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COURSE OF BACK PAIN IN PRIMARY CARE: A PROSPECTIVE STUDY OF PHYSICAL MEASURES

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Objective: **To describe physical measures used in patients with back pain when no specific treatment is given, to examine associations between change over time in these measures and changes in pain and back-related disability, and to study the value of physical measures at baseline and at a 4-week follow-up to predict outcome at 12 months.**

Design: **A prospective consecutive study.**

Subjects: **Forty-four patients presenting with low back pain in primary care.**

Methods: **The patients underwent a physical examination at baseline and at 4 weeks. Follow-up was carried out using questionnaires until 12 months. Linear regression was used to identify predictors.**

Results: **Most measures had improved significantly at the 4-week follow-up. Thoracolumbar rotation, isometric endurance back extensors, and fingertip-to-floor distance at 4 weeks were significant predictors for pain intensity and back-related disability at the 12-month follow-up. Eighteen out of 44 patients reported an increase in pain after the assessment of the physical measures at baseline. This group of patients improved more in physical measures between baseline and the 4-week follow-up.**

Conclusion: **Physical measures assessed at the 4-week follow-up, but not at baseline, could provide important additional information for identifying those patients at risk for worse outcome in pain or back-related disability at 12 months.**

Key words: low back pain, primary care, physical measures, physical examination, disability

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INTRODUCTION

Physical measures, such as range of motion and muscle strength, have been investigated in general, working and clinical populations. These investigations have had a range of aims, including to determine which subjects would develop back pain over time (1), to detect the severity of back pain (2) and risk factors for developing back pain (3), to predict return to work (4, 5) and development of chronic problems (6). Physical measures have also been used as diagnostic tools to discriminate between healthy subjects and those with back pain (7, 8), and in the evaluation of different treatments (9, 10). However, several issues concerning physical measures need further exploration.

For the routine assessment of non-specific back pain in clinical practice, both physical measures, such as range of motion, and self-reported measures such as patient-reported pain intensity and function are used (11). Changes in physical measures over time have been reported in several studies comparing different treatment strategies (5, 12, 13), but little is known about changes when no active treatment is offered.

Finding predictors for low back pain disability and chronicity at an early stage is an important issue for primary care (14, 15). Researchers who have attempted to find predictors for future back pain severity have concluded that physical measures have only limited prognostic value (4, 16, 17). Roland & Morris concluded that changes in physical signs should not be used as measures of outcome (17). In studies concerning predictors regarding future back problems, results of physical measures at the time of the first visit to the healthcare unit have mainly been used to predict outcome at a later point in time. Carey et al. (18) investigated a group with chronic low back pain and noted that poor back-related disability at 4 weeks, a self-reported measure, was a more powerful predictor for chronicity than poor baseline back-related disability and sciatica. This raises the question of whether also physical measures have stronger predictive value when measured in a more sub-acute phase (4 weeks) compared with an acute phase (baseline) of the back problems.

In clinical practice it is known that performing physical measures provokes pain in some patients but not in others. McQuade et al. (19) reported that many subjects felt better after undergoing physical measures. An intriguing question is whether patients reporting more pain after physical examination, compared with patients reporting equal or less pain after physical examination, have different results in physical measures. Another question is whether patients who report more pain after physical examination differ in outcome regarding pain or back-related disability at 12 months compared with those who report equal or less pain after physical examination.

The objectives of this paper were to describe some physical measures in patients with back pain when no specific treatment is given, to examine associations between change over time in these measures and change in pain and back-related disability; and to investigate the value of physical measures at baseline and

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at the 4-week follow-up for predicting pain and back-related disability at the 12-month follow-up.

METHODS

Subjects and methods

The study is a prospective descriptive study involving 2 primary healthcare centres in southern Sweden. The patients visited the primary healthcare centre and had either a general practitioner (GP) or a physiotherapist (PT) as their primary contact. Inclusion criteria were an age of 18–60 years and that the back pain could be provoked by combined side flexion, ipsi-lateral rotation and extension, or sustained maximal flexion. Exclusion criteria were having received active treatment for the current back pain within the previous month, affected nerve root (signs reflected in sensibility, muscle strength as well as reflexes), major medical or psychiatric disease, involvement in an accident less than 10 days previously, pregnancy and inability to understand Swedish.

