Palestrica of the third millennium – Civilization and Sport
Vol. 13, no. 4, October-December 2012, 306–315

Improvement of algo-dysfunctional syndrome by postural therapy in lumbosacral spine diseases

Ameliorarea sindromului algo-disfuncţional prin terapie posturală în patologia lombo-sacrată

Dana-Maria Dimulescu, Gheorghe Chiriţi
"Carol Davila" University of Medicine and Pharmacy Bucharest,
National Institute of Rehabilitation, Physical Medicine and Balneoclimatology

Abstract

Background. Patients with lumbosacral pathology are one of the most common groups that are consulted in rehabilitation services, on account of the algo-dysfunctional syndromes caused by these diseases.

Aims. Achievement of a prospective, randomized study regarding the efficiency of the physical-kinetics recovery program with the emphasis on postural therapy in two groups of patients with lumbo-sacral spine diseases (radiculopathies, low back pain, sequelae after lumbar disk herniation surgery, lumbar canal stenosis); utilization of a clinical-functional assessment following the evidence-based research model.

Methods. The groups (1-experimental, 2-control) each comprised 60 patients of both sexes and different ages, with lumbo-sacral spine diseases. The differentiation between the two groups was achieved using a methodology of recovery whereby therapy-group 1 received postural therapy as part of the physical-kinetics program. The following clinico-functional parameters were assessed: pain, physical dysfunctions (fingertip-to-floor-test, lumbosacral spine static disorders, muscle strength, Lassegue, osteotendinous reflexes), disabilities (ADL, movement ability, absenteeism, work ability-return to activity).

Results. Pain improved by 67.40% (group 1) vs. 56.53 (group 2); cumulated physical dysfunctions improved by 42.49% (group 1) vs. 32.67% (group 2). Cumulated disabilities score recorded improvements of 69.40% (group 1) vs. 59.14% (group 2).

Conclusions. The results of this study show a higher efficiency for the recovery process that includes an optimized postural therapy methodology for patients with lumbosacral spine diseases (radiculopathies, low back pain, sequelae after lumbar disk herniation surgery, lumbar canal stenosis) in the improvement of pain, physical dysfunction and disability scores.

Keywords: lumbosacral spine diseases, postural therapy, algo-dysfunctional syndrome, disabilities.

Rezumat

Premize. Pacienţii cu patologie lombo-sacrată constituie una din cele mai frecvente cauze de adresabilitate în serviciile de recuperare, prin sindroamele algo-disfuncţionale cauzate de aceste afecţiuni.

Obiective. Efectuarea unui studiu prospectiv, randomizat, privind eficienţa programului de recuperare fizical-kinetică, cu accent pe terapia posturală, la 2 loturi de pacienţi cu patologie a coloanei lombo-sacrate (radiculopatii, LBP, sechele HDL-LDH operată, stenoză de canal lombar); utilizarea unei evaluări clinico-funcţionale, după modelul cercetărilor bazate pe dovezi.

Metodă. Loturile (1-experimental şi 2-martor) au inclus câte 60 pacienţi de ambe genuri, din diferite grupe de vârstă, cu afecţiuni ale coloanei lombo-sacrate. Diferenţierea între cele 2 loturi s-a realizat prin metodologia de tratament recuperator - la lotul 1 punând accent pe metodologia de tratament postural în cadrul programului fizical-kinetic. Parametrii clinico-funcţionali evaluaţi au fost: durerea, disfuncţiile fizice (IDS-FFT, modificările de statică ale coloanei lombare, forţa musculară, Lassegue, ROT-OTR), dizabilităţile (ADL, capacitatea de deplasare, absenteismul şi capacitatea de muncă - revenirea în activitate).

Rezultate. Durerea s-a ameliorat cu 67,40% la lotul 1, comparativ cu 56,53% la lotul 2. Disfuncţiile fizice cumulate au obţinut ameliorări de 42,49% la lotul 1, comparativ cu 32,67% la lotul 2. Scorul dizabilităţilor cumulate s-a ameliorat cu 69,40% la lotul 1, comparativ cu 59,14% la lotul 2.

Concluzii. Rezultatele studiului indică o eficienţă semnificativ mai mare a programului de recuperare, ce include o metodologie de terapie posturală optimizată, la pacienţii cu patologie lombo-sacrată (radiculopatii, LBP, sechele HDL-LDH operată, stenoză de canal lombar) în ameliorarea scorurilor durerii, disfuncţiilor fizice şi dizabilităţilor.

Cuvinte cheie: patologie lombo-sacrată, terapie posturală, disfuncţii fizice, dizabilităţi.

List of abbreviations: ADL - Activity of daily living, FFT (IDS) - Fingertip-to-floor-test, LBP - Low back pain, LDH (HDL) - Lumbar disk herniation, OTR (ROT) - Osteotendinous reflexes, VAS - Visual Analogue Scale, EMG - Electromyography, GPR - Global Postural Reeducation, SE - Stabilization exercises, AINS (NSAID) - Non-steroidal anti-inflammatory drugs, AIS (SAID) - Steroidal anti-inflammatory drugs, SNV (ANS) - Autonomic Nervous System

Received: 2012, July 17; *Accepted for publication:* 2012, September 10
Address for correspondence: "Carol Davila" University of General Medicine and Pharmacy, Bucharest, Eroilor Sanitari Av. no.8a
E-mail: dm.dimulescu@gmail.com

Introduction

Approximately 70 to 85% of individuals can suffer an episode of low back pain during their lifetime and over 80% of them will suffer recurring episodes.

