—	—	—	.22[a]	.11[a]	.33[a]	.36[a]	—	—
Anger suppression	—	.05	.05	—	—	—	.31[a]	—	.31[a]	—	—	—
Pain perceptions	.18[a]	.06	.24[a]	-.27[a]	—	-.27[a]	.39[a]	—	.39[a]	—	—	—

Note. Dir, direct; Indir, indirect; Tot, total.
[a] $p < .05$.

supported. However, it is possible that the pathways from guilt and anger suppression were not significant in the current study because they have both positive and negative influences on perceptions of pain. Their potential for increasing pain was previously discussed, but it is possible that they both have reducing effects on pain as well. Blaming oneself for one's behavior at the time of negative life events may facilitate the development of a sense of greater control over the event, and the event may then appear more avoidable in the future. In this regard, behavioral self-blame has been found to be associated with better coping in the SCI population (Bulman & Wortman, 1977). Regarding anger suppression, Dinardo (1972) reported that hospitalized SCI patients who exhibited a consistent pattern of internalization of negative affect appeared to the staff to exhibit better self-concepts, less overt depression, and better adjustment than "external-sensitizers." Therefore, it is possible that both positive and negative influences exist but negate each other in the model.

Also contrary to expectations, the relationship between punishing responses and perceived pain was not significantly mediated by anger or guilt. The finding of a positive, direct relationship between punishing responses and pain perceptions is contradictory to the operant model of chronic pain. Perhaps the relationship between punishing responses and pain may be better explained by a form of classical rather than operant conditioning. This possibility finds a basis in the work of psychoanalytic theorists who have postulated that, beginning at a very early age, children learn to associate punishment with pain (Engel, 1959). Later in life, punishment may act as a conditioned stimulus, evoking the expectation of pain (the unconditioned stimulus). This expectation may result in heightened pain perceptions in an individual who already has a chronic pain problem. Thus, the punishing response from a significant other may be sufficient to result in increased perceptions of pain without necessarily requiring significant mediation by the emotions generated in such situations.

In summary, the present study provides important information regarding the relationships between specific psychological variables and perceptions of pain in individuals with chronic SCI pain. However, due to the small sample size, some caution may be warranted in generalizing the findings. With the chi-square statistic, the objective is to fail to reject the null hypothesis which states that the model holds exactly in the population. Therefore, with a small sample size, the probability of detecting a false null hypothesis may be low. Of note, Anderson and Gerbing (1984) and Boomsma (1986) both found that small sample sizes, which they defined as less than 100, led to too frequent rejections of the null hypothesis rather than the reverse when using the maximum likelihood estimation procedure.

In addition, through a specification search, the original model was altered, and there exists some possibility that the revised model capitalized on chance characteristics of the current sample. Consequently, future research efforts in this area should include cross-validation of the model with a different sample. Finally, the low squared multiple correlations for the structural equations suggest that one or more latent variables exist that account for a significant amount of variance in the latent variables currently in the model. Coping styles and anxiety are two additional variables that might be considered in future research.

Implications of the Current Findings

Clearly, chronic pain represents a significant problem for many individuals, and previous research in this area suggests that current pharmacological and surgical treatments are perceived as minimally effective in alleviating the pain (Conant, 1996; Nepomuceno *et al.*, 1979; Woolsey, 1986). The results of the present study suggest that both emotional and physical pain may coexist and co-vary within the experiential world of the individual with chronic SCI pain. It is possible that, as increases in one form of pain signal elevations in the other, externally guided decreases in one may lead to reductions in the other. Thus, therapists working with individuals with chronic SCI pain may find it helpful to attend to the possible presence of anger and negative interactional patterns with significant others. The development of more effective anger management strategies and more adaptive interpersonal patterns could potentially have a beneficial impact on pain perceptions.

In addition, the inverse relationship between internal health locus of control and pain suggests another possible target for intervention when working with some individuals with SCI pain. Spinal cord-injured individuals who have minimal belief in their abilities to influence their health and, specifically, their pain may be assisted in developing an awareness of those aspects of their experience over which they do have control. Cognitive–behavioral therapeutic methods such as relaxation techniques, coping skills training, and activity pacing may be useful in assisting such individuals to attain a sense of control over their pain (Philips & Rachman, 1996). Adaptation of these techniques to the needs of the individual with chronic SCI pain requires specialized knowledge regarding this population as well as creativity in developing appropriate interventions given SCI-specific limitations and expectations (Umlauf, 1992).

The present study resulted in a model of psychological variables associated with chronic SCI pain perceptions which has relatively good fit. In light of the amount of life disruption caused by this problem and the limited efficacy of current medical management techniques, it is important for there to be continued research in this area. Further elucidation of the relationships between psychological variables and chronic SCI pain may lead to the development of more effective strategies for managing this pain.

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