Pain, 62 (1995) 363–372
Elsevier Science B.V.

PAIN 2787

Fear of movement/(re)injury in chronic low back pain and its relation to behavioral performance

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(Received 29 April 1994, revision received 15 December 1994, accepted 16 December 1994)

Summary Two studies are presented that investigated 'fear of movement/(re)injury' in chronic musculoskeletal pain and its relation to behavioral performance. The 1st study examines the relation among fear of movement/(re)injury (as measured with the Dutch version of the Tampa Scale for Kinesiophobia (TSK-DV)) (Kori et al. 1990), biographical variables (age, pain duration, gender, use of supportive equipment, compensation status), pain-related variables (pain intensity, pain cognitions, pain coping) and affective distress (fear and depression) in a group of 103 chronic low back pain (CLBP) patients. In the 2nd study, motoric, psychophysiologic and self-report measures of fear are taken from 33 CLBP patients who are exposed to a single and relatively simple movement. Generally, findings demonstrated that the fear of movement/(re)injury is related to gender and compensation status, and more closely to measures of catastrophizing and depression, but in a much lesser degree to pain coping and pain intensity. Furthermore, subjects who report a high degree of fear of movement/(re)injury show more fear and escape/avoidance when exposed to a simple movement. The discussion focuses on the clinical relevance of the construct of fear of movement/(re)injury and research questions that remain to be answered.

Key words: Fear of movement; Fear of injury; Kinesiophobia; Low back pain; Chronic musculoskeletal pain; Behavioral assessment; Behavioral performance

Introduction

Chronic pain syndromes such as chronic low back pain (CLBP) are responsible for enormous costs for health care and society (Nachemson 1992). For these conditions a pure biomedical approach often proves insufficient. Numerous studies have shown that there is little direct relationship between pain and disability (Waddell 1987) and suggest that the behavioral or biopsychosocial approach offers the foundations for a better insight in how pain can become a persistent problem (Fordyce 1976; Turk et al. 1983). From this behavioral perspective chronic pain syndromes can best be studied by means of individual differences in overt motoric, cognitive and psycho-physiological responses (Vlaeyen et al. 1989). The main assumption is that pain and pain disability are not only influenced by organic pathology, if found, but also by biological, psychological and social factors that act upon the three above-mentioned response systems of pain. Operant conditioning has been described as the process that may be responsible for persisting disability due to the continuation of motoric pain behaviors (Fordyce 1976). Pain may also depend on cognitive processes, such as misinterpretation of proprioceptive signals (Schmidt 1986; Cioffi 1991) or low self-efficacy expectancies (Dolce et al. 1986). Through the process of classical conditioning, personally relevant stressors may elicit increasing autonomic and symptom-specific arousal responses such as muscle-tension (Flor and Turk 1989).

Avoidance learning

In 1982, Fordyce et al. described how pain behavior may also result from avoidance learning, which has

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SSDI 0304-3959(94)00279-7

been classified under operant conditioning. Avoidance refers to "the performance of a behavior which postpones or averts the presentation of an aversive event" (Kazdin 1980). Avoidance learning has long been considered to underly the formation of many so-called 'neurotic' symptoms (Kanfer and Philips 1970). In the case of pain, a patient may no longer perform certain activities because he/she anticipates that these activities increase pain and suffering. In the acute phase, avoidance behaviors, such as resting, limping or the use of supportive equipment, are effective in reducing suffering from nociception. Later on, these protective pain and illness behaviors may persist in anticipation of pain, instead of as a response to it. Long-lasting avoidance of motoric activities can have detrimental consequences, both physically (loss of mobility, muscle strength and fittness, possibly resulting in the 'disuse syndrome') (Bortz 1984) and psychologically (loss of self-esteem, deprivation of reinforcers, depression, somatic preoccupation). Philips and Jahanshahi (1986) found that, in a group of headache sufferers, avoidance was the most prominent behavior reported by these individuals. In their study, avoidance was not limited to avoidance of movement, but also withdrawal from social situations. Philips (1987) argued in favor of a cognitive theory of avoidance behavior, rather than the operant theory. She takes the view that avoidance is influenced by the expectancy that further exposure to certain stimuli will promote pain and suffering. This expectancy is assumed to be based on previous aversive experiences with the same or similar situations. She also pointed to the similarities between avoidance behavior displayed by pain patients and that of patients with phobias and suggests that "chronic pain and chronic fear — both aversive experiences which result in avoidance behavior — may share important characteristics" (Philips 1987, p. 277). Recent studies have focused on the relationship between fear/anxiety and chronic pain, of which the object of fear has been *fear of pain* (Lethem et al. 1983; McCracken et al. 1992, 1993), *fear of work-related activities* (Waddell et al. 1993) and *fear of movement that is assumed to cause (re)injury* (Kori et al. 1990; Kole-Snijders et al. 1993; Crombez 1994).

