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RELATIONSHIP BETWEEN EARLY SOMATIC, RADIOLOGICAL, COGNITIVE AND PSYCHOSOCIAL FINDINGS AND OUTCOME DURING A ONE-YEAR FOLLOW-UP IN 117 PATIENTS SUFFERING FROM COMMON WHIPLASH

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SUMMARY

To analyse the significance of the interplay between somatic and psychosocial factors in influencing the course of recovery a non-selected well defined group of 117 whiplash patients was investigated. Initial examination was performed, on average, 7.2 ± 4.2 days after trauma and follow-ups were carried out at 3, 6 and 12 months. At the initial investigation all patients were given a neurological examination, cognitive and psychosocial factor assessment and cervical spine X-rays. At each follow-up stepwise regression was performed to evaluate the relationship between initial findings and the course of recovery. Fifty-one (44%), 36 (31%) and 28 (24%) patients were symptomatic at 3, 6 and 12 months respectively. Poor improvement at all examinations was significantly correlated with factors associated with severity of injury such as initial symptoms of radicular irritation and intensity of neck pain. Moreover, results indicate that poor recovery is related to severity of injury in addition to some pre-traumatic factors (previous history of head trauma and headache) and initial injury-related reaction (i.e. sleep disturbances, reduced speed of information processing and nervousness). However, psychosocial factors did not prove predictive at any follow-up examination. These results indicate that symptoms suggesting a more severe neck injury appear to be particularly related to delayed recovery from common whiplash. Moreover these results may be of value in the objective evaluation of potentially difficult claims for compensation, which may in some cases be falsely based.

KEY WORDS: Common whiplash, Somatic symptoms, Radiological findings, Psychosocial factors, Cognitive functioning, Personality traits.

ALTHOUGH the compulsory introduction of seat belts has reduced the incidence of head injuries, whiplash injury has been diagnosed more frequently following automobile accidents [1–4]. While no physiological correlates [5–7] can generally be identified after this type of injury, a considerable percentage of patients show protracted disability [3, 4, 7]. In addition to somatic complaints including neck pain, headache and brachialgia [7–10] several psychological symptoms [8, 11] and cognitive problems [10, 12–14] have been documented during the course of the whiplash syndrome. The widespread opinion that protracted symptoms following whiplash reflect neurotic or compensation-seeking behaviour [6, 8, 15–19] is not based on experimental studies designed using random patient sampling. Furthermore, we have recently shown in a non-selected group of patients that psychosocial factors do not primarily influence the course of recovery from common whiplash [20]. Other studies have suggested that the poor outcome after this type of injury may rather be related to the severity of injury, as assessed by neurological signs [9, 21–23], early onset of neck pain [3, 21] or radiologically detectable abnormalities [9, 22, 23]. While the debate on the etiology of the whiplash syndrome is still continuing [24, 25] studies of the relationship or interplay between psychosocial and somatic factors possibly influencing outcome are still lacking.

The present study, therefore, was designed to evaluate the relationship between factors suggested previously to determine rate and extent of recovery from common whiplash. Somatic complaints and signs assessed early after trauma should be evaluated in conjunction with initial radiological findings, cognitive functioning and psychosocial variables in a non-selected group of recently injured common whiplash patients.

Previously there has been considerable disparity in the results of studies on whiplash injury which may in part be due to the lack of clear definition of the syndrome. In accordance with previous reports [24] common whiplash in this study is considered a medical trauma causing cervical musculo-ligamental sprain or strain due to hyperflexion/hyperextension. In contrast to many previous studies [9, 14, 17, 21, 22] the diagnosis thus excludes fractures or dislocations of the cervical spine, head injury or alteration of consciousness (including post-traumatic amnesia).

METHODS

Patients

By announcing the study in the *Swiss Medical Journal* and repeated distribution of letters to primary care physicians we asked for referral of patients who had recently suffered whiplash injury. At referral, as