The methodology for rehabilitation focused on posture alignment therapy, applied in diseases of the lumbosacral spine together with modern pharmacological therapy, contributes to the improvement of the pain dysfunction syndrome, to the lowering of the costs necessary for in-hospital medical care as well as to an increase in the quality of the patient's life (Dimulescu & Chiriți, 2007).

Specialized literature studies report various percentages of improvement of LBP after one month of recovery treatment: 58% (Pengel et al., 2003), 73% (Granger, 2003). Other authors (Hurley & Mcdonough, 2004) do not show differences in the improvement of pain intensity in acute LBP patients, by combining the effect of manipulations with the use of medium frequency currents. Jellema & Bierma-Zeinstra (2002) highlighted the role of lumbar orthoses in 59 workers with LBP who used the device in 2 phases: during the first phase (first week) the workers wore the orthosis each work day; during the second phase (the next six weeks), the orthosis was worn during work days when workers complained of LBP; pain decreased from 10 to 7 (VAS scale), 61-81% of the workers wearing the lumbar orthosis while performing their tasks, the extensive use of the device at home not being specified.

Cacciatore & Horak (2005) studied the improvement of postural coordination through the use of conscious processes of altering automatic postural coordination and continuous muscle activity, achieving an improvement of pain intensity through the Alexander Technique; prior to using this technique, patients exhibited laterally asymmetric automatic postural responses to translations; after using this technique, the magnitude and asymmetry of the responses and balance improved and low back pain decreased.

Cacciatore et al. (2011) demonstrated that dynamic modulation of postural tone using the Alexander Technique reduces axial stiffness in patients with LBP. Jones et al. (2012) show that LBP patients subject to postural perturbations (on a balance platform) reduce these perturbations through a hyperactivity of trunk and ankle muscles.

Harrison et al. (2005) used a posture correction programme, through mirror images, which included trunk tilting exercises and traction opposite to the trunk tilt direction, thus obtaining a reduction of pain intensity. Li & Huang (2007) showed the superior effect of decompression and rehabilitation in the reduction of pain intensity in patients with spinal disc herniation, split into three groups: A - computerized pelvic tractions and therapeutic ultrasound; B - only pelvic tractions; C - pelvic tractions, therapeutic ultrasound and Chinese traditional medicine, the best results being achieved by group C ($p<0.05$); Rydeard & Leger (2006) highlighted the effect of conventional therapy and of specific training exercises (Pilates) performed for 4 weeks by patients with LBP, with an improvement of the pain score ($p=0.002$).

Bonetti et al. (2010) evaluated the efficiency of global postural reeducation – GPR, compared to stability exercise (SE) programmes in patients with chronic LBP, showing the superiority of global postural reeducation exercises in pain reduction. Dunk & Callaghan (2010) studied postural responses and pain scores in patient with chronic LBP during prolonged sitting; the posture of the spine was examined via a movement analysis pattern during two posture alignments. Patients with LBP showed a marked statistical reduction of pain ($p<0.0001$).

Kressig & Beauchet (2003) showed the role of "tai chi" in improving physical dysfunctions.

Objectives

We aimed to elaborate a study on the efficiency of the chosen individually adapted physical rehabilitation methods, focusing on posture alignment therapy, according to modern evidence-based physical medicine standards, by using evaluation scales and scores for clinical and functional data (pain, objective physical dysfunctions), as well as for disabilities including, besides ADL and movement ability, social, professional and economic criteria such as absenteeism and working inability determined by sickness.

Hypothesis

A growing number of studies show the advantages of the rehabilitation programme in lumbosacral pathology. Including posture alignment therapy in the recovery methodology may optimize the results obtained in the improvement of the studied clinical and functional parameters.

Material and methods

This study was conducted in the National Institute of Rehabilitation, Physical Medicine and Balneoclimatology in Bucharest. A set of assessment methods was used, based on scales and scores of: pain, physical dysfunctions, disabilities, comparing admission and discharge, in accordance with the assessment methodology used in modern evidence-based research.

Clinico-functional parameters evaluated in the studied groups were represented by:

a) *Pain*

As a defining basic parameter in this disease category, it was evaluated based on VAS (visual analogue scale: 0-10): intensity of dominant pain indicated by the patient during the test, by granting points (0-3): 0 – absence of pain, 1 point for 1-3 VAS values, 2 points for 4-7 VAS values, 3 points for 8-10 VAS values;

By the addition of the 5 values, we calculated a pain score which can be between 0 and 15 points.

b) *Physical dysfunctions*

They were appreciated based on the evaluation of 5 clinical examination parameters:

- mobility of the lumbar spine in flexion, evaluated by the fingertip-to-floor-test (FFT), with 0-3 points (0 – below 5 cm, 1 – between 6 and 10 cm, 2 – between 11 and 30 cm, 3 – over 30 cm);
- lumbosacral spine static disorders (scoliosis, disappearance of lumbar lordosis or hyperlordosis,

evaluated with 0 points-absent and 1point-present);

- muscle strength, evaluated by testing the muscles in the affected territory, the resulting values (0-5) being evaluated with 0-3 points: value 5 = 0 points, value 4/4 plus = 1 point, values 3/4 minus = 2 points, values below 3 = 3 points;

- Lasègue test, evaluated with 0-2 points (0 – negative, 1 – diminished between 45-90°, 2 – diminished below 45°);

- Achilles and patellar reflexes, evaluated together with 0-2 points (0-normal, 1-diminished or 2-absent at least one of them).