Fear of pain

In an attempt to explain how and why some individuals develop a chronic pain syndrome, Lethem et al. (1983) introduced a so-called 'fear-avoidance' model. The central concept of their model is fear of pain. 'Confrontation' and 'avoidance' are postulated as the two extreme responses to this fear, of which the former leads to the reduction of fear over time. The latter, however, leads to the maintenance or exacerbation of fear, possibly leading to a phobic state. The avoidance results in the reduction of both social and physical activities, which in turn leads to a number of physical and psychological consequences augmenting the disability. In 1992 the Pain Anxiety Symptoms Scale (PASS) (McCracken et al. 1992) was developed to measure cognitive, physiologic, and motoric aspects of fear of pain. The authors found correlations with measures of anxiety, cognitive errors, depression, and disability. In a 2nd study (McCracken et al. 1993), the authors showed that, in a group of CLBP patients, greater pain-related anxiety was associated with higher predictions of pain and less range of motion during a procedure involving a passive but painful straight leg raising test. They also showed that different types of pain-anxiety symptoms have different relations with pain coping responses as measured with the Coping Strategies Questionnaire (CSQ) (Rosenstiel and Keefe 1983). Cognitive anxiety responses (e.g., 'I find it hard to concentrate when I hurt') negatively interfered with coping strategy use, whereas physiological anxiety responses appeared to enhance coping (MacCracken and Gross 1993). The authors also found a substantial overlap between the CSQ factor Catastrophizing and anxiety symptoms. This is of interest as previous studies found strong correlations between catastrophizing attributions and depression.

Fear of work-related activities

CLBP patients may not only fear pain but also activities that are expected to cause pain. In this case, fear is hypothesized to generalize to other situations that are closely linked to the feared stimulus. Vlaeyen (1991) found that a group of 50 CLBP patients had mean elevated scores that were clinically significant on the Social Phobia and Agoraphobia scales of the Fear Survey Schedule (FSS-III) (Wolpe and Lang 1964; Arrindell et al. 1990). Waddell et al. (1993) developed the Fear-Avoidance Beliefs Questionnaire (FABQ), focusing on the patient's beliefs about how work and physical activity affect his/her low back pain. The FABQ consists of 2 scales (Fear-Avoidance Beliefs of Physical Activity and Fear-Avoidance Beliefs of Work) of which the latter was consistently the stronger. The authors found that fear-avoidance beliefs about work are strongly related with disability of daily living and work lost in the past year, and more so than biomedical variables such as anatomical pattern of pain, time pattern, and severity of pain.

Fear of movement / (re)injury

A more specific fear is fear of movement and physical activity that is (wrongfully) assumed to cause reinjury. In the study of Vlaeyen (1991) mentioned earlier, the same group of CLBP patients scored clinically significant on the scale Fear of Bodily Injury, Death and Illness of the FSS-III. Kori et al. (1990) introduced the term 'kinesiophobia' (kinesis = movement) for the condition in which a patient has "an excessive, irrational, and debilitating fear of physical movement and activity resulting from a feeling of vulnerability to painful injury or reinjury". In accordance with Lethem et al. (1983), Crombez (1994) empirically derived a subgroup of Avoiders and Confronters among a sample of CLBP patients. Although there were no differences found in gender, age, number of back surgeries, use of medication, and reported pain intensity, Avoiders reported significantly more fear of pain and fear of injury than the Confronters. When exposed to a maximal performance test (flexion and extension of the knee), Confronters showed a significantly better performance than the Avoiders. Although fear of movement/(re)injury might well be an important predictor of pain disability in people with CLBP, almost no empirical data confirming this hypothesis are currently available. In this paper, two studies will be presented that are aimed at examining the construct of fear of movement/(re)injury, and its relation to behavioral performance.

The 1st (correlational) study examines how fear of movement/(re)injury relates to biographical variables (age, gender, duration of pain complaints, use of supportive equipment and compensation status), pain-related variables (pain-intensity, pain-coping, pain-cognitions) and distress-related variables (fear and depression). The 2nd (experimental) study examines whether fear of movement/(re)injury is related to behavioral performance. The two studies were carried out with patients admitted to a behavioral rehabilitation program at the Lucas Foundation for Rehabilitation in Hoensbroek, The Netherlands.

Study 1: fear of movement/(re)injury: relation with biographical, pain-related and distress-related variables

Method

Subjects

One hundred and three CLBP patients that were on a waiting list for a behavioral rehabilitation program were included in this study. The sample consisted of 45 men and 58 women with mean ages of 42.9 (SD = 7.7) and 39.0 years (SD = 8.9), respectively. The duration of pain complaints was 9.75 (SD = 9.6) and 10.5 years (SD = 8.7), respectively, with no significant differences ($t = -0.45$, $P = 0.655$). Of the total sample, 63% received financial disability compensation for at least 1 year, with a mean duration of 3.7 years (SD = 4.7), 35% had received one or more back surgeries, and 28% used supportive equipment of whom 50% was using supportive equipment for ambulation. All patients had minimal organic findings or displayed pain complaints that were disproportionate to the demonstrable organic basis of their pain.

Procedure

Before entering the behavioral rehabilitation program, patients were requested to complete a comprehensive assessment procedure, including self-report and observational measures, that was part of a randomized clinical trial evaluating the effectiveness of the treatment.