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soon as possible after trauma, the baseline examination (t_1) was performed. Follow-up examinations were conducted at 3 (t_2), 6 (t_3) and 12 months (t_4). These included psychological and cognitive assessment at all follow-up examinations and neurological evaluation at t_3 and t_4. Therapeutic measures during follow-up remained the responsibility of the referring physician. [According to The Swiss Accident Insurance Scheme the treating physician is responsible for certification of injury-related disability. If injury-related disability occurs, patients receive a proportional amount of salary irrespective of liability. The scheme does not provide compensation for non-economic loss (i.e. pain and suffering). If persistent disability is likely, which is the case when no therapeutic measure improves the patient's health status, a permanent disability assessment is initiated. This usually happens many months after injury.)] Inclusion criteria were: injury according to the above definition, German as the native language, age less than 55 yr (because of norms on neuropsychological testing), and a negative history of persistent neurological dysfunctions (such as trigeminal neuralgia, polyneuropathy, multiple sclerosis). During 24 months from first announcement of the study a consecutive series of 164 patients has been referred. During the same period in our catchment area, the number of whiplash injuries (including injuries to other parts of the body in an unknown number of patients) can be estimated to be about 205–210 [26]. Twenty-seven patients did not meet the criteria and 20 patients dropped out at follow-up examinations. All included patients (n = 117, mean age = 30.8 ± 9.6 yr, range 19–51 yr, mean educational attainment = 12.7 ± 2.7 yr, women 58%) were injured in automobile accidents (60% rear-end collisions) and were fully covered by accident insurance. Patients' vocational activities were as follows: 46 (39%) performed mainly intellectual, 45 (38%) mainly physical and 26 (23%) mixed activities.

Clinical assessment

Baseline examination (t_1) included semistructured interviews, complete physical-neurological examination, cervical spine X-rays, assessment of cognitive functioning, self-ratings of well-being and cognitive ability and personality traits.

During the first interview (t_1) initial subjective complaints and the interval between injury and the onset of neck pain and headache were assessed. A short interval was considered to reflect more severe injury [3]. Initial neck pain and headache intensity, suggested in previous studies [27] to be of most prognostic significance, was rated by the patients on a scale from 0 (no pain) to 10 points (maximal pain). Pre-traumatic headache significantly impairing patients quality of life was analysed in terms of its frequency, divided into at least weekly or less than weekly, and its type, coded according to the International Headache Classification [28]. The relevance of personal and family history and the current social disposition were evaluated focusing on factors previously suggested [29–32] (see notes to Table I).

Neurological and physical examination (t_1) evaluated neck muscle tenderness, restricted neck movement and symptoms and signs of radicular compromise. The latter two have been suggested to indicate more severe injury [21]. Injury-related disability (i.e. at t_2, t_3 and t_4) was recorded as a percentage of work-time loss.

Radiological examination in all patients (t_1) included standard X-rays of the cervical spine (antero-posterior, lateral, right and left oblique as well as lateral views in flexion and extension, the antero-posterior view in lateral inclination and the transoral view of the Dens). The following findings previously suggested [22] to be of prognostic value were taken into account: degenerative changes (i.e. osteoarthrosis indicative of which the following findings were initially recorded: narrowed intervertebral disc space, osseous spurs either at the vertebral body endplates or at zigoapophyseal joints, and increased bone density neighbouring the joint surfaces), misalignment of the cervical curvature and restricted movement in the antero-posterior or the lateral projection or both on functional X-rays. Functional X-rays were assessed according to norms suggested by Buetti-Baeumel [33].

Self-ratings

Personality traits at t_1 were examined using the Freiburg Personality Inventory (FPI) [34]. For the purpose of analysis, the following dimensions of the FPI were considered of particular relevance: *nervousness, depression, openness, neuroticism* and *passivity* (Table I). *Nervousness*-scale is considered to be indicative of proneness to report psychosomatic symptoms. High scores on this scale, however, may also be recorded during the course of a somatic illness. *Depression*-scale was used in order to assess negative affectivity, a factor possibly influencing symptom reports [35]. *Openness*-scale was used to assess social acceptability which, in addition, may influence the tendency towards deception. *Neuroticism*-scale assesses a factor which is considered to influence the manner and seriousness with which symptoms are reported [35, 36]. *Passivity*-scale was used as a measure of how the patient deals with problems (i.e. in an active way or with passive resignation).

Self-rated well-being at t_1 was evaluated using the *Well-being* scale [37]. A score greater than 17 (mean 11, normal range 4–17 points) is considered to reflect a significantly impaired well-being [37], a facet of negative affectivity, which again, is thought to influence symptom reports [35].

Self-rated cognitive ability was documented using the *Cognitive Failures Questionnaire* [36]. This scale assesses changes in patient's cognitive ability as a result of the injury. A score of 30 or more on this scale indicates a significant impairment [38].

