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A CONTROLLED STUDY ON THE OUTCOME OF INPATIENT AND OUTPATIENT TREATMENT OF LOW BACK PAIN

Part IV. *Long-term Effects on Physical Measurements*

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ABSTRACT. Effects of inpatient and outpatient treatment on physical measurements in chronic low back pain patients ($n=476$) were analyzed at 1.5- and 2.5-year follow-ups as well as 3 months after a refresher programme which was carried out 1.5 years after the first treatment. Physical measurements consisted of hip and lumbar spinal mobility, and trunk muscle strength. At the 1.5-year follow-up the two treatment groups did not differ from the control group, but at the 2.5-year follow-up inpatients showed better improvements in physical functions from the pretreatment level. The refresher treatment was found to improve physical functions more effectively than the first treatment program, especially in the outpatients. Self-care with heavy exercising was related with the improvement of physical functions, but back exercises and light exercising were not. Statistically significant but modest correlations were found between improved physical functions and subjective progress during the long-term follow-ups.

Key words: low back pain, outcome of treatment, physical measurements, physical exercise.

Physical exercise constitutes an important part of conservative management of chronic low back pain. Rehabilitative and preventive benefits of improved physical functions have been suggested by different studies (1, 2, 9, 10), but definitive proofs of their effects are still lacking.

Although exercise during treatment improves physical functions, instruction and motivation for effective exercise after treatment is probably more important. Physical measurements carried out soon after treatment reveal the efficacy of exercise during treatment, but long-term follow-ups probably reflect changes of clinical relevance better in the long run.

Only a few studies (3, 4, 7, 8, 9) on low back pain treatment report long-term (more than a couple of months) follow-ups of physical measurements; three studies on intensive training (3, 8, 9) and one on back school (4) found improvements. Two of these studies (4, 8) used a control group.

This paper presents results on physical measurements 1.5 and 2.5 years after a treatment of chronic low back pain as well as results 3 months after a refresher treatment. In addition, connections of changes in physical measurements with subjective progress and physical exercise after treatment are studied. Long-term follow-up results on pain, disability, and compliance with self-care are presented in another paper (6).

MATERIAL AND METHODS

Subjects

The subjects suffered from chronic or recurrent low back pain, although they were currently at work. Selection criteria and a detailed description of the subjects and the procedure of the study have been presented earlier (5). The subjects were randomly assigned to inpatient, outpatient and control groups. Of the original sample of 476 subjects, 415 and 402 joined the 1.5- and 2.5-year follow-ups, respectively. Only the treatment groups ($n=253$) took part in the follow-up after the refresher programme (22-month follow-up).

Back treatment

The first inpatient treatment was a 3-week programme and the first outpatient treatment comprised 15 sessions. The refresher treatment was 2 weeks and 8 sessions, respectively.

Both in- and outpatient treatments consisted of heat and electrotherapy, back exercises, back school and relaxation exercises. In addition, inpatients received massage and took part in physical exercises and muscle strength exercises. The number of these treatments has been presented earlier (13).

The contents of the refresher treatment, carried out after the 1.5-year follow-up, corresponded to that of the first treatment, but the total number was about 60% for inpatients and 50% for outpatients.

The control group received no systematic treatment, but the patients were given written and oral instructions on back exercises and ergonomics at the beginning of and during the study.

Table I. *Change scores (pretreatment vs. follow-ups) of physical measurements in men*

Means and standard deviations of inpatients, outpatients and controls as well as statistical significance between (p) and within (* $p<0.05$, ** $p<0.01$, *** $p<0.001$) the groups