By the addition of the 5 evaluated parameters, we calculated for each patient the score of physical dysfunctions, which can amount to 0-11 points.

c) *Disabilities*

They were assessed by the evaluation of ADL, movement ability, absenteeism and return to activity after treatment:

- ADL was evaluated using a simplified scale (ADL 24); based on the obtained score, ADL dysfunctions were evaluated with: 0=normal (60 points); 1=mild dysfunctions (50-59 points); 2=moderate dysfunctions (35-49 points); 3=severe dysfunctions (< 35 points).

- Movement ability was evaluated with 0-4 points: 0=normal, 1=possible outside the house, with limits +/- walking assist devices, 2=possible only inside the house, with no restrictions, 3=possible inside the house with difficulty +/- walking assist devices; 4=bed or chair-ridden.

- Absenteeism caused by LBP was assessed on admission for the last 30 days, and on discharge based on the medical leave granted subsequently, using a scale with 0-4 points: 0=no leave, 1=medical leave of 1-3 days, 2=medical leave of 4-7 days, 3=medical leave of 2-3 weeks, 4=medical leave of 1 month.

- Work ability (return to professional activity) was appreciated in active patients, using a scale of 0-2 points: 0=return to activity, 1=needs medical leave, 2=medically retired.

Absenteeism and return to activity were included in disabilities only for active patients; disabilities that can reach 13 points in professionally active patients (Dimulescu & Chiriţi, 2008).

Groups

Each of the 2 groups (group 1- experimental group and group 2 - control group) included 60 patients of both genders from different age categories, with disorders from the LBP group, similar in structure.

Table I

Structure of groups according to gender and age.

Groups/Age (years)		20-30	31-40	41-50	51-60	61-70	Total
Group 1	Female	10	11	5	4	2	32
	Male	9	10	3	3	3	28
Total		19	21	8	7	5	60
Group 2	Female	10	10	5	4	2	31
	Male	10	10	2	4	3	29
Total		20	20	7	8	5	60

Table II

Structure of groups according to gender and mean age.

Groups/Gender	No. of cases	Mean age	Minimum age	Maximum age
Group 1	60 (100%)	41.74	20	69
Male	28 (46.7%)	42.07	21	67
Female	32 (53.3%)	41.46	20	69
Group 2	60 (100%)	41.57	20	70
Male	29 (48.3%)	41.65	20	66
Female	31 (51.7%)	41.51	20	70

Table III shows the distribution of the groups by gender and diagnosis.

Given these characteristics of distribution by age and gender, mean age and diagnosis in the 2 groups, it may be that they satisfy the conditions of a randomized trial, allowing for the comparison of results.

Treatment and rehabilitation methodology used in the 2 study groups

In this prospective study, the distinction between the two treatment groups is made by the methodology that was applied to the patients.

In group 2, considered the control group, patients were treated by using the usual Rehabilitation Clinic methodology, which includes for all patients with LBP and sciatic radiculopathy:

- low and medium frequency electrotherapy (diadynamic, stereofrem), ultrasound: antalgic, decontracturant effects;

- therapeutic massage - antalgic, decontracturant effects;

- kinesitherapy - exercises to increase the mobility of the lumbosacral spine (based on Williams or McKenzie technique) according to the clinical form of the disease and symptoms, exercises to increase muscular strength (isometric, isotonic) for abdominal muscles, stabilizers of the hip, neutral posture of the spine, muscle rehabilitation in paretic radiculopathies (Lucescu, 2009);

- pharmacological therapy: NSAIDs, SAIDs, analgesics, decontracturants.

In group 1 (experimental group), the methodology was applied selectively, giving a particular role to postural

Table III

Structure of groups according to gender and diagnosis.

Groups/Diagnosis		Radiculopathies	LBP	Sequelae after lumbar disk herniation surgery	Lumbar canal stenosis	Total
Group 1	Female	9	12	6	5	32
	Male	8	11	5	4	28
Total		17 (28.3 %)	23 (38.3%)	11 (18.3%)	9 (15%)	60 (100.0%)
Group 2	Female	9	11	6	5	31
	Male	9	11	5	4	29
Total		18 (30%)	22 (36.6)	11 (18.3%)	9 (15%)	60 (100.0%)

therapy, depending on the clinical form (radiculopathies, sequelae after lumbar disk herniation surgery, musculoligamentous LBP, lumbar canal stenosis), and evolution stage (acute, subacute or chronic).

The complex physical-kinetic treatment included:

- rest in antalgic positions;
- adopting postures aimed at increasing vagal tone and rebalancing the vegetative nervous system (Mendez & Gomez-Conesa, 2001; Lucescu, 2009);
- wearing a spinal orthosis - this is done whenever it is needed to limit spinal motion, correct positions, reduce mechanical stress on the lower lumbar segment of the spine (Anderson & Redford, 2000);
- relaxation exercises, indicated especially for patients with paravertebral muscular contractures (patient involvement is aimed for the purpose of contracted muscle awareness, of achieving muscle relaxation and preventing constant muscle tension - "hold-relax" exercises, using Kabat diagonals for legs to influence trunk muscles);
- exercises to increase the mobility of the lumbosacral spine (based on Williams or McKenzie technique) according to the clinical form of the disease and symptoms;
- exercises to increase muscular strength (isometric, isotonic) for abdominal muscles, stabilizers of the hip, neutral posture of the spine (lumbar extensor muscles, relaxation of spinal muscles and psoas-iliac muscle, toning of abdominals and gluteal muscles) (Lucescu, 2009);
- exercises to develop control and coordination (including proprioceptive facilitation techniques, tactile sensitivity, passive mobilization, stretching, visual or acoustic feedback, EMG bio-feedback); rehabilitation exercises for muscles in the affected territory (in the case of paretic radiculopathies).

