A randomized controlled trial of flexion exercises, education, and bed rest for patients with acute low back pain

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A randomized control trial of back flexion exercises, education and bed rest was carried out to determine the effects on subjects with low back pain. Two hundred and sixty subjects and 22 family physicians participated in the study. Subjects were randomly allocated to one of four treatment groups: back flexion exercises and education program; exercise/education plus bed rest; bed rest alone; or a control group. Subjects in the bed rest groups were instructed to remain in bed for a minimum of four days. Subjects in the exercise/education groups were taught a standardized back flexion exercise program by a physiotherapist and instructed in back care techniques. Results demonstrated that subjects who received flexion exercises and education were able to stop their medication sooner than the bed rest and control groups. No other statistically significant difference in degree of pain, activities of daily living, straight leg raise (SLR), or lumbar flexion was observed among the four treatment groups.

KEY WORDS: Back, bed rest, exercise therapy

Un essai de contrôle randomisé des exercices de flexion du dos, de l'éducation et du repos au lit a été effectué pour en déterminer les effets sur des sujets souffrant de douleurs lombaires. Deux cent soixante sujets et vingt-deux médecins de famille ont participé à l'étude. Les sujets ont été affectés au hasard à quatre groupes de traitment: programme d'exercices de flexion du dos et d'éducation; exercices/éducation plus repos au lit; repos au lit seul; ou groupe-témoin. On a dit aux sujets astreints au repos au lit de rester au lit pendant au moins quatre jours. On a appris aux sujets des groupes du programme d'exercices/d'éducation des exercices de flexion du dos standardisés par un physiothérapeute et on leur a donné des instructions sur les techniques de soin du dos. Les résultats ont démontré que les sujets qui ont suivi le programme d'exercices de flexion et d'éducation ont pu cesser plus tôt de prendre leurs médicaments que le groupe astreint au repos au lit et le groupe-témoin. On n'a observé aucune différence significative au point de vue statistique entre les quatre groupes thérapeutiques du degré de douleur, des activités de la vie quotidienne, du soulèvement de la jambe non fléchie ou de la flexion lombaire.

It is estimated that 65 to 80 percent of the general population has suffered from low back pain on some occasion and that 90 percent of these cases will go on to have further recurrences of pain.[1] Back pain is the third leading cause of physical limitation and disability.[2] Most patients receive some form of conservative therapy for their back pain before invasive intervention is considered. Conservative therapies such as heat, bed rest, exercise or traction, although seldom harmful, do result in loss of work time for patients and extensive use of the health care system. Despite their widespread use, there is little evidence of the efficacy of these therapies.

Kendall and Jenkins,[3] in a double-blind trial of patients with chronic back pain, found that isometric flexion exercises were more effective than hyperextension exercises, or strengthening and mobility exercises, in decreasing pain and increasing trunk flexion, extension, and degrees of straight leg raising. However, without a control group, the degree of improvement that might have occurred without treatment cannot be determined. Davies et al[4] compared the effectiveness of short-wave diathermy alone, and combined with either back extension or lumbar isometric flexion exercises, in 43 patients with back pain of less than 6 month's duration. Although there was significant improvement in pain and lumbar flexion in all groups, without a control group it is unclear whether these improvements were merely following the path of the condition's natural history.

Wiesel et al[5] compared continued ambulation to bed rest and found that the bed rest group experienced less pain and a faster return to normal activities. Although strict compliance with bed rest was achieved in this military setting, the assessor was not blind to the subject's treatment group possibly biasing the results. Authors[2,6-9] who have done extensive reviews on conservative therapies for back pain question the wide acceptance of treatments such as exercise, bed rest, traction, heat, manipulation and medications, since little evidence of their effectiveness exists.

The purpose of this study is to compare the effects of two widely used therapies for low back pain: bed rest, and back flexion exercises. The methodology of the trial and the physician's role has been described in greater detail in a paper by Gilbert et al.[10] This report will expand on the role of physiotherapy and education for patients with low back pain.