Measures

Fear of movement / (re)injury

Miller et al. (1991) developed the Tampa Scale for Kinesiophobia (TSK) as a measure of fear of movement/(re)injury. The original 17-item TSK was translated into Dutch (TSK-DV) by the authors and subsequently corrected by a professional translater. The same scoring format and keys were maintained (see Appendices I and II). Each item is provided with a 4-point Likert scale with scoring alternatives ranging from 'strongly disagree' to 'strongly agree'. A total score is calculated after inversion of the individual scores of items 4, 8, 12 and 16. Based on the data of the current patient sample, following information underscores the reliability of the TSK-DV: According to the Kolmogorov-Smirnov goodness-of-fit test, the scores on the TSK were normally distributed (K-S $z = 0.820$, $P =$

TABLE I

BIOGRAPHICAL DIFFERENCES OF TSK-DV SCORES

Means, standard deviations (SD) and F values for ANOVA and ANCOVA with Pain intensity (VAS) as covariate.

	TSK-DV			ANOVA		ANCOVA	
	n	mean	SD	F	P	F	P
Gender							
Male	45	40.8	7.7				
Female	58	36.6	7.6	7.57	0.007	5.07	0.027
Supportive equipment							
Yes	19	36.6	9.0				
No	84	38.9	7.5	1.31	0.255	1.45	0.231
Disability compensation *							
Yes	67	39.4	8.2				
No	36	36.7	7.0	2.78	0.099	5.54	0.021

* In the Netherlands, Disablement Insurance Benefits (WAO, Wet Arbeidsongeschiktheid) are given after being on sick leave for at least 1 year.

TABLE II

PEARSON CORRELATION COEFFICIENTS r BETWEEN THE TSK-DV, FEAR SURVEY SCHEDULE (FSS-III-R), BECK DEPRESSION INVENTORY (BDI), COPING STRATEGIES QUESTIONNAIRE-DUTCH VERSION (CSQ-DV), VAS AND PAIN COGNITION LIST, EXPERIMENTAL VERSION (PCL-e)

Variables	mean	SD	r
TSK-DV (fear of movement/ (re)injury)	38.4	7.8	
FSS-III-R (fear)			
Social phobia	24.6	9.7	0.30 **
Agoraphobia	20.2	7.1	0.27 **
Fear of Bodily Injury, Illness and Death	22.4	9.1	0.33 ***
BDI (depression)	13.7	7.3	0.50 ***
CSQ-DV (pain coping)			
Diverting attention	24.4	11.5	−0.02
Reinterpreting pain	16.0	11.1	0.21 *
Catastrophizing	23.7	11.8	0.41 ***
Ignoring pain	28.0	10.5	−0.14
Praying	23.3	12.1	0.11
Positive self-talk	36.0	10.5	−0.20 *
Increasing activities	28.0	10.2	−0.02
Relaxation	40.5	9.3	−0.03
Pain control	8.4	4.6	0.12
VAS (pain intensity)	62.3	17.2	0.25 **
PCL-e (pain cognitions)			
Pain impact	50.6	10.0	0.20 *
Catastrophizing	50.0	10.5	0.58 ***
Outcome efficacy	21.4	4.5	0.12

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$ (1-tailed).

0.512). Cronbach's alpha was 0.77, which is fair. These data are consistent with an earlier study using a different chronic pain sample (Kole-Snijders et al. 1993).

Biographical variables

A questionnaire was completed that covered different biographical aspects, of which the following were selected for this study: gender, age, pain duration since onset of the pain, compensation status, duration of compensation and the use of supportive equipment for ambulation.

Pain-related variables

Pain intensity. The visual analog scale (VAS) (Jensen and Karoly 1992), a widely used measure of pain experience, is used in this study. Patients were asked to rate the mean pain intensity over the last week. A 10-cm line was provided with written anchors at the two extremes: 'no pain at all' and 'the worst pain ever experienced'.

Pain coping. A Dutch version of the CSQ (Rosenstiel and Keefe 1983) was developed by Spinhoven and Linssen (1991). The following subscales were empirically derived: Diverting Attention, Reinterpreting Pain, Catastrophizing, Ignoring pain, Praying, Positive Self-Talk, Increasing Activities, Relaxation, and Pain Control.

Pain cognitions. The Pain Cognition List (PCL-e) (Vlaeyen et al. 1990) is a 77-item questionnaire aimed at the assessment of distorted pain cognitions and experienced self-control. Five scales are factor-analytically derived: Pain Impact, Catastrophizing, Outcome-Efficacy, Acquiescence and Reliance on Health care. For this study the first 3 factors were selected. Pain impact reflects the experienced impact the pain has on the patients' functioning. Catastrophizing refers to an attentional focus on negative aspects of the patients' situation. The factor Outcome-Efficacy represents the patients' expectation that a given behavior can lead to desirable outcomes.

Distress

Fear. The Dutch version of the Fear Survey Schedule (FSS-III-R) (Wolpe and Lang 1964; Arrindell et al. 1990) is used. The FSS-III-R is a 76-item questionnaire consisting of clusters of phobic complaints: Social Phobia, Agoraphobia, Fear of Bodily Injury, Illness and Death, Fear of Sex and Aggression, and Fear of Living Organisms. For this study only the first 3 clusters were selected.

