RELATIONSHIPS BETWEEN SPINAL MOBILITY, PHYSICAL PERFORMANCE TESTS, PAIN INTENSITY AND DISABILITY ASSESSMENTS IN CHRONIC LOW BACK PAIN PATIENTS

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ABSTRACT. Correlations between the Oswestry Disability Questionnaire (ODQ), the Pain Disability Index (PDI), PDI subscales PDI factor 1 (PDI 1), PDI factor 2 (PDI 2) and visual analogue scale (VAS) pain intensity on the one hand and spine range of motion measures and static and dynamic functional performance tests on the other, were studied in 52 chronic low back pain patients. Comparable groups of male and female patients were studied. A moderately significant ($p < 0.01$) inverse correlation was observed between the ODQ and rotation to the left even after correction for age, but not when men and women were studied separately. A significant ($r = -0.480$, $p < 0.001$) inverse correlation was observed between the repeated squatting test and pain intensity and in men both pain intensity and disability correlated ($r = -0.607$, $p < 0.001$) with this particular test. Only for the women were there moderately significant ($p < 0.01$) inverse correlations between disability assessments and all the physical performance tests with the exception of the static back muscle test. In the women only the isometric lifting test showed a moderately significant inverse correlation ($r = -0.504$, $p < 0.01$) with pain intensity. Such apparent gender differences in the overlap between physical performance tests and self-report disability assessments and pain intensity may be clinically relevant. The results will, however, require confirmation on larger groups of chronic low back pain patients.

Key words: chronic low back pain, disability assessments, pain intensity, range of motion, physical tests.

INTRODUCTION

In chronic pain patients the relationship between pain intensity and disability is complex (22, 27) and the correlation between disability and pain intensity has been observed to be moderate (27), also in low back pain patients (10, 28). The role of limitations in back mobility and physical performance test scores as determinants of low back pain disability and impairment is similarly uncertain. In, for example, a recent prospective study on a large population of patients with industrial low back pain (3), measures of spinal flexibility were noted to be poor predictors of future reports of back pain. Similarly, a reduction in lumbar flexion seems to correlate poorly with the chronicity of back pain (5, 29).

Two self-report disability assessments, i.e., the Oswestry Disability Questionnaire (7) (ODQ) and the Pain Disability Index (PDI) (23), have in recent studies proved to have acceptable psychometric properties to be reliable and useful for assessing low back pain patients (7, 10, 12, 24, 25). The correlation between self-report of pain and disability and more objective measures, assessing various functional capabilities, may, however, be weak (21, 29). Physical measures may have a lower reliability than self-report measures of disability and the latter may be more relevant to patient quality of life (25). The test–retest reliability for the PDI in a group of chronic low back pain patients was recently observed to be high (intraclass correlation coefficient, ICC = 0.91; time interval between administration one week), making the test a viable alternative to the presently more widely employed ODQ (10, 16). To be useful tests in clinical practice, the tests should, in addition to being reliable, be easy to administer, easy to comprehend, and should relate to fluctuations in the clinical state (7). The tests should also reflect the state of impairment of the patient, and should preferably predict future disability (29).

In the present study, the relationship, if any, between scores on the PDI and the ODQ and measures of spinal range of motion and some easy to administer static and dynamic back pain patient functional performance tests was investigated. The relationship of such functional measures to VAS ratings of pain intensity was also studied.

MATERIAL AND METHODS

Patient description

Fifty-five consecutive patients (28 men and 27 women) entering a functional restoration programme for chronic low back pain patients entered the study. Patients suffering from other major diseases causing disability, vertebral fractures, a disc herniation requiring operative treatment, a diagnosed psychiatric disorder requiring medication or a diagnosed underlying disorder causing low back pain, were excluded, as were pregnant women. All those entering the study had suffered from low back pain for a period of at least three months, and could thus be classified as patients with chronic low back pain (8). The median of back pain symptoms was 9.5 months (range 3–60 months). Three of the women failed to answer any of the disability assessment questionnaires, whereas all patients completed the spinal range of motion and functional tests. Thus the final study material comprised 52 patients (28 men and 24 women). The mean (SD) age of the patients was 42.7 years (8.2 years), for the men 39.3 years (9.0 years) and for the women 47.2 years (4.1 years), the women being slightly older on average.