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Method

A randomized control trial was performed to determine the effectiveness of a program of flexion exercises and back education, as compared to bed rest with and without exercise and education, and no treatment at all. Informed consent was obtained from the 252 patients who participated in the study.

Subjects

Patients considered for the trial were those who presented with low back pain to 22 participating family physicians over a 10-month period. Subjects were eligible for inclusion if they were over 16 years of age, complaining of lumbosacral pain (with or without radiating pain in the lower extremity) and had been free from pain for at least 30 days prior to the current episode. Subjects whose symptoms proved to be due to fractures, pregnancy, spondylolisthesis, spinal infection, disease of the hip or pelvis, gastrointestinal disease, tumor, Paget's disease, or rheumatic disease were excluded. Also excluded were patients with abnormal sensation, muscle strength, or tendon reflexes.

The subjects, both male and female, ranged in age from 17 to 79 years, with a mean age of 40.6 ± 14.7 (SD) years. The baseline characteristics of the subjects are listed in Table 1. The duration of the current episode of back pain at the time of entry is outlined in Table 2. Fifty-three percent of the subjects had pain of less than 5 days duration while 47 percent had experienced pain for more than 6 days at the time of entry to the study.

Procedure

Subjects were randomly allocated to one of four treatment groups which were stratified by whether their physician placed them on major or minor medication. Major medication was defined as any anti-inflammatory agent or analgesic containing 8 or more aspirin per day. Minor medication was defined as analgesics containing less than 8 aspirin per day or muscle relaxants. Stratification ensured that there were equal numbers of subjects taking major and minor medications within each treatment group. Patients were then randomly assigned to one of four treatment groups (Table 3) in a 2×2 factorial design: (1) exercise and education plus bed rest; (2) exercise and education alone; (3) bed rest alone; and (4) none of the above (control group).

Treatment regimens

Exercise/education: Patients randomized to exercise/education (groups 1 and 2) were instructed in an exercise program based on an adapted form of Kendall's[11] flexion routine. All subjects were instructed by the study physiotherapist within 7 days of entering the study. The exercise program consisted of 5 repetitions of: (1) the posterior pelvic tilt in the hook-lying position (patient supine, hips and knees flexed, feet on mat); (2) partial sit-up in above position; (3) partial sit-up with rotation in above position; (4) posterior pelvic tilt with active hip and knee flexion; and (5) posterior pelvic tilt in standing. Subjects were generally able to complete the exercise program in 20 minutes.

Subjects were instructed to continue with the exercise program for at least 2 months, or longer if their back pain persisted or recurred. Patients received a printed copy of the exercises and were seen in follow-up appointments until they had mastered the exercise program.

Patients also viewed a 30-minute slide tape presentation on back education. It described the anatomy of the spine, positions for resting, and methods for adapting work positions to prevent further pain or injury. Back education was based

TABLE 1 Baseline patient characteristics: mean (SD)

	Group 1 Bed rest and exercise and education (n = 65)	*Group 2 Exercise and education (n = 62)*	*Group 3 Bed rest (n = 60)*	*Group 4 Control (n = 65)*
Age (years)	40.7 (14)	41.7 (15.3)	40.0 (14.9)	40.1 (14.5)
Sex (M/F)	32/33	29/33	30/30	37/28
Referred pain (%)*	28	33	33	29
Workers' Compensation cases (%)	18	16	15	11
Straight leg raising (worst leg)				
<70 degrees (%)	48	47	58	56
Lumbar flexion (cm)	4.0 (2.1)	4.6 (1.8)	4.2 (2.0)	4.0 (1.9)
Activities of daily living** (0–100)	40.4 (16.4)	35.9 (13.7)	36.3 (13.1)	36.6 (12.4)
No. of prior episodes:				
0	21	18	17	21
1–4	25	27	29	24
≥5	19	16	12	17
McGill pain scale:				
Total score	23.0 (7.4)	22.7 (6.7)	25.2 (8.6)	25.1 (6.9)
Word count	13.7 (2.5)	13.7 (2.5)	14.9 (3.4)	14.8 (3.0)
Duration of pain at entry				
0–5/6+ days	41/24	30/32	29/31	35/30
Pain intensity moderate/severe	36/29	37/25	31/29	40/25
Pain medication minor/major	42/23	44/18	45/15	46/19