Depression. In this study, a Dutch translation of the Beck Depression Inventory (BDI) (Beck et al. 1979) was selected. This version is the 21-item self-report questionnaire designed to measure the severity of depression that was suggested by the Dutch Committee for the Standardization of Depression Questionnaires (Zitman et al. 1989).

Statistical procedure

For the relation between TSK-DV-scores and age, duration of pain complaints, duration of compensation, fear, depression, pain

TABLE III

SUMMARY OF STEPWISE HIERARCHICAL REGRESSION ANALYSIS OF TSK-DV, WITH CURRENT PAIN INTENSITY, GENDER, AND COMPENSATION STATUS ENTERED IN THE FIRST STEP AND VARIABLES CATASTROPHIZING (PCL-e and CSQ-DV), DEPRESSION (BDI) AND FEAR OF BLOOD, INJURY (FSS-III-R) TESTED WITH A FORWARD INCLUSION METHOD

Dependent variable: fear of movement/(re)injury (TSK-DV).

Step	Independent variables	Adj. R^2	R^2	$R_{x,y,z}$	β
1.	Compensation	0.11	0.14	0.21	0.21 *
	Pain intensity (VAS)			0.19	0.18
	Gender			−0.18	−0.18
2.	Compensation	0.45	0.48	0.17	0.13
	Pain intensity (VAS)			0.16	0.12
	Gender			−0.24	−0.19 *
	Catastrophizing (PCL-e)			0.62	0.59 ***
3.	Compensation	0.48	0.51	0.18	0.14
	Pain intensity (VAS)			0.13	0.10
	Gender			−0.21	−0.16
	Catastrophizing (PCL-e)			0.45	0.45 ***
	Depression (BDI)			0.26	0.24 *

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

$R_{x,y,z}$ = partial correlation coefficient.

TABLE IV

MEANS, SD, EXPECTED CORRELATIONS AND PEARSON CORRELATION COEFFICIENTS r FOR THE BEHAVIORAL APPROACH TEST (BAT), ELECTRO-CARDIOGRAPHY (ECG), SKIN CONDUCTANCE LEVEL (SCL), STATE-TRAIT ANXIETY INVENTORY (STAI), VAS (Fear-VAS, measuring fear intensity)

T_0 = Baseline; T_1 = Anticipation, T_2 = Start movement, T_3 = Termination of movement, T_4 = Return to baseline.

		Mean	SD	Exp. correl. [a]	r
TSK-DV		35.82	7.39		
BAT		165.4	108.3	-	−0.44 **
ECG	T_1-T_0	−2.84	6.75	+	0.28
	T_2-T_0	13.19	9.72	+	0.27
	T_3-T_0	10.14	8.57	++	0.24
	T_4-T_0	0.80	7.02	+	0.22
SCL	T_1-T_0	0.91	1.43	+	0.26
	T_2-T_0	2.25	2.68	++	0.03
	T_3-T_0	1.57	2.39	++	0.10
	T_4-T_0	2.58	2.89	+	0.09
STAI-state	T_0	38.6	10.3	+	0.22
STAI-trait	T_0	42.7	9.7	+	0.17
Fear-VAS	T_3	17.7	24.6	++	0.52 ***
STAI-state	T_3	39.1	10.7	++	0.33 *

[a] Expected correlations: − = negative, ± = no correlation, + = positive, ++ = strongly positive.
* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$ (1-tailed).

intensity, pain coping, and pain cognitions, Pearson correlation coefficients were calculated. Univariate ANOVAs, with and without current pain intensity as a covariate, were used for gender, use of supportive equipment and compensation status. A hierarchical multiple regression analysis with a stepwise forward inclusion method with TSK-DV as dependent variable was used, in which the independent variables were entered in the equation in a sequential order. Two groups of variables were introduced in the equation, in order to determine whether other independent variables improved prediction of fear of movement/(re)injury beyond the prediction afforded by gender, compensation and current pain intensity.

Results

No significant correlations were found between TSK-DV and age ($r = 0.02$, NS), duration of pain complaints since pain onset ($r = 0.01$, NS), and duration of compensation ($r = 0.17$, NS for n = 51). Table I shows that men score significantly higher than women, and that the use of supportive equipment for ambulation and compensation status appear not to be related to fear of movement/(re)injury. A similar pattern of results appears when a correction for current pain intensity is carried out except that patients who receive disability compensation score higher than patients who do not receive such financial compensation. Table II shows the differential pattern of significant correlations between TSK-DV and other psychological measures. The strongest correlations are found between TSK-DV and 'catastrophizing' (of both the PCL-e and CSQ-DV), depression (BDI), and the 3 factors from the Fear Survey Schedule (Social Phobia, Agoraphobia and Fear of Bodily Injury, Illness and Death). Lower, but still significant correlations are found with reported pain intensity (VAS), Reinterpreting Pain and Positive Self-Talk of the CSQ-DV, and Pain Impact of the PCL-e. We decided to enter independent variables in the multiple regression analysis that have correlations > 0.30 with the dependent variable (TSK-DV). The 1st step of the hierarchical multiple regression analysis revealed that only compensation status is predictive for TSK-DV, when gender and pain intensity are taken into account. When these 3 measures are controlled for, Catastrophizing (PCL-e) is most predictive of fear of movement/(re)injury, followed by Depression (BDI) (Table III). Variance inflation factors (VIFs) were quite small (range: 1.01–1.63), suggesting that there is no problem of collinearity among the independent variables. In general, it can be concluded that fear of movement/(re)injury can be reliably measured, and that it is related