Statistical analysis

Based on literature data regarding the objective evaluation of the evolution of spine diseases such as LBP and lumbar radiculopathies – on Oswestry, Roland-Morris, Waddel, Dallas or Quebec scales – this prospective study attempted to monitor the assessment of a number of significant parameters of these diseases, which allowed for the calculation of global indicators of pain, physical dysfunctions and disabilities (apart from ADL, also including the ability to move and indicators with social and economic value such as absenteeism caused by disease and the patients' resumption of their professional activity after treatment); finally, the results were assessed by calculating the difference between the global score at admission and at discharge, expressed as percentage.

Ensuring the statistical significance of the obtained results was performed at first by coding them according to the evaluations and the quota previously mentioned, and finally through the analysis of their statistical significance by employing adequate tests (the Student's average comparison test, correlations between initial and final scores).

In order to compare the mean values of quantitative variables, the "t" test (Student's test) was used.

If the calculated test value was lower than the Tt critical value (extracted from the tables designed especially for "Student distribution"), the difference between the mean values was considered as statistically insignificant (SI), in this case the p-value (p-risk) > 0.05, and if the calculated test value was higher than the Tt critical value from the tables ($p<0.05$), the difference between the mean values was considered statistically significant. In this case, depending on p values, the following situations shall be considered:

- $0.01 < p < 0.05$ – statistically significant difference (S);
- $0.001 < p < 0.01$ – statistically very significant difference (VS)
- $p<0.001$ – statistically highly significant difference (HS)

An EPI INFO file ("database") with the recorded data of the investigated patients was created for future statistical processing, the charts were created in EXCEL and the paper was written in WORD format using WINDOWS XP as OS.

Results

a) *Pain*

A comparative assessment of the pain scores reveals an improvement of 67.40% in the experimental group (1), while in the control group (2), the improvement reached 56.53%. In patients with radiculopathies, pain improvement was 69.11% (group 1), compared to 58.63% (group 2); both groups had a higher improvement of pain than the group average. In patients with LBP, the improvement of the pain score was 80.62% in group 1 compared to 69.25% in group 2. In patients with sequelae after lumbar disk herniation surgery, the pain score improvement had lower values, 50.55% in group 1, 40.19% in group 2, respectively. In patients with lumbar canal stenosis, the improvement of the pain score had values of 53.45% in group 1, compared

Table IV

Evolution of mean pain scores according to diagnosis.

Groups	No. of cases	Mean scores		Score differences (admission-discharge)	Statistical significance (p-value)
		Admission	Discharge		
Group 1	60	7.21	2.35	4.86 (67.40%)	$p < 0.01$
Radiculopathies	17	9.52	2.94	6.58 (69.11%)	$p < 0.01$
LBP	23	6.04	1.17	4.87 (80.62%)	$p < 0.001$
Sequelae after lumbar disk herniation surgery	11	8.09	4.00	4.09 (50.55%)	$p < 0.05$
Lumbar canal stenosis	9	4.77	2.22	2.55 (53.45%)	$p < 0.05$
Group 2	60	7.34	3.19	4.15 (56.53%)	$p < 0.05$
Radiculopathies	18	9.38	3.88	5.50 (58.63%)	$p < 0.01$
LBP	22	6.18	1.90	4.28 (69.25%)	$p < 0.01$
Sequelae after lumbar disk herniation surgery	11	8.36	5,00	3.36 (40.19%)	$p < 0.05$
Lumbar canal stenosis	9	4.88	2.77	2.11 (43.23%)	$p < 0.05$

to 43.23% in group 2 (Dimulescu & Chiriti, 2008).

b) *Physical dysfunctions*

1. *FFT*

The recorded improvement percentage was 55.48% in group 1, compared to 43.11% in group 2.

2. *Lumbosacral spine static disorders*

The recorded improvement percentage was 69.23% in group 1, compared to 54.94% in group 2.

3. *Muscle strength*

The recorded improvement percentage was 30.99% in group 1, compared to 24.27% in group 2.

4. *Lassegue Score*

The recorded improvement percentage was 35.71% in group 1, compared to 23.28% in group 2.

5. *Osteotendinous reflexes*

There was no improvement in the osteotendinous reflex scores in the 2 groups, which remained unchanged.

Table V

Evolution of FFT score in groups I and II according to diagnosis.

Groups	No. of cases	Mean scores		Score differences (admission-discharge)	Statistical significance (p-value)
		Admission	Discharge		
Group 1	60	1.64	0.73	0.91 (55.48%)	p < 0.01
Radiculopathies	17	1.94	1.00	0.94 (48.45%)	p < 0.05
LBP	23	1.78	0.52	1.26 (70.78%)	p < 0.001
Sequelae after lumbar disk herniation surgery	11	1.45	0.90	0.55 (37.93%)	N.S.
Lumbar canal stenosis	9	1.00	0.55	0.45 (45.00%)	p < 0.05
Group 2	60	1.67	0.95	0.72 (43.11%)	p < 0.05
Radiculopathies	18	2.00	1.33	0.67 (33.50%)	N.S.
LBP	22	1.77	0.73	1.04 (58.75%)	p < 0.01
Sequelae after lumbar disk herniation surgery	11	1.54	1.09	0.45 (29.22%)	N.S.
Lumbar canal stenosis	9	0.89	0.56	0.33 (37.07%)	N.S.