		Inpatients			Outpatients			Controls			
		n	*M*	SD	*n*	*M*	SD	*n*	*M*	SD	*p*
Lumbar mobility	1.5 y.	96	−0.0	3.3	82	−0.3	2.9	83	−0.2	3.3	NS
	22 mo.	89	0.4	3.2	67	−0.3	3.4				NS
	2.5 y.	92	0.5	3.7	81	−0.5	3.2	80	−0.5	2.8	NS
Hip mobility	1.5 y.	96	0.5	2.6	82	0.0	2.6	83	0.4	2.3	NS
	22 mo.	88	1.5***	3.3	67	0.6	3.0				NS
	2.5 y.	92	1.1**	3.4	79	0.4	2.8	80	0.4	2.8	NS
Trunk strength	1.5 y.	89	0.8**	2.4	77	0.9**	2.8	78	1.1***	2.7	NS
	22 mo.	86	1.5***	2.6	63	1.3***	2.7				NS
	2.5 y.	86	1.2**	2.8	73	1.0**	2.7	78	0.6	2.9	NS
Index of Physical Measurements	1.5 y.	89	1.7**	5.6	77	0.7	5.6	78	1.5*	5.4	NS
	22 mo.	85	3.7***	6.2	63	2.1**	6.6				NS
	2.5 y.	86	3.5***	6.5	73	1.3	6.7	78	0.4	6.1	<0.01[a]

[a] I–O: $p<0.05$, I–C: $p<0.01$, O–C: NS.

Physical measurements

The methods have been described earlier (10–13). Indexes were formed by summing up the measurement scores after standardization; missing observations were estimated by regression analyses.

The following indexes were formed:

- lumbar spinal mobility (sum of flexion, extension, right and left lateral flexion and rotation)
- hip mobility (sum of right and left flexion, extension, internal and external rotations, and straight leg raising)
- trunk strength (sum of isometric flexion and extension strength and dynamic trunk raising from supine and prone positions)
- index of physical measurements, IPM (sum of all three indexes mentioned above).

Self-assessment of back pain disability

The LBP Disability Index is a sum of items, used on questionnaire answers, describing perceived disability caused by low back pain during the past month in 15 different situations and activities (range 0–45) (5).

Physical exercise after treatment

The amount of physical exercise during the past month was assessed by questionnaires at the 8-month as well as the 1.5- and 2.5-year follow-ups. For the analyses, the amount of back exercises, light exercising (e.g. walking, bicycling) and heavy exercising (e.g. jogging, cross-country skiing, swimming), were classified in the following way: At the 1.5-year follow-up: 1) at both the 8-month and 1.5-year follow-ups at least once a week, 2) less than once a week at either follow-up.

At the 2.5-year follow-up: 1) at least once a week, 2) less than once a week.

Statistical methods

The statistical significances of differences in the changes of physical measurements (each follow-up vs. pretreatment) between the three study groups were tested with one-way analyses of variance and t-tests for unmatched groups (BMDP7D). The significance of changes within the study groups was tested with the t-test for matched groups.

Connections of exercise with changes in the Index of Physical Measurements were tested with two-way analyses of variance and covariance (BMDP2V) using the change score of the index as a dependent variable, study groups and the mode of exercise as grouping factors and pretreatment values of the dependent variable as the covariate.

Correlations between change scores of the physical measurements and the LBP Disability Index were calculated by using Pearson coefficients corrected for the effect of age.

RESULTS

Changes in the physical measurements of the inpatients, outpatients and controls from the pre-treatment state to the 1.5-year, 22-month (3 months after the refresher treatment) and 2.5-year follow-ups are shown in Tables I and II. Fig. 1 presents the mean scores for the Index of Physical Measurements (IPM) from pre-treatment to the 2.5-year follow-up.

At the 1.5-year follow-up, the IPM showed significant positive changes in all study groups except for the outpatient group of women, but there were no statistically significant differences between the groups.