TABLE V

t TESTS FOR THE DIFFERENCES BETWEEN LOW-FEAR SUBJECTS (TSK-DV ≤ 37) AND HIGH-FEAR SUBJECTS (TSK-DV > 37) ON THE BEHAVIORAL APPROACH TEST (BAT), ELECTRO-CARDIOGRAPHY (ECG), SKIN CONDUCTANCE LEVEL (SCL), STATE-TRAIT ANXIETY INVENTORY (STAI), VAS (Fear-VAS, measuring fear intensity).

T_0 = Baseline, T_1 = Anticipation, T_2 = Start movement, T_3 = Termination of movement, T_4 = Return to baseline.

		Low responders		High responders		t
		Mean	SD	Mean	SD	
TSK-DV		30	5.06	42	3.16	−8.11 ***
BAT		209.6	108.1	118.4	89.4	2.63 *
ECG	T_1-T_0	−3.65	7.7	−1.62	5.2	−0.73
	T_2-T_0	12.51	9.7	14.21	10.2	−0.42
	T_3-T_0	10.35	9.7	9.84	7.1	0.14
	T_4-T_0	0.51	8.6	1.24	4.1	−0.25
SCL	T_1-T_0	0.61	1.5	1.32	1.3	−1.37
	T_2-T_0	2.01	3.0	2.57	2.3	−0.56
	T_3-T_0	1.35	2.5	1.86	2.4	−0.57
	T_4-T_0	2.45	2.9	2.74	3.1	−0.26
STAI-state	T_0	35.47	11.1	41.94	8.5	−1.88
STAI-trait	T_0	38.88	9.5	46.69	8.5	−2.48 *
Fear-VAS	T_3	6.94	8.6	29.13	30.7	−2.86 **
STAI-state	T_3	35.24	10.1	43.13	10.2	−2.24 *

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

to catastrophizing cognitions as well as dysphoric mood in general. A more specific question is whether fear of movement/(re)injury is, as would be expected theoretically, related to behavioral performance. If CLBP patients who are fearful of movement because of the (irrational) anticipation of (re)injury are exposed to movement, increased fear must be observable. In order to test this hypothesis, the 2nd study is set up.

Study 2: fear of movement / (re)injury and behavioral performance

This study describes an experiment during which CLBP patients are exposed to a simple motoric activity. Subjects were requested to lift a 5.5 kg bag and to hold it as long as possible. Measures of the 3 response systems of fear were assessed. It was hypothesized that patients scoring high on the TSK-DV would experience more fear when exposed to this motoric activity, quit lifting the bag much sooner, and show more psychophysiological reactivity than low responders on the TSK-DV.

Method

Subjects

Thirty-three of 51 CLBP patients (64.7%) who were on a waiting list for a behavioral rehabilitation program agreed to participate in the experiment. The group consisted of 25 female and 8 male patients with a mean age of 42.4 years (SD = 9.7; range: 26–59). The mean duration of their pain complaints was 10.3 years (SD = 10.1; range: 1.6–40). The group of non-volunteers consisted of 11 female and 7 male CLBP patients with a mean age of 42.8 years (SD = 10.8; range: 23–64). There is no difference between the volunteers and the non-volunteers on gender ($\chi^2 = 1.195$, NS) and age ($t = -0.131$, NS). As in study 1, all patients had minimal organic findings or displayed pain complaints that were disproportionate to the demonstrable organic basis of their pain.

Measures

Motoric behavior. A Behavioral Approach Test (BAT) was developed for this experiment, based on the pain-rest contingency principle. For this test the patient was asked to stand up and lift a 5.5 kg bag with the dominant arm and hold it until pain or physical discomfort made it impossible for the patient to continue. The lifting time (in seconds) was registered by the experimenter by means of a stopwatch. When a maximum score of 300 sec was reached, the test was terminated by the experimenter who indicated that the patient could sit down and leave the bag on the floor.

Psychophysiology. Heart rate frequency (ECG) and skin conductance level (SCL) were registered using Medicotest disposable ECG electrodes, type VL-00-S, and Beckmann 2 mm Ag-AgCl electrodes, respectively. ECG R-peaks were filtered from the total ECG signal and, as well as SCL signals registered through the Labtech Notebook software program. Data processing occurred with the edit program ELTOPRAC. For both variables means for 5 time intervals were calculated: T_0 (baseline) being 20 sec before termination of completion of the questionnaires, T_1 (anticipation) being 15–35 sec after starting the audiotape with verbal instructions, T_2 (start of movement) being 13.5 sec from the start of lifting the bag, T_3 (end of movement) being 13.5 sec before leaving the bag on the floor, and T_4 (return to baseline) being 30–50 sec following the completion of the task. Time intervals T_0 to T_3 represent increasing approaches to the (feared) stimulus.

