# ASSESSMENT OF CHRONIC PAIN BEHAVIOUR: RELIABILITY OF THE METHOD AND ITS RELATIONSHIP WITH PERCEIVED DISABILITY, PHYSICAL IMPAIRMENT AND FUNCTION

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**The aim of the present study was to develop a reliable assessment of pain behaviour performed during the execution of a range of functional assessment measures. For the initial reliability study 18 subjects (consecutive referrals) were assessed. Subjects were observed and videotaped during a variety of physical tasks and demonstrations of pain behaviour were recorded; the videotapes were scored by two independent observers on two occasions. The relationships between pain behaviour, distress and physical function and impairment were also investigated in a group of 51 patients with chronic back pain. Self-report of disability and pain intensity were assessed using the Finnish version of Oswestry disability questionnaire and the pain visual analogue scale (VAS). Depression and somatic perception were assessed using the modified Zung and modified somatic perception questionnaire. The Tampa scale for kinesiophobia was used to evaluate fear of movement and (re)injury. The results of the intra- and inter-observer reliability study demonstrate good to excellent levels of agreement. The exception was facial expression (kappa 0.29), which was excluded from the final instrument. There was a strong correlation between pain behaviour and subjective pain report and disability ($p < 0.01$). The correlations between total pain behaviour and performance of physical function tasks is striking ($p < 0.01$). Subjective disability was analysed by means of multiple regression analysis. Pain measured on the VAS was the most important variable explaining 36% of the variance, pain behaviour and pain combined explained 48% of the variance for self reported disability. In conclusion, this functional video-based assessment of pain behaviour is a reliable measure of pain behaviour. The total scores for pain behaviour correlate with tasks that involve the back; tests involving upper limbs were not affected. This test is suitable for the assessment of those with pain problems specifically involving the back. Furthermore, in the group studied pain and pain behaviour were the two most important determinants of self-reported disability.**

*Key words:* pain behaviour, chronic back pain, pain management, physical function, reliability.

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## INTRODUCTION

The aims of management of patients with chronic pain problems differ from the management of those with acute problems in that treatment focuses on the reduction of disability, alleviation of psychological distress and reduction of pain behaviour (1). If these factors are to be the outcomes following intervention, then reliable measures are needed.

Initial physiotherapy assessment of chronic low back pain patients involves an assessment of self-reported disability, physical impairment and current physical capacity using simple functional tasks (2, 3). During such assessment, and in particular during the functional capacity evaluation, patients frequently demonstrate a variety of pain-associated behaviours (4). Furthermore, erratic performance of clinical assessment variables was shown to be influenced by psychological and behavioural factors (5, 6); but the influence of behavioural factors has been under research because of the lack of a suitable measure.

Loeser & Fordyce (7) have defined pain behaviours as "any and all outputs of the individual that a reasonable observer would characterize as suggesting pain. Such as (but not limited to) posture, facial expression, verbalizing, lying down, taking medicines, seeking medical assistance and receiving compensation." Overt pain behaviours are observable in the individual. Alterations in posture, limping and the demonstration of guarded movements are obvious examples of overt pain behaviours. Others include facial grimacing, rubbing or touching the affected area and groaning or sighing (8). Quantification of exaggerated pain behaviour during medical assessment has only been systematically measured in those suffering from low back pain. A group of inappropriate signs and symptoms identified as suggesting magnified pain behaviour has been recognized (9).

Observational measures often depend on the observation of the subject over a period of time by trained observers (10, 11). These again rely on the identification, by trained observers, of pain behaviours in a number of categories of mobility, posture,

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verbal pain report, non-verbal pain report. These have usually been used in an in-patient setting and observations are taken through the course of a day. This approach is time-consuming and requires training large numbers of personnel (11) and may be inappropriate for many clinical settings.

A videotaped behavioural observation measure was developed by Keefe & Block (8, 12), which relies on the observation of overt pain behaviours such as grimacing, limping and rubbing the affected area. This method has been used in a wide variety of painful conditions (8, 13) and has demonstrated an excellent level of reliability (12). However, this video rating system and other observational measures have been criticised for not presenting the subject with functional tasks. Patients may only demonstrate pain behaviour during the execution of a task that they perceive as potentially painful or dangerous (14). Recently, an attempt has been made to develop a task-oriented behavioural analysis system for use in chronic low back pain sufferers where subjects perform a number of everyday activities and specific tasks; the occurrence of pain-related behaviours during these tasks is then assessed. The initial results (4) demonstrated an acceptable level of inter- and intra-observer reliability and the total scores were highly correlated with other pain behaviour measures, disability and fear/avoidance beliefs.