Assessment of cognitive functioning

Attention span was assessed for the auditory modality by the *Digit Span*, a subtest from Wechsler memory scale [39], and for the visuo-spatial modality using

TABLE I
Findings as assessed at baseline in the entire sample (n = 117)

	No.	(%)†
*Subjective complaints**		
Neck pain	108	(92)
Headache	67	(57)
Fatigue‡	66	(56)
Shoulder pain	57	(49)
Anxiety§	52	(44)
Sleep disturbances‖	46	(39)
Back pain	45	(38)
Sensitivity to noise	34	(29)
Poor concentration	31	(26)
Blurred vision	25	(21)
Irritability	25	(21)
Sensitivity to light	23	(20)
Dizziness	18	(15)
Forgetfulness¶	17	(14)
Difficulty in swallowing	10	(9)
Initial pain intensity	Mean	± S.D.
Neck pain	4.2	± 2.1
Headache	3.0	± 3.0
Symptom onset (h)	Mean	± S.D.
Onset of neck pain	9.8	± 16.9
Onset of headache	9.1	± 13.4
Neurological examination	No.	(%)*
Neck muscle tenderness	87	(74)
Restricted neck movement	66	(56)
Symptoms of radicular irritation	17	(14)
Symptoms or signs of radicular deficit	17	(14)

	No.	(%)†
Radiological findings		
Misalignment of cervical curvature	58	(50)
Degeneration (osteoarthrosis)	27	(23)
Restricted movement (antero-posterior projection)	29	(25)
Restricted movement (lateral projection)	19	(16)
Restricted movement (both projections)	37	(31)
*Psychosocial stress***	No.	(%)*
Neurotic symptoms in childhood	43	(37)
Performance problems in school	23	(20)
Dysfunctional family	23	(20)
Family history of somatic illness	45	(38)
History of psychological/behavioural problems	31	(26)
Current psychosocial stress	40	(34)
Psychological variables††	Mean	± S.D.
Nervousness-scale	4.8	± 1.7
Depression-scale	4.0	± 1.9
Openness-scale	5.8	± 1.9
Neuroticism-scale	4.0	± 1.9
Passivity-scale	4.7	± 1.7
Well-being scale	16.7	±12.2
Cognitive Failures Questionnaire	18.3	±15.7
Cognitive functioning	Mean	± S.D.
Digit span	10.5	± 1.9
Corsi block-tapping	11.2	± 1.5
Number connection test	71.7	±15.6
Trail making, Part A	23.4	± 8.1
Trail making, Part B	67.9	±25.3
PASAT	15.9	± 8.8

*A combination of complaints should be considered.

†Percentages do not always sum to 100 because of rounding.

‡Subjects stated that they experienced increasing levels of fatigue during the day due to involvement in different activities (no clear-cut symptoms for chronic fatigue syndrome were assessed).

§Phobic reaction as a consequence of being a driver (most subjects avoided driving after the accident) or passenger in congested traffic. Post-traumatic stress disorder could not be diagnosed.

‖Difficulties in falling asleep and/or sleep interruption due to pain, exclusively.

¶Patients indicated an inability to follow the information flow. No real memory impairment could be uncovered in the interview.

***Psychosocial stress*: Several issues considered as psychosocial stressors were assessed in the interview. While this list is not exhaustive, several examples of assessed psychosocial stressors are given. A combination of factors for each category of psychosocial stress is possible. *Neurotic symptoms in childhood*: bed-wetting, eating difficulties, passivity/absence of fantasy, negligible social skills, problems in dealing with figures of authority (e.g. teacher), socially withdrawn, anxiety, speech problems (e.g. stuttering) and nail-biting. *Performance problems in school*: difficulties presumably unrelated to intellectual ability (i.e. developmental arithmetic, expressive writing and reading disorders). *Dysfunctional family*: parental alcohol or drug abuse, physical or sexual abuse directed towards children, marital physical abuse, and parental death. *Family history of somatic illness*: illness of close family member interpreted as social modelling for illness behaviour of patients (e.g. neurological disorders, accident-related illness or impairment, headache, back pain, etc.). *History of psychological/behavioral problems in adolescence and adulthood*: problems during puberty (e.g. anorexia nervosa) and adolescence (e.g. drug abuse), and psychological problems such as depression, so-called nervous breakdowns, suicidal ideation, and previous psychiatric or psychotherapeutic treatment. *Current psychosocial stress*: marital or relationship problems, family problems, work related difficulties, and financial difficulties.