Self-report. Besides the TSK-DV, a VAS (fear-VAS) with 'I am not afraid to reinjure myself' on one extreme and 'I have never been so afraid to reinjure myself' on the other, and the Dutch version of

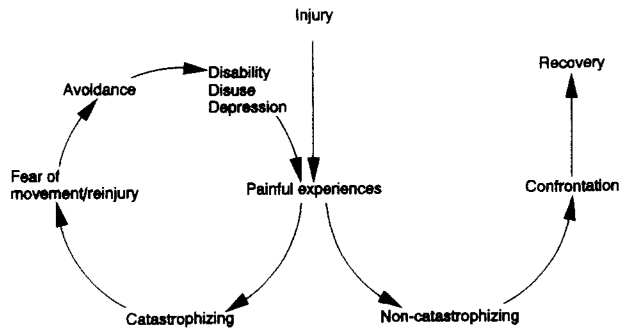

Fig. 1. Cognitive-behavioral model of fear of movement/(re)injury.

the State Trait Anxiety Inventory (STAI) (Van der Ploeg et al. 1980) were included in this study.

Procedure

All patients completed a biographical questionnaire at home, prior to participating in the experiment. When entering the laboratory, patients were given brief information about the experiment. Subsequently, Medicotest disposable ECG electrodes were attached to the sternum manubrium, under the sternum, and between the 1st and 2nd ribs. Two 2 mm Beckmann electrodes were attached to the ring and middle fingers of the non-dominant hand. While ECG and SCL recordings were started, patients were asked to complete the TSK-DV as well as a Dutch version of the STAI. Next, audiotaped instructions of the BAT were given to the patient. When a subject reached a lifting time of 300 sec, he/she was asked to quit lifting and to replace the bag on the floor. After termination of the behavioral performance, the patient was asked to complete the fear-VAS and the State part of the STAI. Then the electrophysiological registration was terminated. Pearson correlation coefficients were calculated between TSK-DV and the other measures, as well as t tests between high responders and low responders on the TSK-DV.

Results

Again, a Kolmogorov-Smirnov goodness-of-fit test revealed that the TSK-DV scores were normally distributed (K-S $z = 0.80$; $P = 0.54$). The median score was 37, which was used as the cut-off for dividing the group into low responders (TSK-DV ≤ 37; n = 17) and high responders (TSK-DV > 37; n = 16). There were no significant differences between the low and high responders regarding gender ($\chi^2 = 0.83$, NS) and age ($t = -1.59$, NS). In contrast to the findings of study 1, high responders reported a significantly longer duration of pain complaints ($t = -2.51$, $P = 0.017$). Table IV shows the means, standard deviations, expected correlations, Pearson correlation coefficients between TSK-DV and other fear measures. Table V shows the means, standard deviations, and t values differentiating between TSK-DV low and high responders.

Motoric behavior. Ten of the 33 subjects reached the maximum approach time of 300 sec, of whom 9 were low TSK-DV responders. A significant negative correlation was found between TSK-DV and BAT. The difference in mean BAT scores for TSK-DV low and high responders was significant. As expected, patients who reported fear of movement/(re)injury avoided motoric activities more than patients who did less so.

Psychophysiology. Unexpectedly, no significant correlations were found between changes in HR or SCL and TSK-DV. Correlations between HR changes and TSK-DV are positive and higher than those with SCL, but do not reach significance. A systematic increase in HR and SCL across the time intervals T_0-T_3 was also not found. Similarly, no significant difference was found between TSK-DV low and high responders for HR and SCL.

Self-report. Significant correlations were found between TSK-DV and fear-VAS, and between TSK-DV and STAI-state, but only after termination of the behavioral performance. For the STAI-trait, a moderate difference was found between TSK-DV low and high responders. As expected, patients who reported fear of movement/(re)injury were more anxious after confrontation with the stimulus than during the preparation.

Discussion

Avoidance behavior is postulated to be one of the mechanisms in sustaining chronic pain disability. In the acute pain situation, avoidance of daily activities that increase pain is a spontaneous and adaptive reaction of the individual (Wall 1979); it usually allows the healing process to occur. In chronic pain patients, however, avoidance behavior appears to persist beyond the expected healing time, and may subsequently lead to the 'disuse' syndrome (Bortz 1984). The disuse syndrome is a detrimental condition, associated with physical deconditioning, in which performance of physical activities leads more easily to pain and physical discomfort, which in turn makes avoidance more likely. Avoidance may also lead to adaptation to the non-working status and a lack of work identity, making it more difficult for the patient to return to work or domestic activities.

One of the reasons that avoidance behaviors persist is not only the short-term effects of reduced suffering, but also the influence of certain beliefs and expectations (Philips 1987). If the individual believes that further exposure to certain stimuli will increase pain and suffering, avoidance or escape will be likely to occur. So far, little scientific attention has been drawn to the specific beliefs that are related to avoidance. In this article, a particular belief is put forward that is hypothesized to enhance avoidance, namely the expectation that movement can cause (re)injury, and thus increased suffering. Two studies were presented that highlight the nature of fear of movement/(re)injury and its relation to behavioral performance.