The aim of this research was to develop a reliable assessment of pain behaviour performed during the execution of a range of functional assessment measures that could be carried out by physiotherapists. The relationships between pain behaviour, distress, and physical function and impairment were also investigated.

## METHODS

Fifty-one patients (24 men and 27 women, mean age 44.6 years, S.D. 8.1) were referred by the Social Insurance Institute to the chronic pain management programme at ORTON Rehabilitation Centre in Helsinki, Finland. The pain management programme was developed for patients who have serious or prolonged low back problems.

Patient profiles were as follows: 26.1% were employed and working, 34.8% were employed but on paid sick leave, 6.5% were unemployed, 26.1% were in receipt of a disability pension, 4.3% were on permanent disability pension and 2.2% were studying full-time. The mean duration of the symptoms was 69.7 months, S.D. 62.8. Of patients, 18% had one operation and 26% had two or more operations. Patients (45.5%) had radiation of pain below the level of the knee. Other signs of root compression e.g. reflex changes or neurological defences were observed in 38.6% of the patients. There were no significant differences between males and females in age ($t = -0.350, p < 0.728$), duration of symptoms ($t = -0.040, p < 0.969$), number of operations or pain radiation.

For the initial reliability study (Group 1), 18 subjects who were consecutive referrals with chronic pain were assessed. Subjects were observed sitting; timed 5 minute walk; lie down prone to the floor and roll over 360° and stand up; bending and reaching; filling, lifting and carrying a box of weights; and stair climbing.

Self-report of disability and pain intensity were assessed using the Finnish versions of the Oswestry disability questionnaire (ODQ) (15) and the pain visual analogue scale (VAS). Depression and somatic perception were assessed using the modified Zung and modified somatic perception questionnaire (MSPQ) (16). Fear of (re)injury was assessed using the Tampa scale for kinesiophobia (TSK) (17).

Two observers assessed the videotapes on two separate occasions with approximately four weeks between ratings. The observers were required to identify the occurrence of pain behaviours during the videotape. Following the rating each observer independently entered his or her results into a computer database. Following the work of previous researchers (4, 12) the occurrence of the following behaviours were recorded: distorted gait, audible pain behaviour (groaning, sighing), facial grimacing, touching or holding the affected body part, stopping or resting, verbal complaints about pain, support and leaning, and guarding tense stiff posture.

The inter- and intra-observer reliability over the four-week period was established on these data. A second group (Group 2) of 33 subjects were assessed in exactly the same way and these data were analysed to identify the relationship between pain, pain behaviour, physical function and disability. There were no significant differences among groups. The subjects completed a battery of physical performance tests including range of spinal motion repetitive flexion, repetitive arching, repetitive squatting (18) and hand-grip strength (19).

The pain behaviour measures represent categorical data and kappa values were determined for both intra-observer reliability and inter-observer reliability. Where it was not possible to calculate kappa values the percentage agreement is given. The threshold for the acceptability of the kappa score was set at >0.6 as suggested by Dworkin & Whitney (20). Cronenbachs' alpha was used to establish the internal consistency of the total pain behaviour score. Potential differences between the reliability study group and the larger study group were investigated by analysis of variance (ANOVA) for continuous data and $\chi^2$ test for sex (Table I).

Table I. *Initial characteristics (means and SD) of the patient groups analysed by ANOVA for group differences*

| | Group 1 ($n = 18$) | Group 2 ($n = 33$) | F | $p$ |
|---|---|---|---|---|
| Disability (ODQ) | 39.0 (17.1) | 39.4 (12.9) | 0.08 | 0.77 |
| Pain (VAS) | 70.5 (27.6) | 70.9 (16.5) | 0.01 | 0.97 |
| Depression (Zung) | 26.0 (11.1) | 24.7 (11.5) | 0.15 | 0.70 |
| Somatic anxiety (MSPQ) | 11.7 (6.6) | 10.2 (7.0) | 0.62 | 0.44 |
| Kinesiophobia (TSK) | 38.6 (7.2) | 35.8 (9.4) | 0.93 | 0.34 |
| Pain behaviour | 6.1 (4.8) | 5.7 (4.0) | 0.02 | 0.89 |
| Gender F/M | 9/9 | 18/15 | 0.097* | n/s |

VAS = visual analogue scale; ODQ = Oswestry disability questionnaire; Zung = modified Zung depression questionnaire; MSPQ = modified somatic perception questionnaire; TSK = Tampa scale of kinesiophobia; * $\chi^2$-test; n/s = not significant.