Patients were asked to complete a pain drawing, showing an outline of the front and back part of a human body, and were asked to shadow areas where either local back pain or pain radiation had been present during the previous 7 days. Patients who indicated in their pain drawings pain symptoms in other parts of the body such as arms, neck and face were excluded. On the basis of pain drawing markings, 34 patients (65%) had back pain with radiation below knee level, 10 (19%) had local back pain and 7 patients (13%) had back pain with radiation above knee level. The distribution of pain in men and women separately is shown in Table I.

Twelve patients (23%) had had a previous back operation. More than half the patients (27, 52%) were doing their regular work at the time of the study, 19 (37%) were on sick-leave and 3 were unemployed (Table I).

Most patients had a diagnosis of non-specific low back pain with or without sciatica. One patient had a spondylolysis and spondylolisthesis at the L5 level, one patient had a spinal stenosis at the L4/5 level, four patients had one or multiple level disc protrusions and two patients had disc herniations that were not considered to require operative treatment. One of these patients had a recurrent right-sided disc herniation at the L5/S1 level.

None of the patients studied had any other serious disease causing disability. One patient reported high blood pressure and a previous thyroid gland operation, one patient low grade skin disease unspecified, one patient glaucoma and ongoing investigations of the thyroid gland and one patient occasional bouts of headache.

Table I. *Basic characteristics of male and female patient groups*

	Men	Women
Total	28	24
Gainfully employed	15	12
On sick leave	11	8
Unemployed	2	1
Other (reschooling, student, housewife, etc.)	0	3
Back operations	7	5
Distribution of pain:*		
Distal radiation	19	15
Proximal radiation	3	4
Local low back pain	6	4

* For one female patient the pain drawing was missing.

Assessment of present pain intensity

In addition to the pain drawing, which was used for assessing the distribution of pain (5, 20, 26), all patients completed two non-numerical VAS pain intensity assessments (11, 13). The VAS instrument has been shown to have an acceptable reliability upon repeated administration and is a valid measure of pain severity (13, 25). The first VAS scale depicted severity of present pain felt in the low back, the second scale severity of present pain felt in either leg. The VAS scales were anchored at no pain at all (= 0) and unbearable pain (= 100). The higher reading from either the low back scale or the leg scale was chosen as representative of the patients' present pain intensity (10).

Assessment of disability

Two different self-report disability assessments, the ODQ (7) and the PDI (23, 24) were employed. Both of these disability questionnaires have a well-proven reliability and validity for chronic pain patients as well as low back pain patients (7, 10, 12, 19, 23, 24). Both questionnaires assess functional limitations due to chronic pain in everyday-life activities. In the original study (7) the ODQ was administered to 25 patients suffering from their first attack of low back pain, and was observed to react very well to the spontaneous recovery in these patients when administered at one-week time intervals. Its test–retest reliability was also very high ($r = 0.99$) when administered on consecutive days (7). When administered repetitively with a one week time interval to a Finnish group of patients suffering from chronic low back pain, a high intraclass correlation coefficient ($ICC = 0.83$) was similarly observed (10). In the ODQ there are ten sections, the first assessing pain intensity and need of pain medication, the other nine assessing difficulties in personal care, lifting, walking, sitting, standing, sleeping, sex life, social life and travelling. Each section is scored 0–5, 0 indicating no difficulty at all and 5 indicating maximal difficulty. The maximal possible score 50 equals 100%. For further details of the questionnaire the reader is referred to the original work of Fairbank et al. (7).