††Scores on scales of the *Freiburg Personality Inventory* (FPI) between 4 and 6 are comparable with 54% of a random sample. Scores over 6 on scales *Nervousness*, *Depression* and *Neuroticism* and scores below 4 on scales *Openness* and *Passivity* are considered pathological. *Passivity*-scale in the original manuscript is entitled *Masculinity*-scale.

Corsi Block-Tapping [40]. Scoring for both is total number of items recalled, in forward and reverse order (normal range 10–11 items).

Speed of information processing was assessed using the *Trail Making Test, Parts A and B* [41]. *Trail Making Test, Part A* requires consecutively connecting numbered circles while *Part B* involves alternating letters and numbers. Scoring is time in seconds to finish each of the parts (normal ranges are 19–29 s for the *Trail Making Test, Part A* and 45–69 s for the *Part B*).

Focused attention was evaluated using the *Number Connection Test* [42] which involves connecting numbered circles from 1–90 in order. The final score is calculated as the average time in seconds of four trials (normal range 64–88 s).

Divided attention was tested using the *Paced Auditory Serial Addition Task* (PASAT) [43]. While listening to a recorded series of single digits, patients have to continuously add up digits, always two at a time: the second to the first, the third to the second and so on verbally reporting each sum to the clinician. The test consists of five trials containing 60 digits each.

Performance level is the average error score of the completed trials (normal range 6.6–15.4 errors).

Statistical analysis

Data were analysed using the Statistical Package for Social Sciences (SPSS-X) [44].

Evaluation strategy: at each follow-up examination (i.e. t_2, t_3 and t_4) the final sample (n = 117) was divided into patients who had recovered and those who still suffered symptoms. Using these groups (asymptomatic *vs* symptomatic) as factor variables a stepwise regression was performed at each follow-up taking age, gender and injury mechanism (i.e. rear-end collision *vs* impact from other directions), a history of head injury or whiplash, the type and frequency of pre-traumatic headache and all findings from the baseline examination listed in the Table I as independent variables. The probability level of significance was taken as $P<0.05$.

RESULTS

No patient was involved in litigation during follow-up.

Findings from the baseline examination (t_1) in the entire sample are shown in Table I. Seventeen (15%) patients reported symptoms of radicular irritation (i.e. pain or paresthesia). Seventeen (15%) patients, again, had symptoms of radicular deficit (i.e. weakness or numbness) in seven (6%) of whom signs of radicular deficit (i.e. reflex or sensory loss, paresis) were found at t_1.

At 3 months (t_2) 51 patients (44%), at 6 months (t_3) 36 patients (31%) and at 1 yr (t_4) 28 patients (24%) still had symptoms. Subjective complaints of patients who remained symptomatic at follow-up are summarized in Table II.

There were no significant differences in vocational activities between symptomatic and asymptomatic groups at any follow-up examination (at t_2 $t_{[df=115]} = -0.82$, $P = 0.415$, at t_3 $t_{[df=115]} = -0.37$, $P = 0.715$, and at t_4 $t_{[df=115]} = -1.16$, $P = 0.276$). Thirteen (11%), seven (6%) and five (4%) patients respectively were disabled at t_2, t_3 or t_4. Among those who were disabled at 1 yr (t_4) two patients worked part-time (25–50% work loss) and three did not work at all.

Fifty-four patients had a history of pre-traumatic headache. Fifteen of them were diagnosed as migraine, 19 as tension-type headache, four as headache originating from the neck and 16 as unclassifiable headache. Thirty-six of these 54 patients suffered from headache at least once per week.

During the initial interview a significant percentage of psychosocial stress was found in the entire sample (Table I). Scores from formal testing (i.e. FPI) correlated well with the interview data (e.g. *depression*-scale with current stress r = 0.40; *neuroticism*-scale with a history of psychological or behavioural problems r = 0.38 or with current stress $r = 0.38$, P for all <0.01) thus indicating good internal validity of data.

At 3 months (t_2) stepwise regression (R^2 = 0.455, $F_{[df=106/6]} = 106/6) = 12.54$, $P<0.0001$) revealed a significant relationship between the following baseline variables and poor recovery: intensity of initial neck pain (t = 4.292, $P<0.0001$), forgetfulness (t = 3.872, P = 0.0002), symptoms of radicular irritation ($t = 2.766$, P = 0.0067), ostheoarthrosis detected by X-rays (t = 2.947, P = 0.0040), headache complained of as a result of current trauma (t = 2.469, P = 0.015) and restricted movement in both projections as detected by X-rays (t = −2.285, P = 0.0243).