The relationships between the measures of pain behaviour, the self-reported pain and physical function variables were investigated by Pearson product moment correlation using a Bonferroni correction for the large number of variables involved. Multiple regression analysis was used to determine the relative importance of physical impairment, pain and pain behaviour on self-report of disability. The variables were entered in blocks. Self-reported pain was entered first followed by pain behaviour, physical impairment variables and then physical function variables.

## RESULTS

The results for the intra- and inter-observer reliability are given in Table II. All of the results demonstrate a high percentage agreement. The kappa scores, where available, likewise demonstrate good to excellent levels of agreement. The exceptions to this are facial expression (kappa 0.29) and verbal report of pain (kappa 0.58). Verbal report of pain only just failed to reach the acceptable threshold with a kappa score of 0.58. Facial expression was therefore excluded from the final measurement instrument; verbal report of pain was retained in the measure.

Table II. *Inter- and intra-observer reliability of pain behaviour measure (*n = *18)*

| | Observer one | | | Observer two | | | Observer one vs two | | |
|---|---|---|---|---|---|---|---|---|---|
| Variable | % agreement | kappa | *p* | % agreement | kappa | *p* | % agreement | kappa | *p* |
| Distorted gait | 88.9 | n/a | 0.001 | 83.3 | 0.67 | 0.004 | 83.3 | 0.67 | 0.004 |
| Audible | 83.3 | 0.74 | 0.001 | 83.3 | 0.73 | 0.001 | 77.8 | 0.67 | 0.001 |
| Facial expression | 72.2 | 0.29 | 0.18 | 88.9 | 0.60 | 0.01 | 72.2 | 0.29 | 0.18 |
| Stopping/resting | 88.9 | 0.84 | 0.001 | 88.9 | 0.83 | 0.001 | 94.4 | 0.92 | 0.001 |
| Touching/holding | 94.4 | 0.82 | 0.001 | 100 | 1.00 | 0.001 | 88.9 | n/a | 0.001 |
| Verbal reports | 88.9 | 0.61 | 0.005 | 88.9 | 0.73 | 0.002 | 83.3 | 0.58 | 0.02 |
| Support/leaning | 83.3 | 0.71 | 0.001 | 93.3 | n/a | 0.001 | 77.8 | 0.68 | 0.001 |
| Guarding/bracing | 83.3 | 0.74 | 0.001 | 88.9 | 0.85 | 0.001 | 83.3 | 0.69 | 0.001 |

n/a = not acceptable.

Table III. *Pearson's product moment correlations between pain behaviour measure, subjective pain report, disability, depression, modified somatic perception and kinesiophobia (*n = *51)*

| | Pain report (VAS) | Disability (ODQ) | Pain behaviour score | Depression (Zung) | Somatic perception (MSPQ) |
|---|---|---|---|---|---|
| Pain report (VAS) | 1.000 | | | | |
| Disability (ODQ) | 0.66** | 1.000 | | | |
| Pain behaviour score | 0.40* | 0.53** | 1.000 | | |
| Depression (Zung) | 0.48** | 0.50** | 0.35* | 1.00 | |
| Somatic perception (MSPQ) | 0.59** | 0.59** | 0.26 | 0.70** | 1.00 |
| Kinesiophobia (TSK) | 0.41* | 0.36* | 0.33* | 0.60** | 0.43** |

** $p = < 0.01$ (two-tailed).
* $p = < 0.05$ (two-tailed).
VAS = visual analogue scale; ODQ = Oswestry disability questionnaire; Zung = modified Zung depression questionnaire; MSPQ = modified somatic perception questionnaire; TSK = Tampa scale of kinesiophobia.

Following the exclusion of the facial grimacing score the internal consistency of the measure was assessed on a group of 33 chronic pain patients prior to enrolment on a pain management programme. The Cronbachs' alpha for the total scores was 0.73, which demonstrates an acceptable level of internal consistency. The exclusion of the verbal report of pain did not affect the alpha score (0.73). It was decided that the verbal report score should be retained in the final measure. Summing the total number of each category of pain behaviour then created a total score of pain behaviour for each subject.