The findings of the 1st study suggest that fear of movement/(re)injury can be measured in a reliable and valid way. Of interest is that patients receiving disability compensation report more fear of movement/(re)injury than those who do not receive any compensation. Given the association between these specific fear beliefs and motoric behavior (study 2), fear of movement/(re)injury can be responsible for higher levels of disability, leading to an increased likelihood of receiving compensation. This finding underscores the clinical and economical importance of the concept of fear of movement/(re)injury.

The TSK-DV has a high degree of face validity and appears to be related with other measures of fear (FSS-III-R and STAI), and with fear of Bodily Injury, Illness and Death (FSS-III-R) in particular. In accordance with the repeatedly found correlations between measures of anxiety and depression, a significant correlation with the BDI was found as well. Noteworthy is also the substantial overlap between fear of movement/(re)injury and the factor Catastrophizing, as revealed by the regression equation, corroborating the suggestion of McCracken and Gross (1993) that catastrophizing may be better considered as part of a psychological distress factor rather than a coping factor. A notable overlap between catastrophizing and depression was already found by others (Smith et al. 1986; Sullivan and D'Eon 1990; Vlaeyen et al. 1990). One explanation for the overlap, however, could be that some of the items of the Catastrophizing subscale of the PCL-e resemble the items contained in the TSK-DV. Inspection of the scale items reveals that this is true for only 2 of the 17 PCL-e catastrophizing items: 'I act very carefully to protect myself against extra pain', and 'The word pain frightens me'. Another possibility is that individuals who report catastrophizing cognitions in relation to pain focus more on the negative aspects of the situation and are more likely to interpret physical arousal as pain cues. As a result of this attentional focus, interoceptive information that often is associated with movement is more easily noticed and perhaps interpreted as 'dangerous' or 'signaling (re)injury'. Several clinical disorders, such as hypochondriasis, are assumed to be reflective of catastrophizing cognitions in combination with a strong internal focus (Barsky and Klerman 1983; Cioffi 1991). A 3rd explanation could be that catastrophizing cognitions trigger unnecessary sympathetic arousal wich results in the subjective feeling of anxiety (Ciccone and Grzesiak 1984). Of course, positive correlations may not be confused with causal effects. Catastrophizing can lead to increased fear, but the opposite might be true as well. Catastrophizing can also be part of the cognitive responses associated with fear of movement/(re)injury, or both may be related to a 3rd variable (e.g., a traumatic experience).

Of interest is further that, although a moderate correlation between TSK-DV and VAS was found, pain intensity ratings are not very predictive for fear of movement/(re)injury. This finding suggests that fear of movement/(re)injury occurs independently from the current pain intensity.

The 2nd study showed that there is a substantial negative correlation between fear of movement/(re)injury and behavioral performance as measured with a BAT. Of interest is that the correlation with the STAI-state is much higher and significant after CLBP patients are exposed to movement than before the exposure. Just after exposure, the correlation with the fear-VAS, measuring experienced fear intensity, is even higher. This underscores the clinical finding in phobics that the closer the confrontation with the feared stimulus, the higher the fear reported. This finding is in accordance with those reported by McCracken et al. (1993) and Crombez (1994) who also found strong relations between avoidance of movement and fear in CLBP patients. As avoidance of movement is shown to be related to increased functional impairment and disability (Council et al. 1988) fear of movement/(re)injury is likely to be predictive of disability levels of CLBP patients. A somewhat unexpected finding was the absence of significant positive correlations between fear of movement/(re)injury and measures of physiologic arousal, although correlations with heart rate were higher than with SCL. In searching an explanation, one must consider that the vast literature on fear (and on pain) suggests that the 3 response systems (motoric, self-report and psychophysiologic) are known to interrelate discordantly (Rachman and Hodgson 1984; Vlaeyen et al. 1989). One possible explanation is that behavioral avoidance occurred before psychophysiologic arousal levels increased. Patients may consider that short-term avoidance of movement may prevent injury or increased pain in the long run (also known as cognitive avoidance (e.g., Salkovskis 1989)).

The association between pain duration and fear of movement/(re)injury remains unclear. Study 2 showed that high responders reported a significantly longer duration of pain complaints than low responders, suggesting that fear of movement/(re)injury indeed plays an important role in the process of becoming a chronic pain patient. On the other hand, such an association was lacking in study 1. Because of the relatively small sample of study 2, the association found may have been coincidental. Replications will be necessary to clarify this issue.

Based on the findings of the present studies, a cognitive-behavioral model is tentatively suggested (Fig. 1) that represents the mechanism how fear of movement/(re)injury possibly contributes to the maintenance of chronic pain disability in CLBP, starting with the injury occuring during the acute phase. The painful experiences, that are intensified during movement, will elicit catastrophizing cognitions in some individuals and more adaptive cognitions in others. As shown in study 1, patients who catastrophize are more likely to be fearful. Fear of movement/(re)injury subsequently leads to increased avoidance (as demonstrated in study 2), and in the long run to disuse, depression and increased disability (Philips 1987; Council et al. 1988), as for example reflected by disability compensation (study 1). Both depression and disuse are known to be associated with decreasing pain tolerance levels (Romano and Turner 1985; McQuade et al. 1988), and hence promoting the painful experiences. In patients with adaptive cognitions, confrontation rather than avoidance is likely to occur, promoting health behaviors and early recovery. Future studies testing the causality assumed in this model need to be carried out.