At 6 months (t_3) R^2 = 0.547, $F_{[df=103/9]}$ = 13.85, $P<0.0001$ persisting symptoms were significantly predicted by the following baseline variables: initial neck pain intensity ($t = 4.595$, $P<0.0001$), sleep disturbances (t = 4.381, $P<0.0001$), age (t = 4.222, P = 0.001), previous history of head trauma ($t = 3.287$, $P = 0.0014$), forgetfulness (t = 3.129, P = 0.0023), history of pre-traumatic headache (t = 3.037, P = 0.0030), symptoms of radicular irritation ($t = 2.422$, $P = 0.0172$), score on scale Neuroticism from personality inventory (t = −2.334, $P = 0.0215$) and poor concentration complained at baseline (t = −2.568, P = 0.0117).

At 1 yr (t_4) R^2 = 0.557, $F_{[df=101/1]}$ = 11.54, $P<0.0001$ persisting symptoms were significantly related to the following baseline variables: age ($t = 3.824$, $P = 0.0002$), previous history of head trauma ($t = 3.333$, $P = 0.0012$), sleep disturbances (t = 3.097, P = 0.0025), intensity of initial neck pain (t = 3.068, P = 0.0028), pre-traumatic headache (t = 3.018, P = 0.0032), intensity of initial headache (t = 2.951, P = 0.0039), score on scale Nervousness from the personality inventory ($t = 2.334$, P = 0.0216), symptoms of radicular irritation ($t = 2.134$, P = 0.0353), score on test of speed of information processing (t = 2.019, P = 0.0461), poor concentration (t = 2.277, P = 0.0249) and score on scale neuroticism from the personality inventory (t = −3.249, P = 0.0016). All other variables, particularly gender, mechanism of injury, a history of whiplash, type or frequency of pre-existing headache, time of onset of symptoms and psychosocial factors were not significant in predicting the outcome 1 yr after the accident.

TABLE II
Subjective complaints at follow-up in those patients who remained symptomatic

Subjective complaints*	Follow-up examination at 3 months No. (%)*	6 months No. (%)*	12 months No. (%)*
Neck pain	44 (86)	29 (81)	22 (79)
Headache	41 (80)	31 (86)	25 (89)
Fatigue	32 (73)	17 (47)	14 (50)
Shoulder pain	21 (41)	15 (42)	14 (50)
Anxiety	22 (43)	15 (42)	16 (57)
Sleep disturbances	18 (35)	15 (42)	11 (39)
Back pain	12 (23)	12 (33)	11 (39)
Sensitivity to noise	20 (39)	13 (36)	11 (39)
Poor concentration	32 (63)	17 (47)	15 (53)
Blurred vision	19 (37)	15 (42)	15 (53)
Irritability	20 (39)	16 (44)	11 (39)
Sensitivity to light	14 (27)	7 (19)	14 (50)
Dizziness	14 (27)	6 (17)	7 (25)
Forgetfulness¶	24 (47)	11 (33)	12 (43)
Difficulty in swallowing	4 (8)	1 (3)	2 (7)

*, ¶, See Table I.

DISCUSSION

The aim of this study was to evaluate the relationship between early somatic complaints, radiological findings, cognitive functioning, psychosocial factors, personality traits and the rate and extent of recovery over 12 months in patients suffering from common whiplash injury. Rigorous clinical criteria were used to ensure an inception cohort according to a strict injury definition. In particular all head injuries were excluded. Considering results from a previous study of cervical spine injuries in Switzerland [26] and the inclusion criteria here the number of patients enrolled in our study probably reflects a representative sample of total whiplash injuries in our catchment area. All patients were injured in automobile accidents, and were fully covered by accident insurance and equally protected against eventual economic loss through the countrywide insurance scheme. As this scheme provides for economic loss and automatic disability assessment of patients with long-lasting symptoms, bias due to compensation-seeking behaviour is improbable. All patients had the same native language and a similar education level hence, bias in illness behaviour due to sociocultural differences is unlikely.

Recovery during follow-up was high: at 1 yr 24% of patients still suffered from injury-related symptoms and only 5% were disabled. The considerably higher percentage of persisting symptoms [3, 7, 21, 22] and protracted disability [2, 4] due to whiplash injury previously reported in the literature may be interpreted as follows: (a) previous studies [3, 21–23] included patients who had fractures or dislocations of the cervical spine or who, in addition, to whiplash injury, had suffered a significant head injury; (b) studies [3, 17, 21, 22] considered selected patients (e.g. those with long-lasting symptoms or litigation cases); (c) study results [3, 17, 21] were biased due to sociocultural differences or insurance schemes possibly promoting compensation-seeking behaviour.

