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The Comparison of the Efficacy Aerobic Exercises Versus Strengthening, Stretching and Mobilization Exercises in Subacute and Chronic Low Back Pain

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Abstract: The aim of this study was to investigate and compare the efficacy of aerobic exercises versus strengthening, stretching and mobilization exercises in patients with subacute or chronic low back pain. Forty patients were recruited for the study and randomly allocated to two groups. All patients were evaluated at admission, mid-treatment and termination of the program by visual analog scale (VAS), face scale, weekly analgesic intake and Million visual analog scale for pain. They were also scored by Roland-Morris scale and Oswestry scale for functional impairment. Beck depression inventory was used to evaluate depression and lumbar range of motion was measured by inclinometry, Schober, finger tip to floor distance. The aerobic exercise group was also evaluated for VO2max and anaerobic threshold levels. Both groups showed significant improvement in all parameters at termination. Comparison between groups showed a higher significant improvement in depression and functional improvement parameters in the group given strengthening, stretching and mobilization exercises by physiatrist.

Key Words: Chronic low back pain - aerobic exercise - strengthening - mobilization exercise - functional impairment

Introduction

Low back pain is one of the leading causes of disability, with 70-80% of the total population affected each year (1-3). Although 70-90% of those affected recover from the first episode independent of treatment, the important factor is to prevent the pain from becoming chronic and the patient disabled. In recent years the focus has been directed at treatment modalities like exercise, and various studies have reported conflicting results. In this study, we aimed to investigate the efficacy of exercise in subacute and chronic low back pain and also to compare various exercises.

Subjects and methods

Forty patients with subacute or chronic low back pain were admitted to the study. The inclusion criteria were low back pain longer than 3 months, age of 25-55 years and morning stiffness shorter than 10 minutes. The exclusion criteria were positive straight leg raising test (SLRT) or neurologic deficits, infections, metabolic, endocrine or tumoral disease, previous spinal surgery and psychiatric disease. All patients were asked to give written consent.

The patient population was randomly allocated to one of two groups. The first group (Group 1) of 20 was given bicycle ergometer exercises 3 times weekly for 2 months. Maximal loading was done by the Bruce protocol. The second group (Group 2) was given strengthening, stretching and mobilization exercises 3 times weekly for 2 months according to a structured exercise program.

The evaluation parameters were pain, functional impairment, depression, spinal mobility, and physical fitness.

Pain was measured by VAS, face scale, duration of pain for one week, daily analgesic intake and Million visual analog scale (4, 5). Functional impairment was measured by Rolland-Moris (5, 6) and Oswestry questionnaires (5, 7). Depression was determined by Beck depression inventory (5,8). Mobility was measured by finger to floor distance, modified lumbar Schober, and Cybex EDI-320 inclinometer (5, 9) and aerobic capacity was measured by VO_{2max} scores in group 1 and by progressive isoinertial lifting evaluation (PILE) protocol in both groups (8). There are other methods to test endurance (10, 11).

Progressive isoinertial lifting evaluation (PILE) protocol is used to evaluate endurance. The patients lift

Table 1. Demographic features of the study groups

	Group 1	Group 2	p
Age	37 ± 6	39 ± 9	>0.05
Gender (m / w)	6 / 14	6 / 14	>0.05
Height	164 ± 7	164 ± 6	>0.05
Weight	67.3 ± 8.4	64.9 ± 9.1	>0.05
Pain duration (months)	88 ± 58	96 ± 97	>0.05

a box containing 2.5 or 5 kg dumbbells four times within a 20-30 second time period. Lifting the weight from ground to waist level tests the lumbar endurance, while lifting from waist to shoulder level tests the cervical endurance. Men can lift 50% of ideal body weight from ground to waist and 40% of ideal body weight from waist to shoulder, the ratios for women are 35% and 25% of ideal body weight. In the patients with low back pain, lifting capacity decreases by 40-50% (8).

Statistical analysis of the results was performed with Student-t test.