In general, the present study underscores the importance of fear of movement/(re)injury in CLBP patients. The TSK-DV has the potential to identify a subgroup of CLBP patients whose disability is mainly determined by the specific fear of movement/(re)injury and not by current pain intensity, the underlying organic pathology, or nociception. From a health economics perspective, there is a growing need for improving cost-effectiveness of interdisciplinary pain management programs. This can be reached by customizing interventions based on patient profiles. The TSK might be a useful instrument to help the clinician to identify a subgroup of CLBP patients for which treatment interventions share the characteristics of behavioral interventions that are developed and have proven effective for diminishing phobic complaints. Graded exposure to the feared stimulus has proven to be a short-term and most effective treatment for phobias (e.g., Butler 1989). For the subgroup of CLBP patients with fear of movement/(re)injury, a more systematic application of graded exposure to movement, such as described by Lindström et al. (1992), is warranted. Research demonstrating the effects of such a customized approach is likely to be promising, but still has to be carried out.

Acknowledgements

We like to express our gratitude to Robert Miller, Shashidar Kori and Dennis Todd for the permission they gave us to translate, use and present the TSK-items in this article. Thanks are also extended to Eric Vuurman of the Institute for Human Psychopharmacology at Maastricht for his assistance in the electrophysiological recordings, Tiny Fasotti-Dumont, Sylvia Jansen op de Haar and Annemarie Rotteveel for their help in the data collection, Arnoud Arntz, Geert Crombez and an anonymous reviewer for their comments on an earlier version of this paper, Gerard van Breukelen for his statistical advice, and Dick van Spronsen for the translation. Peter Heuts and the staff of the Department of Pain Management of the Lucas Foundation of Rehabilitation, Hoensbroek, The Netherlands are acknowledged for the clinical management of the patients that were included in this study. This research was partly supported by Grant OG 91-088 of the Dutch Health Insurance Council.

APPENDIX I

ORIGINAL ITEMS OF THE TAMPA SCALE FOR KINESIOPHOBIA (Miller et al. 1991)

1. I'm afraid that I might injure myself if I exercise.
2. If I were to try to overcome it, my pain would increase.
3. My body is telling me I have something dangerously wrong.
4. My pain would probably be relieved if I were to exercise.
5. People aren't taking my medical condition seriously enough.
6. My accident has put my body at risk for the rest of my life.
7. Pain always means I have injured my body.
8. Just because something aggravates my pain does not mean it is dangerous.
9. I am afraid that I might injure myself accidentally.
10. Simply being careful that I do not make any unnecessary movements is the safest thing I can do to prevent my pain from worsening.
11. I wouldn't have this much pain if there weren't something potentially dangerous going on in my body.
12. Although my condition is painful, I would be better off if I were physically active.
13. Pain lets me know when to stop exercising so that I don't injure myself.
14. It's really not safe for a person with a condition like mine to be physically active.
15. I can't do all the things normal people do because it's too easy for me to get injured.
16. Even though something is causing me a lot of pain, I don't think it's actually dangerous.
17. No one should have to exercise when he/she is in pain.

APPENDIX II

TRANSLATED ITEMS OF THE TSK-DV

1. Ik ben bang om bij het doen van lichaamsoefeningen blessures op te lopen.
2. Als ik zou proberen me over de pijn heen te zetten, dan zou hij erger worden.
3. Mijn lichaam zegt me dat er iets gevaarlijk mis mee is.
4. Mijn pijn zou waarschijnlijk minder worden als ik aan oefeningen zou doen.
5. Mijn gezondheidstoestand wordt door anderen niet serieus genoeg genomen.
6. Door mijn ongeluk loopt mijn lichaam de rest van mijn leven gevaar.
7. Pijn houdt altijd in dat er sprake is van een blessure.
8. Als mijn pijn erger wordt van iets dan betekent dat nog niet dat dat gevaarlijk is.
9. Ik ben bang om per ongeluk blessures op te lopen.
10. De veiligste manier om te voorkomen dat mijn pijn erger wordt is eenvoudig door ervoor te zorgen dat ik geen onnodige bewegingen maak.
11. Ik zou niet zoveel pijn hebben als er mogelijk niet iets gevaarlijks aan de hand was met mijn lichaam.
12. Hoewel ik pijn heb, zou ik er beter aan toe zijn als ik lichamelijk actief zou zijn.
13. Pijn zegt me wanneer ik moet stoppen met oefeningen doen om geen blessures op te lopen.
14. Voor iemand in mijn toestand is het bepaald af te raden om lichamelijk actief te zijn.
15. Ik kan niet alles doen wat gewone mensen doen, omdat ik te makkelijk geblesseerd raak.
16. Ook al krijg ik ergens veel pijn van, dan geloof ik niet dat dat eigenlijk gevaarlijk is.
17. Niemand zou oefeningen hoeven te doen wanneer hij of zij pijn heeft.

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