The correlations between the total pain behaviour score, disability, subjective pain, depression (modified Zung), somatic perception (MSPQ) and kinesiophobia (TSK) were investigated. The results of this can be seen in Table III. There was a strong correlation between pain behaviour and subjective pain report and disability ($p < 0.01$). Additionally, the TSK had the strongest correlation ($r = 0.6$) to depression (modified Zung), but only low or moderate correlations to subjective pain or disability.

The influence of pain behaviour on performance of physical

Table IV. *Pearson product moment correlation between pain behaviour, subjective pain report, disability and physical performance variables (*n = *51)*

| | Extension | Forward flexion | Lateral flexion to left | Lateral flexion to right | Rotation to left | Rotation to right | Repetitive sit-up | Repetitive arching | Repetitive squatting | Hand grip left | Hand grip right | Timed walk | Lift |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Disability (ODQ) | −0.24 | −0.20 | −0.31* | −0.43** | −0.39* | −0.44** | −0.30 | −0.58** | −0.24 | −0.14 | −0.07 | −0.53** | −0.37* |
| Pain (VAS) | −0.02 | −0.50 | −0.23 | −0.40* | −0.20 | −0.30 | −0.15 | −0.44** | −0.17 | −0.20 | −0.27 | −0.44** | −0.42** |
| Total pain behaviour scale | −0.34* | −0.39** | −0.33* | −0.43** | −0.33* | −0.47** | −0.43** | −0.55** | −0.36* | −0.07 | −0.06 | −0.73** | −0.43** |

** $p = < 0.01$ (two-tailed).
* $p = < 0.05$ (two-tailed).
VAS = visual analogue scale; ODQ = Oswestry disability questionnaire.

Table V. *Summary of the stepwise multiple regression (R) analysis with disability as the dependent variable (*n = *51)*

| Model | R Square | Adj. R Square | Standardized coefficients Beta | *t* | *p* |
|---|---|---|---|---|---|
| 1. VAS | 0.38 | 0.37 | 0.617 | 5.37 | 0.000 |
| 2. VAS | | | 0.46 | 4.08 | 0.000 |
| Pain behaviour | 0.50 | 0.48 | 0.38 | 3.38 | 0.002 |
| 3. VAS | | | 0.30 | 2.50 | 0.016 |
| Pain behaviour | | | 0.37 | 3.48 | 0.001 |
| MSPQ | 0.59 | 0.56 | 0.34 | 3.00 | 0.004 |

Variables removed from the equation Depression (modified Zung depression questionnaire) and Fear of (re)injury (Tampa scale of kinesiophobia).
VAS = visual analogue scale; MSPQ = modified somatic perception questionnaire.

function test is given in Table IV. The correlations between total pain behaviour and performance of dynamic trunk exercises, repeated sit to stand, timed walk and lift is particularly striking ($p < 0.01$). There is no correlation between pain behaviour and grip strength ($p > 0.05$).

The relationships between subjective report of pain and the physical impairment (range of motion) measures is very poor, only lateral flexion to the right reached significance. Subjective pain report correlated more closely with measures of physical function. There were significant correlations with repetitive arching, timed walk and lifting but not with hand grip strength.

Multiple regression analysis was performed with disability as the dependent variable. Variables were grouped into pain, pain behaviour, physical impairment and physical function, psychological variables of depression and somatic perception were also included. Each block was entered step-wise into the regression model. The results are given in Table V. Pain measured on the VAS was the most important variable explaining 36% of the variance, pain behaviour and pain combined explained 48% of the variance for self-reported disability. Physical impairment and physical function variables failed to add to the explanation of disability. Somatic perception contributed a further 8% of the variance. Fear of (re)injury also did not contribute to the explanation of initial levels of disability.

## DISCUSSION

Keefe & Dunsmore (14) give a critical appraisal of pain behaviour measures and suggest that they may not elicit pain behaviours in some individuals; some measures may not represent a sufficiently vigorous physical challenge to the individual and therefore do not elicit pain behaviour. The current study tried to develop a pain behaviour measure using everyday functional tasks which might be perceived as challenging by those with back pain. In addition it included a non-back pain physical challenge.