Table VI

Evolution of spine static disorder score in groups I and II according to diagnosis.

Groups	No. of cases	Mean scores		Score differences (admission-discharge)	Statistical significance (p-value)
		Admission	Discharge		
Group 1	60	0.91	0.28	0.63 (69.23%)	p < 0.01
Radiculopathies	17	1.00	0.35	0.65 (65.00%)	p < 0.01
LBP	23	1.00	0.13	0.87 (87.00%)	p < 0.001
Sequelae after lumbar disk herniation surgery	11	0.82	0.45	0.37 (45.12%)	N.S.
Lumbar canal stenosis	9	0.66	0.33	0.33 (50.00%)	N.S.
Group 2	60	0.91	0.41	0.50 (54.94%)	p < 0.05
Radiculopathies	18	1.00	0.50	0.50 (50.00%)	p < 0.05
LBP	22	1.00	0.32	0.68 (68.00%)	p < 0.01
Sequelae after lumbar disk herniation surgery	11	0.72	0.45	0.27 (37.50%)	N.S.
Lumbar canal stenosis	9	0.77	0.44	0.33 (42.85%)	N.S.

Table VII

Evolution of muscle strength score in groups I and II according to diagnosis.

Groups	No. of cases	Mean scores		Score differences (admission-discharge)	Statistical significance (p-value)
		Admission	Discharge		
Group 1	60	1.71	1.18	0.53 (30.99%)	p < 0.05
Radiculopathies	17	1.82	1.23	0.59 (32.41%)	p < 0.05
LBP	23	1.43	0.86	0.57 (39.86%)	p < 0.01
Sequelae after lumbar disk herniation surgery	11	2.18	1.72	0.46 (21.10%)	N.S.
Lumbar canal stenosis	9	1.66	1.22	0.44 (26.50%)	p < 0.05
Group 2	60	1.73	1.31	0.42 (24.27%)	N.S.
Radiculopathies	18	1.83	1.38	0.45 (24.59%)	N.S.
LBP	22	1.45	1.00	0.45 (31.03%)	p < 0.05
Sequelae after lumbar disk herniation surgery	11	2.18	1.81	0.37 (16.97%)	N.S.
Lumbar canal stenosis	9	1.66	1.33	0.33 (19.87%)	N.S.

Table VIII

Evolution of Lassegue score in groups I and II according to diagnosis.

Groups	No. of cases	Mean scores		Score differences (admission-discharge)	Statistical significance (p-value)
		Admission	Discharge		
Group 1	60	0.70	0.45	0.25 (35.71%)	N.S.
Radiculopathies	17	1.52	0.88	0.64 (42.10%)	p < 0.05
LBP	23	0	0	0	-
Sequelae after lumbar disk herniation surgery	11	1.09	0.81	0.28 (25.68%)	N.S.
Lumbar canal stenosis	9	0.44	0.33	0.11 (25.00%)	N.S.
Group 2	60	0.73	0.56	0.17 (23.28%)	N.S.
Radiculopathies	18	1.50	1.11	0.39 (26.00%)	p < 0.05
LBP	22	0	0	0	-
Sequelae after lumbar disk herniation surgery	11	1.09	0.90	0.19 (17.43%)	N.S.
Lumbar canal stenosis	9	0.55	0.44	0.11 (20.00%)	N.S.

6. *Cumulated physical dysfunction score*

The physical dysfunction score improved by 42.49% in group 1 compared to 32.67% in group 2, after 2 weeks of hospitalization.

In patients with radiculopathies, the results reached 40.05% in group 1, compared to 28.51% in group 2, lower values than the group average. In patients with LBP, there was an improvement of 63.13% in group 1, compared to 51.42% in group 2; in patients with sequelae after lumbar disk herniation surgery, the improvement values were 25.03% in group 1, compared to 19.33% in group 2; in patients with lumbar canal stenosis, the physical dysfunction score had improvement values of 30.85% in group 1 and 24.88% in group 2 (Dimulescu & Chiriti, 2008).

c) *Disabilities*

1. *ADL Score*

The improvements recorded in the ADL score were 73.10% in group 1, compared to 63.55% in group 2.

2. *Movement ability*

The recorded improvements were 68.69% in group 1, compared to 58.97% in group 2.

3. *Absenteeism* determined by sickness was assessed only in active patients in the two groups, and accounted for 55 out of 60 patients in each of the 2 groups; all patients had medical leaves before hospitalization.

The results indicate significant reductions of absenteeism after treatment in both groups, by 70.85% in group 1, compared to 59.50% in group 2.

4. *Work ability – return to activity*

A return to activity percentage of 63.10% was found for patients in group 1, while for patients in group 2 the percentage was lower – 53.46%; most of the patients who returned to activity after treatment had a diagnosis of LBP, 80.00% in group 1, 69.04% in group 2, respectively.

5. *Cumulated disability score*

The improvements recorded in the disability score were 69.40% in group 1, compared to 59.14% in group 2. In patients with radiculopathies, the improvement percentage was 70.88% (group 1), compared to 60.39% (group 2). Patients with LBP had improvements of 83.37% in

Table IX

Evolution of physical dysfunction score in groups 1 and 2 according to diagnosis.