In this study, " no specific treatment" means that a GP prescribed medication and additional investigations (e.g. an X-ray) for the patients if this was judged necessary. All the patients were informed that back pain is generally self-limiting and that their back problems did not require specific treatment. Furthermore, after a physical examination by a PT (which was performed 0–3 days after the GP consultation), the patients filled out a questionnaire, and an appointment was made for a follow-up physical examination after 4 weeks. Patients were not offered any manual treatment, instructions on exercises, or written information about their complaints. If patients asked how to manage their problems, they were told that they should try to resume their normal activities as soon as they felt this was possible. The research ethics committee at Linköping University approved the study (Dnr 97149) and local health authorities gave their consent.

Design and measures

Patient questionnaires, including self-reported pain, disability, somatic or depressive distress and general health, were used initially and at 3, 6 and 12 months. Background data were included in the first questionnaire.

Measures of pain included present pain intensity (using a horizontal visual analogue scale (VAS), with 0 mm indicating no pain and 100 mm the worst imaginable pain (20)), pain frequency on a 5-point scale, and use of pain medication on a 4-point scale. Location of pain was reported as low back or low back and neck. Disability was measured using the Oswestry low back pain disability questionnaire (Oswestry score) (21). The instrument contains 10 items concerning pain-related disability. The items are scored from 0 to 5 and the results transformed to a percentage value, with 0% representing no restrictions in performing any function. General health was measured with a horizontal VAS (0 = best imaginable to 100 = worst imaginable) and well-being was rated on a 6-point scale. Somatic and depressive distress were measured with the Zung (22) and the MSPQ (23) and were combined using a DRAM grouping (24) into normal, at risk, somatic or depressive distress.

All patients underwent a physical examination at baseline and after 4 weeks. Before and after the examination the patients filled in present pain intensity (VAS) on separate forms. For every patient the same PT, blinded for the results from the first examination and the results of the self-reported data, performed the initial and follow-up physical examinations. The performance of the physical measures and the instructions given to the patients were standardized. The examiner asked the patients to try their hardest, but to take their pain and fatigue into account. Patients were informed that they could discontinue each test any time they wanted. It was stressed that it was the patient's decision to discontinue. The testing order, as shown below, made it possible to perform all physical measures consecutively. The procedure took 15–20 minutes. No warm-up was done before the measurements were performed. In isometric endurance measures a time ceiling of 120 seconds was used. Each measurement was carried out once.

The following measures were included in the physical examination:

Thoracolumbar rotation

The patient sat on an adjustable couch with the thighs entirely supported and the cervical range of motion (CROM) device (Performance Attainment Associates, Roseville, MN, USA) placed on his/her head (25). One magnet lay on the couch behind the patient's buttocks and one in the patient's lap. After the patient reached maximal neck rotation to one side, the inclinometer was adjusted to zero. The patient was subsequently asked to rotate further, as much as possible. No movement of the pelvis was allowed. The result was recorded in degrees. The results of left and right rotation were added.

Isometric endurance back flexors

Lying supine with arms crossed and hands on the opposite shoulders, knees bent and feet resting on the couch, the patient was asked to nod and continue to lift head and shoulders until the inferior angle of the scapula was barely lifted from the couch, and to maintain this position as long as possible or until the position became uncomfortable (modified after McQuade et al. (19)). Time was recorded in seconds.

Isometric endurance back extensors

The patient lay prone with the trunk horizontal outside the adjustable couch and the arms folded across the chest. The legs were fixed to the table by canvas straps. The patient was asked to maintain this position as long as possible or until the position became uncomfortable (modified after Biering-Sørensen (1)). Time was recorded in seconds.

Straight leg raising (SLR)

The patient lay prone. The examiner lifted the heel from the couch while supporting the calf. SLR was judged positive if the patient reported pain before the inclinometer attached caudal to the knee joint showed 60 degrees. Both legs were tested.

Fingertip-to-floor distance

The patient stood erect in a comfortable position. He/she was asked to bend forward as far as possible with the knees straight. The distance between the tips of the middle fingers and the floor was recorded in centimetres (26).

Statistics

For the comparison between groups, the Mann-Whitney U test, chi-square or Fisher's exact test was performed. Comparison within groups was assessed with the Wilcoxon signed rank test. The Spearman Rank sum correlation was used for analysing associations between variables. Statistical significance was set at $p < 0.05$ (two-tailed). Simple linear regression was used to identify factors of importance (independent variables explaining a significant proportion of variation or R^2) that might predict level of Oswestry score and pain intensity at the 12-month follow-up (27). Analyses were carried out using the SPSS statistical package version 10.1 (Chicago, 2001).