All the results for the intra- and inter-observer agreement gave acceptable results. Kappa analysis was used because it is the "preferred statistic for interpreting intra-examiner reliability, especially preferred over percentage agreement which do not correct for agreement occurring by chance" (20). The results of a reliability study demonstrated that the behaviours could be reliably recorded by trained physiotherapists with the exception of facial expression and to a much lesser extent, verbal report of pain. The recording of facial expression proved to be difficult due to technical reasons. In order to view the whole posture and gait of the subject it was not always possible see their facial expression clearly. Due to the unacceptably low kappa score this item was removed from the final measure.

The results for verbal report only just failed to achieve the threshold for acceptability with a kappa score of 0.58. Due to the borderline result, falling only just outside the threshold set, it was decided to retain this measure in the final analysis and in the construction of the total pain behaviour score.

The relationship between pain and pain behaviour has been demonstrated to be rather equivocal in other studies with reports for concordance (12, 21), discordance (4, 10, 22) and for concordance only following treatment intervention (10, 22). This study demonstrated a strikingly high relationship between pain and pain behaviour in this group during this test situation. This may be a result of the nature of the tasks the subjects were required to undertake. Subjects were required, among other things, to lift heavy weights, perform repeated exercises involving the low back and walk for a prolonged period. Subjects in a routine clinical setting would tend to avoid physically challenging tasks and the pain behaviour might not be observed.

The subjects in this study were tested using standardized physical performance measures designed to assess back impairment (range of motion) and function. (The relationships can be seen in Table IV.) Pain behaviour correlated with all the variables except grip strength. The physical impairment and function measures demonstrate that the pain behaviour is specific to tasks, which would be expected to stress the back such as lifting, bending and walking. The maximal grip strength does not demonstrate any relationship with the pain behaviour score. This gives clear evidence that the measure specifically assesses behaviour related to the subjects' back pain problem and does not generalise to actions that, although are effortful, would not be expected to be painful in those with back pain and might be inappropriate to use in other conditions.

Close relationships between disability and pain behaviour have been reported by many studies (4, 8, 10, 21) and the correlations between disability and pain behaviours have been consistently higher than the correlations between report of pain and pain behaviours. This is not the case in this study. The correlations between the disability and pain behaviour and disability and pain report are very similar. Pain behaviour observed in a setting not involving performance of functional tasks may not adequately reflect the difficulty a subject experiences.

The regression analysis shows that pain report accounted for 36% of the variance for self-report of disability (see Table V). When pain behaviour was added to the model this increased to

48%; the addition of somatic anxiety helped to explain 56% of the variance for disability; depression and fear of (re)injury did not contribute to the model. The physical impairment and physical function variables failed to add additional explanation of variance to the model. This does not mean that they are simply another measure of pain behaviour, they are the product of number of influences of which pain behaviour is just one; fear/avoidance beliefs, pain expectancy and self-efficacy beliefs are also influential (6).

This group of patients had suffered back pain for at least one year, reported very high levels of disability and high pain report. Other studies into the relationships between pain, disability and function have not reported such high levels of pain and disability (2, 23). The relationships demonstrated between the variables in this study may not be representative of patient groups reporting lower levels of pain and disability. This is a matter for further investigation. Disability in those with back pain is highly influenced by psychological factors such as depression, somatic anxiety, fear/avoidance beliefs and coping strategies. Levels of depression and psychological distress in particular have been demonstrated to be highly associated with disability (16, 24). The group in this study are no exception; disability is highly correlated with depression, somatic perception and pain behaviour though less so with kinesiophobia (see Table IV). However, the results of the multiple regression analysis reveal that depression is less important than pain, pain behaviour and somatic perception. Because of the size of the study group we believe that a larger study is required before conclusions can be drawn from these results. The relative importance of pain behaviour, depression, fear and somatic perception in the development, maintenance and resolution of disability following rehabilitation interventions will be the subject of further research using this new tool.

This functional, video-based assessment of pain behaviour is a reliable measure of pain behaviour in back pain. The total scores for pain behaviour correlate very strongly with functional performance and specific impairment (range of motion of the low back) but only for tasks that involve the back; tests involving the upper limb (grip strength) were not affected. This makes this particular test of pain behaviour suitable for the assessment of those with pain problem specifically involving the back, but probably not other conditions.

The results demonstrate that, in this group of highly disabled individuals reporting high levels of pain report and the subject's consequent pain behaviour were the most important determinants of disability and physical function.

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