Note: * Referred pain = pain radiating into one or both legs
** Higher scores indicate greater impairment

TABLE 2 Duration of pain at entry (days)

	Study Group				
	Bed + ed	Ed	Bed	Control	Total
0–1 day	16	7	11	10	44
2–3 days	15	14	11	15	55
4–5 days	10	9	7	10	36
6–7 days	5	2	6	8	21
8–14 days	4	11	6	10	31
≥15 days	14	18	14	10	56
(missing)	1	1	5	2	9
Total:	65	62	60	65	252

on the lumbar flexion approach advocated by Kendall[11] and Hall.[12] Printed copies of back care suggestions were reviewed by the study physiotherapist with the subjects.

Bed rest: Subjects randomized to bed rest (group 1 and 3) were instructed by their family physicians to remain in bed for a minimum of 4 days. They were given written instructions outlining proper resting positions.[11,12]

Control group: Patients allocated to the control group were given the same analgesic medications as the other groups. They received no further instructions or interventions.

Patient assessment and follow-up

The family physician evaluated the subjects at the initial visit using a standardized assessment form to determine previous episodes of back pain, cause of pain, medication, and previous forms of treatment. Two standardized objective measurements were taken by the physician: straight leg raising (SLR), and lumbar flexion. Straight leg raising was measured bilaterally using a gravity-corrected goniometer. Lumbar flexion was measured using the method described by Moll and Wright.[13] Patients were reevaluated by their physicians at 10 day intervals, until the pain had subsided, or until 30 days had passed since the initial visit.

Patients completed the McGill Pain Questionnaire[14] and an Activity Discomfort Scale[15] each time they visited the physician. The Activity Discomfort Scale was found to be reliable (Cronbach's alpha=0.95) in a pilot study.[16] They also recorded their degree of pain, restriction, and improvement in a daily diary.

A research assistant, who was blind to the treatment group, did a long term follow-up by telephone interview 6 and 12 weeks after the subjects' entry into the project. The interviewer administered a questionnaire in which patients described their current level of pain, restrictions in daily activities, and any current treatment they were undergoing. One year after entry a questionnaire was mailed to patients to determine the number of recurrences and the current status of their back pain.

Subjects were asked at each follow-up whether they had seen a physiotherapist, chiropractor, acupuncturist, specialist, or anyone else about their back problem.

Compliance with bed rest, exercise and back care techniques were measured by means of a diary in which all subjects recorded, on a daily basis, the time they spent resting and exercising, their daily activities, and any restrictions. Subjects in the exercise group also reported to the research assistant at the 6- and 12 week telephone interviews the extent to which they continued to follow the exercise and back care program. Activity monitors[17] (worn on the wrist to record body movement) were used by randomly selected patients to obtain an objective measure of daily activity. However, the monitors proved unreliable.

Statistical analysis

A sample size of 65 patients per group (260 total) was determined (alpha=0.05, two-tailed, power=80 percent) using the Activity Discomfort Scale as the main outcome measure; a standard deviation of 1.0 was considered to be clinically important.

Five major outcomes, as described in the patient assessment, were evaluated at each physician visit. Outcomes were expressed as a rate of recovery, determined by dividing the total change from baseline to final assessment by the number of days between entry and final physician visit.

Results

Follow-up

Of the 270 subjects admitted to the study, 8 failed to meet the inclusion criteria and 10 refused to accept their randomly assigned treatment, resulting in a total sample of 252 patients. Follow-up data was not obtained for one patient. Eighty-seven percent completed at least one 10-day diary (see Table 4). A telephone follow-up was completed for 96 percent of the subjects at 6- and 12 weeks, and for 90 percent at the one-year mark.