Groups	No. of cases	Mean scores		Score differences (admission-discharge)	Statistical significance (p-value)
		Admission	Discharge		
Group 1	60	5.46	3.14	2.32 (42.49%)	$p < 0.05$
Radiculopathies	17	7.04	4.22	2.82 (40.05%)	$p < 0.05$
LBP	23	4.21	1.51	2.70 (63.13%)	$p < 0.01$
Sequelae after lumbar disk herniation surgery	11	6.623	4.97	1.66 (25.03%)	N.S.
Lumbar canal stenosis	9	4.31	2.98	1.33 (30.85%)	N.S.
Group 2	60	5.54	3.73	1.81 (32.67%)	$p < 0.05$
Radiculopathies	18	7.05	5.04	2.01 (28.51%)	$p < 0.05$
LBP	22	4.22	2.05	2.17 (51.42%)	$p < 0.05$
Sequelae after lumbar disk herniation surgery	11	6.62	5.34	1.28 (19.33%)	N.S.
Lumbar canal stenosis	9	4.42	3.32	1.10 (24.88%)	N.S.

Table X

Evolution of ADL score in groups I and II according to diagnosis.

Groups	No. of cases	Mean scores		Score differences (admission-discharge)	Statistical significance (p-value)
		Admission	Discharge		
Group 1	60	1.19	0.32	0.87 (73.10%)	$p < 0.01$
Radiculopathies	17	1.70	0.41	1.29 (75.88%)	$p < 0.01$
LBP	23	0.95	0.13	0.82 (86.31%)	$p < 0.01$
Sequelae after lumbar disk herniation surgery	11	1.18	0.54	0.64 (54.23%)	N.S.
Lumbar canal stenosis	9	0.88	0.33	0.55 (62.50%)	$p < 0.05$
Group 2	60	1.18	0.43	0.75 (63.55%)	$p < 0.05$
Radiculopathies	18	1.72	0.61	1.11 (64.52%)	$p < 0.05$
LBP	22	0.90	0.22	0.68 (75.55%)	$p < 0.05$
Sequelae after lumbar disk herniation surgery	11	1.18	0.63	0.55 (46.61%)	N.S.
Lumbar canal stenosis	9	0.77	0.33	0.44 (57.14%)	N.S.

Table XI

Evolution of movement ability score in groups I and II according to diagnosis.

Groups	No. of cases	Mean scores		Score differences (admission-discharge)	Statistical significance (p-value)
		Admission	Discharge		
Group 1	60	1.15	0.36	0.79 (68.69%)	$p < 0.01$
Radiculopathies	17	1.70	0.52	1.18 (69.41%)	$p < 0.01$
LBP	23	0.91	0.17	0.74 (81.31%)	$p < 0.01$
Sequelae after lumbar disk herniation surgery	11	1.09	0.54	0.55 (50.45%)	N.S.
Lumbar canal stenosis	9	0.77	0.33	0.44 (57.14%)	N.S.
Group 2	60	1.17	0.48	0.69 (58,97%)	$p < 0.05$
Radiculopathies	18	1.66	0.66	1.00 (60.24%)	$p < 0.05$
LBP	22	0.90	0.27	0.63 (70.00%)	$p < 0.05$
Sequelae after lumbar disk herniation surgery	11	1.09	0.64	0.45 (41.28%)	N.S.
Lumbar canal stenosis	9	0.88	0.44	0.44 (50.00%)	N.S.

group 1, compared to 71.87% in group 2. In patients with sequelae after lumbar disk herniation surgery, the recorded improvement values were 54.36% in group 1, 45.18% in group 2, respectively. In patients with lumbar canal stenosis, the improvement values were 62.15% in group 1, compared to 53.10% in group 2.

Regarding the results obtained for the general disability score, the highest improvement percentages were recorded in patients with LBP, followed by those with radiculopathy, canal stenosis, sequelae after lumbar disk herniation surgery (Dimulescu & Chiriti, 2008).

Discussion

By comparing the initial values (at admission) and final values (at discharge, after two weeks of treatment) of the studied parameters, the efficiency of posture alignment therapy within the recovery treatment was observed in the experimental group.

Hurley & Mcdonough (2004) performed a prospective randomized study on the effects of manipulations combined with medium frequency (interferential) current therapy compared to the individual use of each procedure; no differences in pain reduction were noticed in patients with acute LBP. Dallolio (2005) used a pneumatic orthosis (Orthotrac) at lumbar level, which allows support for stability and decompression in 41 patients (23 males and 18 females aged 19-25) with radicular pain (disc protrusion, spondylolisthesis, foraminal stenosis, facet syndrome); the patients wore this orthosis for 60 minutes, three times a day, for five weeks; all patients showed a decrease or even the disappearance of radicular pain (the assessment was performed using the SF-36). Jellema & Bierma-Zeinstra (2002) highlighted the role of lumbar orthoses in 59 workers with LBP, who used the device in 2 phases: during the first phase (first week) the workers wore the orthosis each work day; during the second phase (the next six weeks), the orthosis was worn during work days when workers complained of LBP; pain decreased from 10 to 7 (VAS scale), 61-81% of the workers wearing the lumbar orthosis while performing their tasks, the extensive use of

Table XII

Evolution of absenteeism score in groups I and II according to diagnosis.