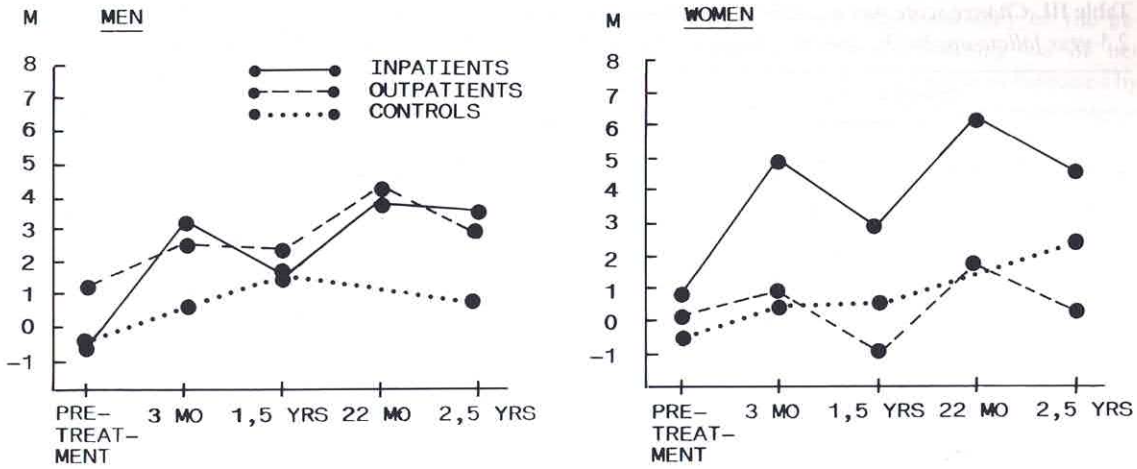

Fig. 1. Mean scores of the Index of Physical Measurements (IPM) in inpatients, outpatients and controls at the pretreatment and the four follow-ups.

At the 2.5-year follow-up, male inpatients showed a significantly greater increase in the IPM than the other groups. In women, the IPM of both inpatients and controls increased significantly to the 2.5-year follow-up, but the differences between the groups were not statistically significant.

Hip mobility and trunk muscle strength increased considerably during the follow-ups, but lumbar mobility even decreased.

Three months after the refresher treatment, changes in trunk muscle strength and the IPM were significantly greater in female inpatients than outpatients, whereas there were no significant differences between male in- and outpatients. The refresher programme improved physical functions about as much as the first one in the inpatients, but more than that in the outpatients. The results remained the same after checking them for the subjects who had dropped out before the refresher programme.

Heavy physical exercise, but neither back exercises

Table II. *Change scores (pretreatment vs. follow-ups) of physical measurements in women*

Means and standard deviations of inpatients, outpatients and controls as well as statistical significance between (p) and within (* $p<0.05$, ** $p<0.01$, *** $p<0.001$) the groups

		Inpatients			Outpatients			Controls			
		n	*M*	SD	*n*	*M*	SD	*n*	*M*	SD	*p*
Lumbar mobility	1.5 y.	55	−1.3*	4.4	51	−1.6***	3.2	50	−0.9	3.9	NS
	22 mo.	49	−0.0	4.2	47	−0.7	3.6				NS
	2.5 y.	54	−0.3	4.0	50	−0.4	3.6	47	0.2	3.9	NS
Hip mobility	1.5 y.	54	0.3	2.6	50	−0.2	2.7	49	−0.2	2.8	NS
	22 mo.	50	1.9***	3.3	46	0.7	3.2				NS
	2.5 y.	54	1.2**	3.0	48	0.3	3.0	45	0.3	3.1	NS
Trunk strength	1.5 y.	50	1.7***	2.7	47	0.5	2.5	44	1.4**	3.2	NS
	22 mo.	48	2.6***	2.9	45	1.1**	2.4				<0.01
	2.5 y.	48	2.3***	2.6	47	0.6	2.4	42	1.6***	2.5	<0.01[a]
Index of Physical Measurements	1.5 y.	50	1.2	7.4	47	−0.9	5.9	44	1.1	7.5	NS
	22 mo.	48	4.7***	8.0	44	1.4	6.8				<0.05
	2.5 y.	48	3.5***	7.6	46	1.0	6.7	42	2.8*	7.6	NS

[a] I–O: $p<0.01$, I–C: NS, O–C: NS.