In general, the PDI is similar to the ODQ, but in it there are seven subsections, each with scores of 0–10, and disability is then expressed by the summed total score for all subsections. The sections depict the experienced degree of functional difficulty (no disability equals 0 and total disability equals 10) with respect to family/home responsibilities, recreation, social activity, occupation, sexual behaviour, self-care and life-support activity (23). Using a factor analysis, two separate subscales, one for voluntary or discretionary activities (items 1 to 5 = factor 1) and the other for self-care and life-support activities (items 6 and 7 = factor 2) have been presented. Factor 1 scores were found to correlate more strongly with psychologic distress and behavioural measures of disability in a recent study on a multidisciplinary pain patient population (12). This introduces the possibility of using the very convenient shorter-form PDI factor 1 as an independent measure of disability in chronic pain patients. Indeed, in a recent study on chronic low back pain patients (10), the PDI factor 1 was seen to correlate as highly with the

ODQ as the total PDI assessment (r = 0.84 vs 0.83), and to have a similarly high (ICC = 0.87 vs 0.91) test–retest reliability as the PDI. Since both the ODQ and the PDI are easy to comprehend and administer, they were chosen for the assessment of self-reported disability in the present study.

Assessment of spinal mobility

One physiotherapist who was experienced in spine rehabilitation assessments performed all patient measurements to exclude intertester variability bias. Measurements were performed on patients prior to their entering a functional spine rehabilitation programme. Lumbar spine flexion, extension and right and left rotation ranges of motion were measured using two goniometers as has been described (1). Lateral flexion (sidebending) to the right and left were measured by having the subject stand with his/her back flat against a wall and the feet 15 cm apart. On each thigh a mark was made at the tip of the index finger with the subject standing erect. The subject was then asked to bend to the side maximally and the distance between neutral and maximal side bending position was recorded (1). For these assessments of spinal range of motion the inter- and intraobserver reproducibility has been observed to range from 0.37 to 0.91 (1).

Static and dynamic physical performance tests

Physical performance tests used in the present study were the repetitive sit-up test, an isometric test assessing spine extensor muscle performance (static back endurance test) (4), a dynamic spine extensor muscle performance test, a repetitive squatting test and an isometric trunk-lifting test (1). In the repetitive tests maximal performance is set at 50 times. The inter- and intraobserver reliability coefficients have been observed to vary between 0.63 and 0.95 for these tests. The readers are referred to the work by Alaranta et al. (1) for a more complete description of these physical performance tests.

Table II. *Descriptive statistics for spinal mobility and physical performance in male patients*

	Men ($n = 28$)		
	Mean	95% CI	Range
FLEX	41°	35°–46°	11°–60°
EXT	13°	10°–17°	2°–38°
ROT (R)	43°	38°–48°	17°–64°
ROT (L)	45°	39°–51°	12°–68°
LAT (R) (mm)	167	146–189	21–240
LAT (L) (mm)	173	150–196	19–300
SIT (0–50)	24	19–29	5–50
BSTAT (sec)	62	43–80	0–150
BDYN (0–50)	23	17–29	0–50
SQUAT (0–50)	30	25–36	3–50
ISOLIFT (% b.w.)	158	141–174	72–232

95% CI: upper and lower 95% confidence interval limits; FLEX: forward flexion; EXT: backward extension; ROT (R, L): rotation to right, left; LAT (R, L): sidebending to right, left; SIT: repetitive sit-up test (possible range 0–50); BSTAT: static back muscle test; BDYN: dynamic back muscle test (possible range 0–50); SQUAT: repetitive squatting test (possible range 0–50); ISOLIFT: isometric lifting test (% body weight).

Statistics

Pearson product-moment correlation coefficients and partial correlations correcting for age were used for assessing the relationship between disability assessments and pain intensity on the one hand and spinal range of motion measures and static or dynamic functional performance tests on the other. Ninety-five percent confidence intervals (CI) were used for comparing male and female patient groups. When 95% CI were used $p < 0.05$ was considered significant. To avoid alpha inflation due to multiple correlations (type I error), the level of statistical significance was otherwise set at $p < 0.001$ and for modest significance at $p < 0.01$.

RESULTS

General observations

The 52 patients reported an average pain intensity of 48.9 (SD 23.8) on the visual analogue scale (1–100). Mean pain intensity (SD) was 44.6 (22.0) for the men and somewhat higher, 54.2 (25.4), for the women.