Groups	No. of cases	Mean scores		Score differences (admission-discharge)	Statistical significance (p-value)
		Admission	Discharge		
Group 1	55	1.99	0.58	1.41 (70.85%)	p < 0.05
Radiculopathies	17	2.23	0.65	1.53 (70.85%)	p < 0.05
LBP	20	1.60	0.25	1.35 (84.37%)	p < 0.01
Sequelae after lumbar disk herniation surgery	11	2.63	1.09	1.54 (58.55%)	p < 0.05
Lumbar canal stenosis	7	1.71	0.57	1.14 (66.67%)	p < 0.01
Group 2	55	2.00	0.81	1.19 (59.50%)	p < 0.05
Radiculopathies	18	2.16	0.88	1.28 (59.25%)	p < 0.05
LBP	19	1.52	0.42	1.10 (72.36%)	p < 0.01
Sequelae after lumbar disk herniation surgery	11	2.63	1.36	1.27 (48.28%)	p < 0.05
Lumbar canal stenosis	7	1.85	0.85	1.00 (54.05%)	p < 0.05

Table XIII

Evolution of work ability score in groups I and II according to diagnosis.

Groups	No. of cases	Mean scores		Score differences (admission-discharge)	Statistical significance (p-value)
		Admission	Discharge		
Group 1	55	1.03	0.38	0.65 (63.10%)	p < 0.05
Radiculopathies	17	1.00	0.35	0.65 (65.00%)	p < 0.05
LBP	20	0.75	0.15	0.60 (80.00%)	p < 0.01
Sequelae after lumbar disk herniation surgery	11	1.63	0.81	0.82 (50.30%)	p < 0.05
Lumbar canal stenosis	7	1.00	0.42	0.58 (58.00%)	p < 0.05
Group 2	55	1.01	0.47	0.54 (53.46%)	p < 0.05
Radiculopathies	18	1.00	0.44	0.56 (56.00%)	p < 0.05
LBP	19	0.84	0.26	0.58 (69.04%)	p < 0.01
Sequelae after lumbar disk herniation surgery	11	1.54	0.90	0.64 (41.55%)	p < 0.05
Lumbar canal stenosis	7	0.85	0.42	0.43 (50.58%)	p < 0.05

Table XIV

Evolution of mean disability score in groups 1 and 2 according to diagnosis.

Groups	No. of cases	Mean scores		Score differences (admission-discharge)	Statistical significance (p-value)
		Admission	Discharge		
Group 1	60	5.36	1.64	3.72 (69.40%)	p < 0.05
Radiculopathies	17	6.63	1.93	4.70 (70.88%)	p < 0.05
LBP	23	4.21	0.70	3.51 (83.37%)	p < 0.01
Sequelae after lumbar disk herniation surgery	11	6.53	2.98	3.55 (54.36%)	p < 0.05
Lumbar canal stenosis	9	4.36	1.65	2.71 (62.15%)	p < 0.05
Group 2	60	5.36	2.19	3.17 (59.14%)	p < 0.05
Radiculopathies	18	6.54	2.59	3.95 (60.39%)	p < 0.05
LBP	22	4.16	1.17	2.99 (71.87%)	p < 0.01
Sequelae after lumbar disk herniation surgery	11	6.44	3.53	2.91 (45.18%)	p < 0.05
Lumbar canal stenosis	9	4.35	2.04	2.31 (53.10%)	p < 0.05

the device at home not being specified. The advantages of the rigid corset compared to the simple corset: it limits movement to a greater extent; it allows better lumbar posture control; it limits lateral and rotational movements.

Advantages of the simple corset: it is easier to accept from an esthetic point of view; older patients accept this type of corset more easily; it ensures a better posture control if the patient is obese; it is lighter than the rigid corset; it decreases muscle tone through prolonged use to a lesser extent; it ensures better abdominal compression. The rigid corset limits spine mobility while the simple corset creates an abdominal connection which, apart from increasing intra-abdominal pressure which in turn leads to a reduction of the load of the spinal disc, also determines the flattening of the abdomen and the reduction of lumbar lordosis (Fisher & Winter, 2000).

Cacciatore & Horak (2005) studied the improvement of postural coordination through the use of conscious processes of altering automatic postural coordination and continuous muscle activity, achieving an improvement of pain intensity through the Alexander Technique; prior to using this technique, patients exhibited laterally asymmetric automatic postural responses to translations; after using this technique, the magnitude and asymmetry of the responses and balance improved and low back pain decreased.

Cacciatore et al. (2011) demonstrated that dynamic modulation of postural tone using the Alexander Technique reduces axial stiffness in patients with LBP. Jones et al. (2012) show that LBP patients subject to postural perturbations (on a balance platform) reduce these perturbations through a hyperactivity of trunk and ankle muscles.

Harrison et al. (2005) used a posture correction programme, through mirror images, which included trunk tilting exercises and traction opposite to the trunk tilt direction, thus obtaining a reduction of pain intensity. Li & Huang (2007) showed the superior effect of decompression and rehabilitation in the reduction of pain intensity in patients with spinal disc herniation, split into three groups: A - computerized pelvic tractions and therapeutic ultrasound; B - only pelvic tractions; C - pelvic tractions, therapeutic ultrasound and Chinese traditional medicine, the best results being achieved by group C ($p<0.05$); Rydeard & Leger (2006), highlighted the effect of conventional therapy and of specific training exercises (Pilates) performed for 4 weeks by patients with LBP, with an improvement of the pain score ($p=0.002$). Lang & Liebig (2003) showed the superiority of a multidisciplinary rehabilitation programme (2 hours of physical therapy, 1 hour of behavioral therapy, 30 minutes of progressive muscle relaxation, 30 minutes of physical education) applied three times a week, for 20 days, compared to the conventional physical therapy programme in improving the pain score for patients with LBP.