Factors revealed by stepwise regression analysis to significantly correlate with poor recovery should be considered in combination. In our view the results indicated that delayed recovery in the present study was primarily related to the severity of the initial injury. This conclusion is based on the following results: Two baseline variables proved significant in predicting poor recovery at all follow-up examinations: symptoms of radicular irritation and intensity of initial neck pain. Obviously symptoms of radicular irritation (probably due to concussion of nerve roots or spasm of scalenus muscles [45]) and a higher intensity of initial neck pain, both of which were found to be important prognostic signs in previous studies [7, 21, 27], indicate a more severe trauma. Age was an additional significant variable in predicting outcome at 6 and 12 months, also reported earlier to correlate with poor outcome after whiplash injury [7, 9, 22] possibly reflects degenerative changes of the cervical spine predisposing to more severe trauma-induced lesions.

Other variables which proved significant in predicting poor recovery may be seen to reflect intensity of the initial reaction to a more severe injury. This is true for sleep disturbances, reported at baseline, which significantly predicted poor recovery at 6 and 12 months. Disturbances included difficulty in falling asleep or sleep interruption due to neck pain. Severity of injury may influence psychological and cognitive functioning of patients and may explain why scores on the nervousness-scale from the personality inventory correlated significantly with poor outcome at 6 and 12 months. As higher scores on this scale may be observed during the course of somatic illness it is reasonable to conclude that initial high scores were due to pain. In addition, low scores on the number connection test are likely to reflect impaired information processing due to pain as suggested earlier [12]. In contrast to what might be expected [36], the Neuroticism-score from the personality inventory was inversely correlated with poor recovery at 6 and 12 months.

Analysis additionally revealed that two pre-traumatic variables (i.e. previous history of head trauma and pre-traumatic headache) were also predictive of delayed recovery at 6 and 12 months: history of head trauma in many cases may have been the basis for suffering from pre-traumatic headache. Pre-traumatic headache in turn may indicate a predisposition to develop headaches (the symptom with increasing relative incidence during follow-up) as a reaction to whiplash injury. As recently suggested the history of pre-traumatic headache should be given more attention in assessment and treatment of whiplash patients [46].

No significant relationship could be found between persisting symptoms and the type of vocational activities reported by other authors [47]. This disparity may also reflect differences in insurance schemes between the present or previous studies some of which may have promoted compensation-seeking behaviour.

Factors not directly related to injury such as different aspects of psychosocial stress did not determine recovery during follow-up. The discussion of the significance of psychosocial variables for the course of recovery in this study is based on strong correlations between several aspects of psychosocial stress as uncovered in the initial interview and assessed by self-rating scales thus emphasizing good internal validity of the findings. These results indicate that the significance of psychosocial factors in primarily determining recovery from post-trauma conditions has been overestimated in previous reports [6, 15–19] due to an emphasis on these factors instead of the relationship between somatic and psychosocial variables.

Stepwise regression shows that baseline variables can only explain a part of the variance involved in the process of recovery after common whiplash (i.e. R^2 at $t_2 = 0.455$, at $t_3 = 0.547$ and at $t_4 = 0.558$). This suggests that additional variables developing during follow-up are important in determining recovery. We suggest a dynamic relationship between damage to cervical structures and problems in adjusting to damage-related symptoms. Indeed, there is a number of other variables which may develop during follow-up which could influ-

ence recovery which, because they could not be assessed at baseline, were not included in the regression. For example anxiety and depression may result from frustration due to inability to regain the pretraumatic level of physical, social and professional functioning. Such a reaction may impair the interrelationship between patient and family or patient and physician and establish a vicious circle.

In conclusion, variables indicative of more severe injury proved the most reliable predictors of recovery from common whiplash. However, present results do not support a linear relationship but rather a complex interplay between severity of injury and initially induced reaction to trauma. The results may provide primary care physicians with reliable criteria with which to identify patients who may have a poor prognosis for recovery and could help towards establishing a scientific rationale for the objective evaluation of potentially difficult claims for subsequent compensation.

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BHPR ANNOUNCEMENTS AND CALENDAR FOR 1994

October 12–13 BHPR/BSR Joint Meeting, Staffordshire.

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