For all patients the mean PDI score was 24.6 (SD 13.6) on the 0–70 scale, 25.7 (SD 13.8) for the men and 23.2 (SD 13.5) for the women. The mean (SD) was 29.8 (14.1) on a scale of 0–100 for the ODQ for all patients, 30.5 (13.7) for men and 29.0 (14.8) for women. The mean PDI factor 1 (scale 0–50) was 20.4 (SD 10.9) for all patients, 20.9 (SD 10.8) for men and 19.9 (SD 11.2) for women. The mean value of the PDI factor 2 was 4.1 (SD 4.0) on a 0–20 scale for all patients, 4.8 (SD 4.1) for men and 3.3 (SD 3.8) for women.

The range of VAS pain intensity values was 3–92, of ODQ values 4–52, the PDI values 2–51, the PDI factor 1 values 2–40 and the PDI factor 2 values 0–18. Thus there was quite a wide spread of reported

Table III. *Descriptive statistics for spinal mobility and physical performance in female patients*

	Women ($n = 24$)		
	Mean	95% CI	Range
FLEX	43°	39°–47°	15°–64°
EXT	15°	12°–18°	5°–28°
ROT (R)	44°	41°–47°	22°–60°
ROT (L)	43°	40°–47°	20°–70°
LAT (R) (mm)	167	148–186	13–275
LAT (L) (mm)	175	158–192	17–245
SIT (0–50)	20	15–25	3–50
BSTAT (sec)	74	54–95	8–215
BDYN (0–50)	26	21–31	5–50
SQUAT (0–50)	18	14–22*	0–50
ISOLIFT (% b.w.)	95	85–105*	44–129

Abbreviations as in Table II. * Significantly lower than for male patients ($p < 0.05$).

Table IV. *Correlations between disability assessments, pain intensity and measures of spinal mobility in 52 chronic low back pain patients*

	FLEX	EXT	ROT(R)	ROT(L)	LAT(R)	LAT(L)
All patients ($n = 52$)						
ODQ	0.085	−0.300	−0.325	−0.363*	−0.189	−0.297
PDI	−0.078	−0.267	−0.271	−0.266	−0.204	−0.333
PDI 1	−0.100	−0.277	−0.323	−0.324	−0.213	−0.348*
PDI 2	0.001	−0.159	−0.054	−0.036	−0.121	−0.195
VAS	0.092	−0.209	−0.191	−0.332	0.026	−0.100
Men ($n = 28$)						
ODQ	0.087	−0.393	−0.356	−0.458	−0.328	−0.467*
PDI	−0.090	−0.269	−0.295	−0.350	−0.262	−0.423
PDI 1	−0.178	−0.292	−0.370	−0.398	−0.323	−0.472*
PDI 2	0.158	−0.140	−0.023	−0.135	−0.036	−0.184
VAS	0.065	−0.217	−0.260	−0.428	−0.005	−0.191
Women ($n = 24$)						
ODQ	0.159	−0.082	−0.284	−0.253	0.078	0.162
PDI	0.039	−0.201	−0.238	−0.165	−0.065	−0.050
PDI 1	0.145	−0.203	−0.243	−0.245	0.020	0.010
PDI 2	−0.266	−0.119	−0.130	0.120	−0.273	−0.196
VAS	0.094	−0.276	−0.082	−0.139	0.059	0.068

Pearson product–moment correlation coefficients, * $p < 0.01$; ODQ: Oswestry Disability Questionnaire; PDI: Pain Disability Index; PDI 1: factor 1 of Pain Disability Index; PDI 2: factor 2 of Pain Disability Index; VAS: visual analogue scale; FLEX = forward flexion; EXT = backward extension; ROT(R,L) = rotation to right, left; LAT(R,L) = sidebending to right, left.

disability values for all the disability assessments and all disability assessment average scores were at the lower end of the severity scale for both men and women. Similarly, average pain intensity ratings were at the lower end of the scale for men, but for the women patients barely at the upper end of the 0–100 VAS scale.