Physician assessment

Physicians followed patients an average of 15 days. At each visit, the physician measured the patient's lumbar flexion and degree of SLR. Patients completed the Activity Discomfort Scale and McGill Pain Questionnaire. Table 3 indicates the rate of improvement for these outcomes. Statistical analysis reveals that subjects on the exercise and education program performed fewer activities of daily living (i.e., gardening, walking) than those who did not receive the exercise and education program ($p=0.05$). There were no other significant differences between subjects receiving exercise or bed rest (Table 4).

Patient daily diary

The data from the diaries were analyzed using a 10-day score for each of the 3 categories assessed daily by the subject: "improvement," "activity level," and "pain." Each of the 3 outcomes was subjected to a 2×2 factorial analysis of variance with covariate adjustment incorporated into the analysis of variance for the 13 baseline variables. The bed rest

TABLE 3 Treatment groups

Group 1	Exercise/education and bed rest
Group 2	Exercise/education
Group 3	Bed rest
Group 4	Control

TABLE 4 Rate of change during physician follow-up: mean (SD)

	Group 1 Bed rest and exercise and education	*Group 2 Exercise and education*	*Group 3 Bed rest*	*Group 4 Control*
Straight leg raising* (degrees)	0.98 (1.70)	0.56 (1.57)	1.96 (3.31)	1.21 (1.96)
Lumbar flexion (cm)*	0.15 (0.30)	0.12 (0.23)	0.14 (0.20)	0.18 (0.24)
Activity Discomfort Scale	−2.04 (1.91)	−1.53 (1.49)	−2.11 (2.34)	−2.29 (1.99)
McGill/Melzack total**	−1.22 (0.88)	−1.27 (1.20)	−1.46 (1.99)	−1.65 (1.31)
McGill/Melzack word count**	−0.73 (0.48)	−0.80 (0.62)	−0.93 (0.97)	−1.01 (0.72)

Note: * Straight leg raising and lumbar flexion are expressed in degrees and cm of improvement per day respectively
** The Activity Discomfort and McGill/Melzack scores show average reduction in activity restrictions and pain per day respectively

TABLE 5 Total diary score over the first 10 days: mean (SD)

	Group 1 Bed rest and exercise and education (n = 50)	*Group 2 Exercise and education (n = 41)*	*Group 3 Bed rest (n = 47)*	*Group 4 Control (n = 48)*
Improvement	22.27 (5.14)	23.30 (6.92)	21.66 (6.54)	21.54 (6.31)
Activities	24.35 (8.75)	21.34 (9.22)	24.34 (10.04)	20.90 (8.46)
Pain	23.77 (5.22)	25.94 (7.47)	24.15 (7.12)	22.88 (5.88)

Note: Lower total scores indicate a better clinical result

TABLE 6 One-year follow-up

	Group 1 Bed rest and exercise and education (n = 60)	*Group 2 Exercise and education (n = 59)*	*Group 3 Bed rest (n = 53)*	*Group 4 Control (n = 54)*
Present pain				
None	37	34	32	35
Mild	6	12	11	11
More than mild	17	13	10	8
Past five months frequency of pain				
None	14	16	14	16
Once a month	26	20	20	18
More often	20	23	19	20
Intensity of pain				
None	14	16	14	16
Mild	18	12	12	16
Worse	28	31	27	22
Restrictions				
None	32	37	27	31
Once or twice	11	7	11	11
More often	17	15	14	12
Sought help from a professional	9	6	5	8

group reported an increase in restriction of daily activities ($p=0.034$); no effect of bed rest or exercise/education was observed in the scores for "pain" and "improvement." The results are shown in Table 5.

Survival analysis using the Cox proportional hazards model[18] was used to compare the groups on the time taken to achieve clinically significant events. Data from the diaries identified the date on which the patient first reported "feeling a lot better," "normal level of activity," "no pain" and "stopped taking drugs." Bed rest patients took 42 percent longer than the other 3 groups to achieve a "normal level of activity" ($p=0.004$); the exercise/education subjects "stopped taking drugs" 46 percent sooner ($p=0.048$) than the bed rest and control groups. No other significant treatment effects were found with the diary data.

Telephone follow-up

No differences among the four treatment groups were observed with regard to either the self-reported level of pain or restriction in activities of daily living at the 6- and 12-week follow-up.