Table 2. Results of evaluation of patients in group 1

	Pre-treatment	Mid-treatment	Post-treatment	Pre-t, Mid-t p	Mid-t, Post-t p	Pre-t, Post-t p
Flexion	48 ± 15	50 ± 16	52 ± 15	<0.05*	>0.05	<0.05*
Extension	9.4 ± 6.1	10.5 ± 4.9	10.6 ± 6.5	>0.05	>0.05	>0.05
Flexion right	14.7 ± 7.5	16.1 ± 7.6	19.7 ± 9.5	>0.05	>0.05	<0.05*
Flexion left	13.2 ± 8.6	14.5 ± 9.4	17.3 ± 10.8	>0.05	>0.05	<0.05*
Modified lumbar Schober	19.0 ± 1.52	21.1 ± 1.80	22.3 ± 1.21	<0.001*	<0.001*	<0.001*
Finger to floor distance	11.8 ± 10.5	6.40 ± 10.4	2.65 ± 5.70	<0.001*	<0.001*	<0.001*
VAS	6.60 ± 1.35	4.10 ± 1.99	2.05 ± 1.19	<0.001*	<0.001*	<0.001*
Face scale	5.70 ± 0.86	4.05 ± 1.05	2.55 ± 1.19	<0.001*	<0.001*	<0.001*
Weekly pain duration	69.0 ± 40.1	31.6 ± 28.9	8.25 ± 7.87	<0.001*	<0.001*	<0.001*
Daily analgesic intake	0.55 ± 0.88	0.05 ± 0.22	0	>0.05	>0.05	<0.001*
Pile testi	9.75 ± 2.89	13.0 ± 3.91	16.3 ± 4.02	<0.001*	<0.001*	<0.001*
VO2 max.	27.3 ± 5.5		34.3 ± 7.2			<0.001*
Anaerobic threshold	16.6 ± 4.1		20.3 ± 4.7			<0.001*
Million VAS	62.3 ± 22.6	32.3 ± 15.3	17.5 ± 10.8	<0.001*	<0.001*	<0.001*
Beck depression inventory	15.7 ± 11.5	10.5 ± 6.3	8.9 ± 7.7	<0.001*	>0.05	<0.001*
Roland-Morris	12.4 ± 5.3	8.2 ± 5.0	5.7 ± 4.9	<0.001*	<0.001*	<0.001*
Oswestry	21.8 ± 7.9	16.7 ± 6.2	12.2 ± 6.3	<0.001*	<0.001*	<0.001*

Pre-t: Pre-treatment

Mid-t: Mid-treatment

Post-t: Post-treatment

*Significant

Table 3. Results of evaluation of patients in group 2

	Pre-treatment	Mid-treatment	Post-treatment	Pre-t, Mid-t p	Mid-t, Post-t p	Pre-t, Post-t p
Flexion	45 ± 17	50 ± 12	51 ± 11	>0.05	>0.05	<0.05*
Extension	9.0 ± 4.8	11.3 ± 6.3	13.2 ± 4.8	<0.05*	>0.05	<0.001*
Flexion right	12.2 ± 6.6	15.2 ± 6.0	16.4 ± 5.4	>0.05	>0.05	<0.05*
Flexion left	10.5 ± 6.8	16.4 ± 5.6	17.8 ± 4.9	<0.001*	>0.05	<0.001*
Modifiye lomber Schober	18.71 ± 1.78	21.6 ± 1.5 0	23.0 ± 1.5 5	<0.001*	<0.001*	<0.001*
Finger to floor distance	13.3 ± 12.4	4.70 ± 7.71	1.5 0 ± 4.0 0	<0.001*	<0.05*	<0.001*
VAS	5.70 ± 1.6 2	3.4 0 ± 1.5 0	1.5 0 ± 1.3 5	<0.001*	<0.001*	<0.001*
Face scale	5.5 0 ± 1.3 9	3.2 5 ± 1.3 7	1.9 5 ± 1.5 3	<0.05*	<0.001*	<0.001*
Weekly pain duration	67.9 ± 53.8	16.2 ± 16.2	7.2 ± 15.1	<0.001*	<0.001*	<0.001*
Daily analgesic intake	1.0 ± 1.4	0.3 ± 0.7	0	>0.05	<0.05*	<0.05*
Pile test	8.77 ± 2.9 9	12.1 ± 3.6 7	14.5 ± 3.9 2	<0.001*	<0.001*	<0.05*
Million VAS	6 8.5 ± 22.1	28.7±13.7	14.5 ± 12.5	<0.001*	<0.001*	<0.001*
Beck depression inventory	14.7 ± 7.9	7.1 ± 5.5	3.8 ± 4.0	<0.001*	<0.001*	<0.001*
Roland-Morris	13.3 ± 4.6	6.5 ± 4.3	3.0 ± 2.2	<0.001*	<0.001*	<0.001*
Oswestry	22.9 ± 8.9	11.7 ± 6.0	6.0 ± 4.1	<0.001*	<0.001*	<0.001*

Pre-t: Pre-treatment

Mid-t: Mid-treatment

Post-t: Post-treatment

*Significant

Results

Comparison of age, gender, height and weight between groups showed no significant difference (p>0.05) (Table 1). Both groups showed significant improvement in all parameters at termination when compared to base-line data (p<0.05 and p<0.001) (Tables 2, 3). Inter-group comparison at termination showed no significant difference (p>0.05) in all parameters, except the Beck depression inventory, Rolland-Moris and Oswestry questionnaire scores (Table 4). These scores were better in group 2 than in group 1 (p<0.05).