Descriptive statistics for spinal mobility and physical

Table V. *Partial correlations between disability assessments, pain intensity and measures of spinal mobility in 52 chronic low back pain patients after correction for age*

	FLEX	EXT	ROT(R)	ROT(L)	LAT(R)	LAT(L)
All patients ($n = 52$)						
ODQ	0.104	−0.291	−0.318	−0.355*	−0.169	−0.282
PDI	−0.070	−0.262	−0.267	−0.261	−0.197	−0.332
PDI 1	−0.082	−0.265	−0.316	−0.312	−0.188	−0.331
PDI 2	−0.019	−0.177	−0.066	−0.054	−0.162	−0.240
VAS	0.119	−0.193	−0.180	−0.317	0.071	−0.062
Men ($n = 28$)						
ODQ	0.187	−0.355	−0.345	−0.448	−0.267	−0.433
PDI	−0.002	−0.217	−0.281	−0.337	−0.176	−0.370
PDI 1	−0.070	−0.223	−0.358	−0.386	−0.208	−0.392
PDI 2	0.163	−0.154	−0.025	−0.138	−0.055	−0.227
VAS	0.133	−0.184	−0.250	−0.419	0.081	−0.140
Women ($n = 24$)						
ODQ	0.123	−0.094	−0.261	−0.237	0.038	0.094
PDI	0.037	−0.202	−0.239	−0.164	−0.070	−0.062
PDI 1	0.145	−0.204	−0.244	−0.245	0.017	0.004
PDI 2	−0.273	−0.119	−0.131	0.121	−0.281	−0.218
VAS	0.102	−0.275	−0.087	−0.142	0.066	0.086

Abbreviations as in Table IV. * $p < 0.01$.

Table VI. *Correlations between disability assessments, pain intensity and physical tests in 52 chronic low back pain patients*

	All patients ($n = 52$)				
	SIT	BSTAT	BDYN	SQUAT	ISOLIFT
ODQ	−0.259	−0.163	−0.324	−0.408*	−0.028
PDI	−0.422*	−0.241	−0.400*	−0.377*	−0.075
PDI 1	−0.415*	−0.237	−0.353*	−0.371*	−0.132
PDI 2	−0.311	−0.176	−0.403*	−0.278	0.094
VAS	−0.357*	−0.069	−0.266	−0.495**	−0.222
Men ($n = 28$)					
ODQ	−0.273	−0.211	−0.177	−0.595**	−0.119
PDI	−0.435	−0.229	−0.230	−0.540*	−0.162
PDI 1	−0.453	−0.226	−0.182	−0.552*	−0.253
PDI 2	−0.272	−0.176	−0.290	−0.365	0.112
VAS	−0.378	−0.191	−0.201	−0.602**	−0.057
Women ($n = 24$)					
ODQ	−0.283	−0.049	−0.471	−0.343	−0.251
PDI	−0.481	−0.181	−0.599*	−0.393	−0.542*
PDI 1	−0.422	−0.193	−0.546*	−0.307	−0.461
PDI 2	−0.451	−0.077	−0.507*	−0.473	−0.551*
VAS	−0.315	−0.015	−0.428	−0.309	−0.505*

Pearson product-moment correlation coefficients, $*p < 0.01$, $**p < 0.001$. Disability index abbrevations as in Table I; SIT = repetitive sit-up test; BSTAT = static back muscle test; BDYN = dynamic back muscle test (repetitive arch-up test); SQUAT = repetitive squatting test; ISOLIFT = isometric lifting test.

performance tests are presented for men in Table II and for women in Table III. For most measures the 95% CI were not significantly different between men and women and the range of measurement values was wide for both men and women for all the measures. Not surprisingly women produced significantly less strength on the isometric lifting test. More difficult to explain, however, was a significantly poorer performance for women on the repetitive squatting test (Tables II and III).

Table VII. *Partial correlations between disability assessments, pain intensity and physical tests in 52 chronic low back pain patients after correction for age*