Table III. *Change score means of the Index of Physical Measurements (IPM) in men and women at the 1.5- and 2.5-year follow-ups by the amount of heavy physical exercise; and statistical significances between groups (p)*

	At least once a week			Less than once a week			
	n	*M*	SD	*n*	*M*	SD	*p*
Men							
1.5 years	78	2.1	5.2	145	0.6	5.2	<0.05
2.5 years	103	1.8	6.3	129	1.8	6.3	NS
Women							
1.5 years	34	2.3	6.8	101	−0.0	6.8	0.09
2.5 years	58	4.4	6.6	74	1.0	6.6	<0.01

nor light physical exercise, was connected with the increase in IPM at the 1.5- and 2.5-year follow-ups. Heavy physical exercise at least once a week was significantly associated with improved IPM at the 1.5-year follow-up for men ($p<0.05$) and at the 2.5-year follow-up for women ($p<0.01$) (Table III); there was also a nonsignificant ($p=0.09$) association in women at the 1.5-year follow-up. These results are presented for all subjects treated as one group, as there were no significant differences between the study groups in this respect.

Table IV presents correlations between the change scores of the physical measurements and the LBP Disability Index from the pretreatment phase to the 1.5- and 2.5-year follow-ups. The correlations of lumbar and hip mobility as well as of trunk muscle strength with the LBP Disability Index varied between $r=0.20$–0.30 except for some correlations.

DISCUSSION

At the 1.5-year follow-up there were no significant differences in physical measurements between the study groups; the short-term effect for the inpatients seen at the 3-month follow-up (13) had substantially diminished. Thus a single treatment programme caused only transient improvements in physical functions and could not bring about more effective self-care exercising than in the control group which, however, received exercise recommendations during the course of the study.

The refresher treatment after the 1.5-year follow-up improved physical functions to about the same level in inpatients and to a higher level in outpatients when compared with the effects of the first treatment. At the 2.5-year follow-up, the gain of the inpatients remained at a high level and that of the outpatients higher than at the 1.5-year follow-up. However, the

Table IV. *Correlation coefficients between change scores (pretreatment vs. follow-ups) of the LBP Disability Index and physical measurements*

The coefficients have been corrected for the effects of age

	1.5 years		2.5 years	
	Men $n=240$	Women $n=140$	Men $n=231$	Women $n133$
Lumbar mobility	0.06	0.39***	0.28***	0.28**
Hip mobility	0.24***	0.20*	0.25***	0.22**
Trunk muscle strength	0.22***	0.23**	0.23***	0.24**
Index of Physical Measurements	0.24***	0.37***	0.34***	0.32***

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

1.5- and 2.5-year follow-ups are not fully comparable because the 2.5-year follow-up took place half a year sooner after the refresher treatment than the 1.5-year follow-up after the first treatment. But more long-lasting physical effects seem to have been achieved after the refresher treatment, especially in inpatients.

The refresher treatment was surprisingly effective considering that its quantity was only about half of that of the first one. Familiarity of treatment and foregoing home exercises may have improved results. Better results in outpatients from the refresher treatment than from the first one may be due to a slow treatment effect which is indicated by the low short-term results of the outpatients (13).

Heavy exercise, but not back exercises or light exercise, was found to be associated with an improvement in physical functions in the subjects of this study who were at work and not severely deconditioned. Conventional back exercises did not increase physical fitness. Such exercises aim, rather, at an improvement in specific physical functions, but their clinical significance has not been substantiated.

This study indicated that a single treatment period could not, on an average, bring about sufficient exercising after treatment to reach long-term improvement of physical capacity. Treatment courses may be important to motivation and learning, but an improvement in physical capacity needs continuous and effective exercise. The planning of future treatment should take this shortcoming into account, if increased physical capacity is aimed at. Guiding after treatment, refresher programmes and follow-ups can probably enhance motivation to more regular exercise. Exercising facilities at work places and at home may also be important.

However, changes in physical measurements correlated significantly but rather poorly with changes in subjective back disability. Low correlations were probably due to small changes, both in subjective progress and in physical measurements. This may be due to the nature of the present sample, which did not include severely deconditioned back pain patients.

Although the correlations were only modest, they show connections between back pain and physical functions. This may be connected with a natural course of the disease and not with treatment. Thus, these results do not reveal whether improved physical capacity relieves back pain or benefits prognosis in the long run.

Increase in physical capacity per se may form only a part of the benefits of physical exercise in low back pain treatment. Equally important may be the patient's attitudinal changes concerning his or her physical capacity and pain perception as indicated by the favourable results received from intensive physical training with behavioural support (3, 9).

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