Discussion

There was no significant difference between groups in relation to age, height, weight, duration of pain and base-line values before treatment (p>0.05). Lumbar mobility measurements, with the exception of extension in group 2, also showed significant improvement (p<0.05). Mayer has stated that lumbar flexion is more widely used in daily living activities, and that increases in extension range are minimal (12). In our study, the duration of exercise treatment may be considered too short for development of increased range in extension. Kendall, Jenkins, Davies and Melhin in their studies have reported that decreases

Table 4. Comparison of results in pre and post treatment between groups 1 and 2

	Pre-treatment			Post-treatment		
	Group 1	Group 2	p	Group 1	Group 2	p
Flexion	48±15	45±17	>0.05	52±15	51±11	>0.05
Extension	9.4±6.1	9.0±4.8	>0.05	10.6±6.5	13.2±4.8	>0.05
Flexion right	14.7±7.0	12.2±6.6	>0.05	19.7±9.5	16.4±5.4	>0.05
Flexion left	13.2±8.6	10.5±6.8	>0.05	17.3±10.	17.8±4.9	>0.05
Modifiye lomber Schober	19.0±1.5	18.7±1.8	>0.05	22.3±1.2	23.0±1.5	>0.05
Finger to floor distance	11.8±10	13.3±12	>0.05	2.65±5.7	1.50±4.0	>0.05
VAS	6.60±1.3	5.70±1.6	>0.05	2.05±1.1	1.50±1.3	>0.05
Face scale	5.70±0.8	5.50±1.3	>0.05	2.55±1.1	1.95±1.5	>0.05
Weekly pain duration	69.0±40	67.9±53	>0.05	8.25±7.8	7.2±15.1	>0.05
Daily analgesic intake	0.55±0.8	1.0±1.4	>0.05	0	0	>0.05
Pile test	9.75±2.8	8.7±2.9	>0.05	16.3±4.0	14.5±3.9	>0.05
VO2 max.	27.3±5.5			34.3±7.2		
Anaerobic threshold	16.6±4.1			20.3±4.7		
Million VAS	62.3±22	68.5±22	>0.05	17.5±10	14.5±12	>0.05
Beck depression inventory	15.7±11	14.7±7	>0.05	8.9±7.7	3.8±4.0	<0.05*
Roland-Morris	12.4±5.3	13.3±4.6	>0.05	5.7±4.9	3.0±2.2	<0.05*
Oswestry	21.8±7.9	22.9±8.9	>0.05	12.2±6.3	6.0±4.1	<0.05*

*Significant

in the intensity of low back pain are related to increased lumbar mobility, and Farfan have stated increased trunk flexibility is advantageous for functional performance (13). In our study we have noted significant increase is PILE protocol in both groups ($p<0.05$). Kishino, Mayer and Curtis have reported a 30-60 % loss in trunk lifting capacity in low back pain patients when compared to normals (9, 14). In our aerobic exercise group VO_{2max} and anaerobic threshold values both showed significant increase when compared to base-line values which confirms the fact that aerobic exercises help increase VO_{2max} and anaerobic threshold ($p<0.05$). Both groups have also showed significant increase in Million, Beck, Roland-Morris and Oswestry scales ($p<0.001$).

Werneke et al in their prospective study of 183 cases have applied a program consisting of mobilization, aerobic exercises and education and have reported favorable results (15). There is no general agreement over the best exercise treatment in low back pain (1,16) and exercises may have limited effect in acute low back pain (1,17). However, Matsui and colleagues reported that improvements in work conditions decreased low back symptoms (18).

In a double-blind, prospective, randomised controlled trial, Friedrich and colleagues recruited 93 low back pain patients and assigned them to either a standart exercise program or to a combined exercise and motivation program. They showed that combined exercise and motivation program increased the rate of attendance at scheduled physical therapy sessions, reduced disability and pain levels by the 12-month follow-up (19). We also observed that the group given strengthening, stretching and mobilization exercises by the physiatrist improved more than the other group in the depression and

functional disability parameters. We consider these results to be due to motivation of the patients by physiatrist.

In our study, we can state that both aerobic exercises and strengthening, stretching and mobilization exercises had favorable effects in subacute and chronic low back pain patients. However, we observed a higher significant improvement in depression and functional improvement parameters in the group given strengthening, stretching and mobilization exercises.

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