	All patients ($n = 52$)				
	SIT	BSTAT	BDYN	SQUAT	ISOLIFT
ODQ	−0.246	−0.157	−0.341	−0.398*	0.006
PDI	−0.419*	−0.237	−0.412*	−0.376*	−0.059
PDI 1	−0.403*	−0.231	−0.374*	−0.355*	−0.098
PDI 2	−0.343	−0.187	−0.394*	−0.321	0.058
VAS	−0.339	−0.059	−0.290	−0.480**	−0.186
Men ($n = 28$)					
ODQ	−0.222	−0.155	−0.180	−0.607**	−0.106
PDI	−0.392	−0.169	−0.235	−0.552*	−0.149
PDI 1	−0.393	−0.143	−0.190	−0.576**	−0.241
PDI 2	−0.298	−0.194	−0.290	−0.365	0.111
VAS	−0.355	−0.154	−0.203	−0.607**	−0.047
Women ($n = 24$)					
ODQ	−0.343	−0.042	−0.508*	−0.296	−0.269
PDI	−0.499*	−0.181	−0.605*	−0.438	−0.545*
PDI 1	−0.439	−0.193	−0.552*	−0.340	−0.463
PDI 2	−0.466	−0.077	−0.511*	−0.534*	−0.553*
VAS	−0.319	−0.017	−0.428	−0.363	−0.504*

Abbreviations as in Tables IV and VI. Pearson product–moment correlation coefficients, $*p < 0.01$, $**p < 0.001$.

Relationship between spinal mobility and assessments of disability and pain intensity

The Pearson-product moment correlation coefficients between disability assessments and spinal range of motion measurements and their statistical significances (14) are presented in Tables IV and V. In Table V partial correlations, corrected for age, are given. For all patients the most significant correlation was noted between the ODQ and limitation of rotation to the left. After correction for age, this moderately significant ($p < 0.01$) correlation was still observed. However, for men and women separately, and after correction for age, none of the correlations were even moderately significant. Prior to correction for age (Table IV) there was a moderately significant inverse correlation in men between disability assessments and sidebending to the left. Neither did VAS pain intensity correlate significantly with any of the spinal mobility measures.

Relationship between static and dynamic physical tests and assessments of disability and pain intensity

In general, there was a more significant correlation between the physical tests and assessments of disability and pain intensity than was observed for the spine range of motion measures. A significant inverse correlation was observed for all patients between pain intensity and repetitive squatting (Tables VI and VII). It did, however, only apply to the male patients ($r = -0.607$, $p < 0.001$), whereas the correlation for the women remained non-significant ($r = -0.363$). For the women, pain intensity correlated significantly with decreased performance in the isometric lifting test ($r = -0.504$, $p < 0.01$).

Notably, the static back muscle test showed no significant correlation with any of the disability assessments or pain intensity before or after correction for age (Tables VI and VII). Furthermore, the isometric lifting test only correlated significantly ($p < 0.01$) with disability assessments and pain intensity in women. The dynamic back muscle test also correlated significantly with disability assessments in women only, before and after correction for age (Tables VI and VII). Interestingly, significant correlations ($p < 0.01$–0.001) were only observed for men for the repetitive squatting test, whereas they were noted for several of the physical tests for the women (Table VII).

DISCUSSION

In order to be clinically meaningful and useful, measures of spinal function, be they of range of motion or of static or dynamic functional performance, should reflect the overall state of disability of the back pain patient and they should preferably relate to working capability and performance. So far, physical measures such as spinal flexibility, isometric lifting strength and aerobic capacity have proved to be poor predictors of back pain reports in industrial employees (2). In another recent study on a patient sample where most patients suffered from acute back pain (6), physical findings were also found to be poor predictors of disability, whereas education and self-rated health were better predictors.

The physical measures that were employed in the present study are to be considered coarse methods of assessment but they are all easily administered and could thus perhaps be useful screening instruments in a clinical setting (1). To the authors' knowledge, no previous detailed studies comparing such measures of spinal flexibility and function with pain intensity and more than one, previously validated, self-report disability assessment for low back pain patients have been undertaken. Using more than one disability assessment may perhaps address somewhat different aspects of the disability complex of chronic back pain patients and may increase the likelihood of finding more meaningful interrelationships with other measures (9).

Recently, the PDI and its PDI 1 subscale (12, 23, 24) have proven reliable for assessing disability in chronic low back pain patients (10). Similarly, the ODQ has demonstrated test–retest reliability when assessing disability in low back pain (7, 10).