Recovery analysis

Recovery was defined as the first follow-up assessment on which both the patient and physician reported that the pain was mild or, failing this, the first telephone interview during which the patient reported that the pain was no worse than mild. Survival analysis did not reveal any significant difference between treatment groups. The median time to recovery was 14 days in all groups.

One year follow-up

The follow-up was done by mailed questionnaire, telephone interview, and physician chart review at an average of 16.8 months following entry to the study. Subjects reported on the intensity and frequency of pain, restrictions in daily activities, and professional care sought for back problems. There were no statistically significant differences among the treatment groups (Table 6).

Discussion

This study examined the effects of bed rest, back flexion exercises and education on lumbar flexion, SLR, pain, and activities of daily living in patients with low back pain.

Bed rest and back flexion exercises were chosen as these are two commonly accepted treatments for alleviating back pain. The rationale for the use of flexion exercises is varied. One rationale is that strong abdominal muscles will protect the lumbar disc from excessive loads through the development of intra-abdominal pressure.[8] Another is that improved posture or a decrease in the lumbar lordosis will remove pressure from the disc.[9] Several electromyographic studies[19,20] evaluating abdominal muscle functioning were reviewed to determine the most beneficial flexion exercises for use in the study's exercise program. These studies revealed that the positions that produce the strongest muscle contraction with the least amount of pressure on the disc are: rotation of the thorax on the pelvis (partial sit-up with rotation), posterior pelvic tilt in standing, posterior pelvic tilt in hook lying and shoulder lift sit-ups. Subjects were able to master this program by the second visit.

Findings demonstrated that subjects who received exercise and education were able to stop medications 46 percent sooner than the bed rest and control groups. It is expected that this would be due to a decrease in pain resulting from the flexion exercises and use of the positioning techniques suggested in the education program. It is interesting to note however that the patients who stopped medication earlier actually reported more pain during physician follow-up (Table 4) and in their diaries (Table 5). This contradiction of less medication but more pain may be due to the subjects' inability to rate their pain accurately or they may have stopped medication on the expectation that the exercises would relieve their pain.

Results showed that patients in the exercise/education groups reported a greater restriction in activities of daily living (Table 4). Rather than this restriction being viewed as a negative effect, it could be taken as a sign of patient compliance with the education program, which recommended that patients avoid certain activities that tend to aggravate back pain.

TABLE 7 Amount (days) of bed rest reported by patients: mean (SD)

Group 1 *Bed rest and exercise and education*	*Group 2* *Exercise and education*	*Group 3* *Bed rest*	*Group 4* *Control*
8.89 (7.82)	5.08 (5.42)	8.53 (7.39)	5.02 (5.96)

No statistically significant difference was found between groups when lumbar flexion was examined (Table 4). Although lumbar flexion has been shown to be a reliable measurement it may not have sufficient sensitivity for short term assessment.

Only subjects in groups 1 and 3 were prescribed bed rest by their physicians. However, data from the daily diaries (Table 7) reveals that subjects in groups 2 and 4 also elected to try bed rest. We can assume that the subjects themselves decided to try bed rest to control their pain. Patients in the bed rest group spent an average of 3 days longer in bed than subjects in the exercise and control groups. Although this signifies a statistically significant difference it is possible that the 5 days spent in bed (Table 7) by the control and exercise groups were a critical factor in their recovery and a source of cointervention.

Finally, subjects in the exercise/education groups were seen by the physiotherapist for a maximum of 3 visits. In most physiotherapy departments and clinics, patients would be seen on a more frequent basis, would have received other modalities, and would have been given an individualized exercise program. This program of exercise and education may have failed because patients were not seen often enough to ensure compliance with the exercises and to reinforce the educational aspects of back care. Further study is required to determine whether these factors would affect low back pain.

Conclusion

This study demonstrates that subjects who received back flexion exercises and a back education program were able to stop their medication sooner than subjects who received bed rest or no treatment. However, no statistically significant difference in degree of pain, activities of daily living, straight leg raising or lumbar movement was observed among the four treatment groups.

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