RESULTS

Material

A total of 55 consecutive patients were included. The descriptive data for the 44 patients with low back pain who underwent the physical examination after 4 weeks and completed the 12-month questionnaire are presented in Table I. The mean age was 42 years (range 18–60) and 66% were women. Most patients had had back pain previously, often with an onset more than 5 years previously. Four patients were experiencing their first episode of back pain.

The dropouts included 11 patients. Three patients wanted another treatment regime after undergoing the physical examination and filling in the first questionnaire. After 4 weeks another 5 patients did not attend the planned follow-up. One patient discontinued participation for family reasons, 1 moved, and 1 did not complete the 12-month follow-up. There were no

Table I. *Initial characteristics of patients who underwent both physical examinations and completed the 12-month follow-up questionnaire. Values are numbers (percentages) unless otherwise indicated*

	Patients ($n = 44$)	
Age in years, mean, SD	42	14
Gender, women	29	(66)
Smoker	8	(18)
Physical exercise $\geq$ once a week before complaints	28	(64)
Employment, full- or part-time	34	(77)
Sick leave	18	(41)
Duration of sick leave >1 month	2	(5)
Similar problems previous 5 years	31	(70)
First onset of complaints, mean no. of years ago, SD	12	10
Low back pain	33	(75)
Low back and neck pain	11	(25)
Duration of current episode		
<1 week	11	(25)
1–4 weeks	17	(39)
1–3 months	5	(11)
>3 months	11	(25)
Pain frequency, continually—daily	41	(93)
Using pain medication, several times a day—daily	13	(29)
Pain intensity in mm on the VAS, mean, SD[a]	44	21
Oswestry score in %, mean, SD[a]	37	17
Well-being: very well, well, fairly well[b]	31	(70)
General health in mm VAS, mean, SD[a]	28	17
DRAM[c] Normal	28	(64)
At risk	14	(32)
Somatic- or depressed distress	2	(4)

SD = standard deviation.
[a] High values indicate greater degree of problems.
[b] Wellbeing on a 6-grade scale: 1 = very well to 6 = very poor.
[c] Distress and Risk Assessment Method; Normal = ZSDS 0–16, At risk = MSPQ <12 and ZSDS 17–33,
Somatic distress = MSPQ ≥12 and ZSDS 17–33, Depressed distress = ZSDS >33.

significant differences between the dropouts and the completers, except for proportion with similar problems before, pain intensity and general health. In the dropouts a smaller proportion had had similar problems during the previous 5 years compared with the completers ($n = 4$, 36%, vs $n = 31$, 70%, $p = 0.04$). Mean pain intensity VAS in the dropout group was higher than among the completers (60 (SD 22) vs 44 (SD 21), $p = 0.04$). Also general health VAS was worse in the dropout group (46 (SD 22) vs 28 (SD 17), $p = 0.02$).

Changes in physical measures between baseline and the 4-week follow-up

Thoracolumbar rotation, isometric endurance back extensors and fingertip-to-floor distance improved significantly between the examination at baseline and the 4-week examination (Table II). Isometric endurance back flexors did not improve. Eight patients reached a ceiling value of 120 seconds in the isometric endurance back extensors measure at the 4-week examination. This constituted the largest number reaching the ceiling value.

Correlation between changes in physical measures, and changes in Oswestry score or pain intensity

Spearman correlation analyses (Table III) showed low to moderate correlations between changes in 3 of the 4 physical measures, and changes in Oswestry scores or changes in pain intensity after undergoing physical examination.

Predictors at baseline and at 4 weeks for disability and pain at 12-month follow-up

Simple linear regression analyses were performed to identify predictors for outcome at 12 months. Physical measures at baseline and at 4 weeks were used as independent variables and pain intensity on the VAS and Oswestry score at 12 months as dependent variables (Table IV). Physical measures at baseline did not significantly predict Oswestry score or pain intensity, with the exception of isometric endurance back flexors ($p = 0.047$) for pain intensity at 12 months. Three out of 4 physical measures at the 4-week examination were found to be significant predictors for Oswestry score and pain intensity at 12 months. Large thoracolumbar rotation, long isometric endurance in back extensors and small distance between fingertip and floor correlated with low disability and pain.

The proportion of variation (R^2) in the dependent variables explained by the models was between 0 and 0.04 at baseline, and between 0 and 0.32 at the 4-week follow-up.

Reporting more (>5 mm on the VAS) pain compared with reporting equal/less pain after physical examination was not found to be a predictor for Oswestry score or pain intensity at 12 months.