The present study only comprised patients who had suffered from low back pain for at least 3 months (median 9.5 months), i.e. chronic low back pain (8, 18). All patients were entering a functional rehabilitation programme and could thus be considered more difficult back pain patients. More than half of both male and female patients had radiation of pain below knee level, as judged by pain drawing markings, which would also suggest a more serious back pain syndrome in most. Furthermore, almost a quarter of the patients had undergone a previous back operation. However, none of the patients required surgical treatment.

With respect to present pain intensity, patients were nearly normally distributed, but average pain intensity was somewhat higher for women than for men. The distribution of patients with respect to disability assessments was, however, somewhat skewed towards the lower end of the scale and average values were also at the lower end. Thus the patients had proportionately more severe pain than disability, which has to be considered when interpreting the results of the present study (27). Owing to the small patient sample the results of the present study do not necessarily apply to chronic low back pain patients in general. They will require confirmation on differently composed samples of chronic low back pain patients. Observed gender differences in the relationships between subjective disability, pain intensity and measures of spinal mobility and physical performance are of particular interest, however, since men and women were closely comparable with respect to work status, prior back operations and the distribution of pain (radiating or not). The women were, however, slightly older on average and also had a somewhat higher average pain intensity. Since age may influence both spinal range of motion and results on physical performance tests (1, 17) partial correlations correcting for age were used.

A major observation of the present study was the almost total lack of significant correlations between spinal mobility measures and either disability assessments or pain intensity. After correction for age, the ODQ for all patients, but none of the other disability assessments, showed a moderately significant inverse correlation with rotation to the left, but for men and women separately no significant correlation could be observed. Notably, not even moderately significant correlations could be observed with the measures of spinal mobility in the sagittal plane. Such results may lend indirect support to recent reports (5, 29) that reduction in lumbar flexion correlates poorly with the chronicity of back pain. The observed correlation between the ODQ and limitation of rotation to the left may not be entirely insignificant clinically, however, since in a recent study (17) it was noted that lumbar lateral flexion was asymmetric in a sample of chronic low back pain patients. Asymmetric spinal motion could be the result of or possibly a cause for low back pain (17).

Some perhaps interesting observations with respect to gender differences were, however, made with respect to interrelationships between disability assessments, pain intensity and static and dynamic physical tests. Of all the physical tests repetitive squatting was most significantly related to pain intensity, but, interestingly, only for men. The correlation between the squatting test and disability assessments was also more evident for men. None of the other physical tests correlated as highly with either disability or pain intensity. This result could in part be explained by the fact that a majority of the patient sample had radiation of pain distally, i.e. below the level of the knee. It is conceivable that patients experiencing such sciatica may have difficulties and painfulness when attempting repetitive squatting. However, a majority of both men and women had such pain radiation and in women the squatting test correlated only moderately with the PDI 2 and with none of the other assessments for either disability or pain intensity. Thus radiation of pain is apparently not the sole explanation for the observed correlations with the repetitive squatting test.

The observation that pain intensity correlated for women who had difficulty in performing the isometric lifting test, whereas pain intensity only correlated significantly with the repetitive squatting test in men, may be clinically significant. It is possible that experienced pain and disability in such physical performance tests affect men and women somewhat differently. Further studies will, however, be necessary to determine whether such is really the case or not. Interestingly, for women there was a significant association between results on almost all the physical performance tests and disability assessments. These results also suggest gender-related differences in the relationship between perceived disability and objective performance on physical tests for low back pain patients.

Somewhat surprisingly, for neither men nor women could a significant relationship be observed between the performance on the static back muscle test and disability assessments or pain intensity. The static back muscle test is considered an endurance test for the back muscles (4) and is thus often included in the clinical assessment of low back pain patients. Even this result should be interpreted with caution, however, because of the limited patient sample.

It is concluded that significant relationships can be observed between the results on particularly dynamic tests for low back pain patients and perceived overall disability as well as pain intensity reported by the patients. This overlap between subjective and observable disability is only partial, however, and may represent somewhat different aspects of the disability concept. Furthermore, there appear to be gender differences in the relationships between perceived disability and intensity of pain on the one hand and observable limitations in physical performance on the other. Interestingly, the relationships between perceived disability, pain and limitations of spinal motion appear to be weak.

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