Table II. *Comparison between the results of the physical measures at baseline and at 4 weeks (*n = *44)*

	Baseline				At 4 weeks				
	X	Md	SD	CI 95%	*X*	Md	SD	CI 95%	[a]
Thoracolumbar rotation (°)	67	65	17	62–72	77	80	17	71–82	**
Isometric endurance back flexors (sec)	44	35	37	33–55	46	34	33	36–56	
Isometric endurance back extensors (sec)	43	22	43	30–56	62	57	39	50–74	**
Fingertip-to-floor distance (cm) $n = 38$.	16	9	17	11–22	9	5	10	6–12	**

X: mean; Md: median; SD: standard deviation; CI: lower and upper 95% confidence interval.
[a] Wilcoxon signed rank test *p*-value; ** $p < 0.01$.

Table III. *Spearman correlations between change (from baseline to 4-week examination) in Oswestry score and pain intensity on the VAS after physical examination, and change in physical measures (*n = *44)*

	Change in Oswestry score	Change in pain intensity after examination
Change in thoracolumbar rotation	−0.41**	−0.36*
Change in isometric endurance back flexors	−0.22	−0.22
Change in isometric endurance back extensors	−0.34*	−0.43**
Change in fingertip-to-floor distance, $n = 38$	0.64***	0.49**
Change in pain intensity after examination	0.64***	1.00

Units of measurement as in Tables I and II.
Spearman's rho; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table IV. *Simple linear regression between measures at baseline and at 4 weeks (independent variables), and Oswestry score and pain intensity on the VAS at 12 months (dependent variables) (*n = *44)*

	Oswestry score in % at 12 months				Pain intensity on the VAS at 12 months			
Independent variables	B[a, b]	(SE B)[c]	R^{2d}	rho_s[e]	B	(SE B)	R^2	rho_s
Baseline								
Thoracolumbar rotation	0.02	(0.12)	0.00	0.05	−0.05	(0.15)	0.00	−0.02
Isometric endurance back flexors	0.07	(0.05)	0.04	0.01	0.13*	(0.07)	0.09	0.09
Isometric endurance back extensors	−0.06	(0.05)	0.03	−0.26	−0.00	(0.06)	0.00	−0.19
Fingertip-to-floor distance, $n = 38$	−0.02	(0.13)	0.00	−0.08	−0.03	(0.16)	0.00	−0.09
Week 4								
Thoracolumbar rotation	−0.35**	(0.10)	0.21	−0.37	−0.38**	(0.13)	0.16	−0.32
Isometric endurance back flexors	−0.02	(0.06)	0.00	−0.09	−0.01	(0.08)	0.00	−0.12
Isometric endurance back extensors	−0.14**	(0.05)	0.17	−0.41	−0.15*	(0.06)	0.12	−0.44
Fingertip-to-floor distance, $n = 40$	0.80***	(0.19)	0.32	0.40	0.98***	(0.24)	0.30	0.30

Units of measurement as in Table II.
[a] Unstandardized coefficient B simple regression.
[b] Simple regression *p*-value; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.
[c] Standard error simple regression.
[d] Simple regression R square.
[e] Spearman's correlation coefficient.

Table V. *Outcome in patients reporting more pain (>5 mm on the VAS,* n = *18) and patients reporting equal or less pain (*n = *26) after compared with before the baseline physical examination. Comparison in change (from baseline to 4-week examination) between the 2 groups*

	Baseline				Change from baseline to 4-week examination				
	More pain[a] after baseline examination		Equal/less pain after baseline examination		More pain after baseline examination		Equal/less pain after baseline examination		
Variables	*X*	SD	*X*	SD	*X*	SD	*X*	SD	*P*[b]
Pain intensity in mm on the VAS[c] before physical examination	32	18	36	25	−20	25	−23	30	
Thoracolumbar rotation (°)	62	16	70	16	20	18	3	18	*
Isometric endurance back flexors (sec)	51	44	39	31	1	31	2	26	
Isometric endurance back extensors (sec)	37	43	47	43	27	36	13	30	
Fingertip-to-floor distance (cm)[d]	23	22	12	13	−14	21	−3	11	*
Pain intensity on the VAS after physical examination (mm)	48	21	29	23	−38	28	−13	28	**

X: mean; SD: standard deviation. Units of measurement as in Table II.
[a] More than 5 mm on the visual analogue scale 0–100 mm; equal / less than 5 mm on the VAS.
[b] Mann-Whitney U test; * $p < 0.05$; ** $p < 0.01$.
[c] Visual analogue scale; high values indicate greater degree of problems.
[d] 14 patients reported more pain, and 24 patients reported equal or less pain after compared with before the baseline clinical examination.

Comparison between patients who reported more pain and those who reported equal or less pain after undergoing physical examination

The patients reported pain intensity on a VAS scale before and after performing the physical tests at baseline and at the 4-week follow-up. Eighteen (41 %) of the 44 patients reported more pain (>5 mm on the VAS) after compared with before the baseline examination, and 26 patients (59 %) reported equal or less (≤5 mm on the VAS) pain (Table V). The group reporting more pain had a worse Oswestry score ($p = 0.019$), a worse DRAM rating ($p = 0.020$) and higher pain frequency ($p = 0.013$) compared with those who reported equal or less pain after the baseline examination.

Patients reporting more pain after the baseline examination changed significantly more between baseline and the 4-week follow-up in 2 of the 4 physical measures compared with those reporting equal or less pain after the examination. They also had a larger decrease in pain intensity after the examination ($p = 0.005$), Oswestry score ($p = 0.008$) and pain frequency ($p = 0.001$). At the 4-week follow-up 4 patients (9 %) reported more pain after the physical examination.

DISCUSSION

The most important finding of this study was that 3 out of the 4 investigated physical measures were identified as significant predictors for pain intensity and back-related disability at 12 months when assessed at the 4-week examination, but not when assessed at the baseline examination. Several studies have reported that physical measures assessed at baseline have poor predictive value (4, 16, 17). Thomas et al. (28), who carried out the physical examination 1 week after the first visit instead of at baseline, concluded that some physical measures were identified as predictors for persistent back pain at the 1-year follow-up.

At baseline the results of physical measures in this study were noticeably influenced by the patient's pain. At the 4-week examination pain had decreased and the ability of the physical measures to predict future outcome had improved. The decrease in pain was significantly related to an improvement in most physical measures. Isometric endurance back flexors, the physical measure least likely to be influenced by pain, was the only measure that did not change significantly between baseline and the 4-week follow-up. Other factors that might influence the results of physical measures could be the patient's motivation, fear of moving, level of depression or real improvement (19, 29). Improvement due to training should be minimal, because the period between the examinations was short and because no exercises were prescribed for the patients.

Improvement in patients with low back pain in primary care has been reported to be greatest during the first 4–8 weeks after the initial visit (30), which is in line with results in the present study. According to English guidelines for back pain, the first 6 weeks are crucial in terms of preventing chronicity (31). This study supported the English guidelines by showing that a follow-up consultation including assessment of physical measures 4–6 weeks after the initial visit may be valuable in detecting patients with low back pain at risk of developing persistent problems.

In a study by Thomas et al. (28), a multivariate model to explain future persistent back pain included both physical and self-reported measures. However, the limited number of patients in the present study did not allow multivariate analyses. Further studies are needed to understand the associations between self-reported and physical measures.

A previous study on predictors for Oswestry score in patients with low back and neck pain in primary care (32) identified 5 self-reported factors: duration of the current episode, Oswestry score at entry, expectations of treatment, pain at several locations and well-being. Kjellman et al. (33) found similar predictors for Oswestry score in patients with neck pain, but they found partly different predictors for pain intensity. It can be discussed if the different courses in patients with low back and neck pain shown in another study by Kjellman et al. (34) might explain the differences in predictive value for disability vs pain. In this study, including patients with low back pain, the same physical measures were identified as predictors for both disability and pain. It is not known whether this also is applicable to the results of physical measures in patients seeking medical assistance for neck pain. Studies are needed to assess the value of physical measures to predict disability and pain in patients seeking medical assistance for neck pain, as well as studies that investigate if different self-reported measures have different values for the prediction of disability or pain in patients with low back pain.

The use of >5 mm on the VAS as the threshold for the comparison of patients with low back pain reporting more pain and those reporting equal or less pain after the baseline physical examination can be discussed. Patients were their own controls with less than a 30-minute time interval, so measurement error should be minimal (35) and spreading should be random. If >10 mm on the VAS had been used as the threshold, 13 instead of 18 patients would have reported more pain after the baseline examination. The outcome values on both physical and self-reported measures would have been similar to the values when >5 mm on the VAS was used, but there would not have been a statistically significant difference between the groups, most likely due to the changed sizes of the groups.

In conclusion, physical measures assessed at the 4-week follow-up, but not at baseline, could provide important additional information for identifying those patients with low back pain at risk of worse outcome for pain or back-related disability at 12 months.

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