Bonetti et al. (2010) evaluated the efficiency of global postural reeducation – GPR, compared to stability exercise (SE) programmes in patients with chronic LBP, showing the superiority of global postural reeducation exercises in pain reduction. Dunk & Callaghan (2010) studied postural responses and pain scores in patients with chronic LBP during prolonged sitting; the posture of the spine was examined via a movement analysis pattern during two posture alignments. Patients with LBP showed a marked statistical reduction of pain ($p<0.0001$). Albaladejo et al. (2010) demonstrated the efficiency of a complex programme in reducing LBP consisting of: educational programme (15 minutes) – based on healthy nutrition, postural hygiene (15 minutes), physical therapy (1 hour) – based on stretching and other exercises that can be performed at home. This programme led to the improvement of the pain score and disabilities of these patients.

We found references concerning the results of some treatment programmes related to physical dysfunctions, usually by means of qualitative assessments: significant improvements of the radicular pain score after multimodal treatment for admitted patients (Frisch, 2003), improvement of functional parameters (Guven, 2003; Jousset, 2003) significant effects on muscle force, finger-ground index, Lassegue test (Sancho, 2003; Marshall & Murphy, 2006), but also by means of quantitative assessments such as the improvement of muscle force by 76.7% (Gimigliano, 2003). Ceran & Ozcan (2006) show that changes in the functional state are associated with pain, disability in patients with LBP. Badke & Boissonnault (2006) show the improvement of muscle strength and resistance in patients with LBP, as a result of a recovery programme which included: passive mobilizations, manipulations, exercises for increasing joint mobility, massage, thermotherapy, cryotherapy. Krismer & Van Tulder (2007) used a multidisciplinary programme including rest, resistance training, behavioral therapy, in order to reduce pain, dysfunctions and to prevent chronicity in patient with LBP. Kressig & Beauchet (2003) show the role of "tai chi" in the reduction of physical dysfunctions. Anema & Steenstra (2007) conducted a study in 196 active participants with LBP: 96 patients benefited from interventions concerning adaptation to the workplace, while 100 were subject to conventional therapy; the assessment was performed after 12, 26 and 52 weeks – the improvement of the functional status was more significant in the patients of the first group.

Some studies report reduction percentages concerning some indicators: reduction of absenteeism by 58% in a group of 30 patients with chronic LBP after a recovery programme (Roques, 2003) or mentions of qualitative assessments are made: maintaining physical capacity and professional activity (Verfaille et al., 2003), improved ADL and work capacity (Lauridsen et al., 2006).

Fischer (2004) assessed the quality of life of 82 patients operated for LDH and sciatica 6 months and 1 year after surgery. Neurological symptoms and pain and disability scores improved significantly after 6 months, but from that point up to one year after surgery, the changes were minor. Scheel & Hagen (2002) obtained an average number of days of medical leave for patients with LBP split into 3 groups: proactive (70 days of medical leave), passive (68 days) and the control group (71 days); the percentage of the patients who returned to work before 50 weeks was similar in the proactive group (89%), the passive group (89.5%) and the control group (89.1%). Lang & Liebig (2003), following a multidisciplinary rehabilitation programme (physical therapy, muscle relaxation, behavioral therapy, physical education), obtained a drop in absenteeism (16 ±35 days), superior to that of the conventional therapy

programme (-2±39 days). Goldby & Moore (2006) showed the effect of a recovery programme including passive mobilizations, manipulations (10 weeks) on the reduction of the disability score in patients with chronic LBP. Kaapa & Frantsi (2006) conducted a prospective study in 120 patients divided into 2 groups, depending on the recovery programme that they followed: multidisciplinary rehabilitation (training, workplace adaptation, the back school, relaxation techniques, behavioral therapy) amounting to 70 hours, and individual physical therapy (active physical exercises, passive therapy) amounting to 10 hours; the results in the improvement of the disability score were similar. Friedrich & Gittler (2005) conducted a prospective study in 92 patients with LBP, in which the control group received a standard treatment programme, the study group underwent a mixed programme consisting of exercises and a motivational programme; a significant improvement of the disability score was achieved by the study group. Faber & Burdorf (2006) showed the effect of specific training exercises – Pilates – in the significant reduction of the disability score (p=0.023), a reduction maintained for 12 months. Anema & Steenstra (2007) conducted a study in 196 active participants with LBP: 96 patients benefited from interventions concerning adaptation to the workplace, while 100 were subjected to conventional therapy; the assessment was performed after 12, 26 and 52 weeks – the time required to resume work was 77 days for the group with workplace adaptation (p=0.002) and 104 days for the group with conventional therapy (p=0.02).

Conclusions

The prospective study on the efficiency of the rehabilitation of patients with lumbosacral diseases shows a significant improvement of the studied clinical and functional parameters among patients of the experimental group (using adequate posture alignment therapy within the recovery programme), compared to the control group: the pain of the experimental group was reduced by 67.40% after treatment compared to 56.53% for the control group; physical dysfunctions were reduced by 42.49% in the experimental group compared to 32.67% in the control group; disabilities were reduced by 69.40 in the first group, compared to 59.14% in the second group. In both groups, the best results were obtained by patients with lumbar pain and muscle and ligament LBP, followed by radiculopathies, while modest results were obtained by patients with lumbar spinal stenosis and patients with sequelae after lumbar disk herniation surgery.

Conflicts of interests

There are no conflicts of interests.

Acknowledgement

The study is part of the doctoral thesis of the first author.

References

Albaladejo C, Kovacs FM, Royuela A, del Pino R, Zamora J. The efficacy of a short education program and a short physiotherapy program for treating low back pain in primary care: a cluster randomized trial. Spine, 2010; 35(5):483-496.

Anderson CW, Redford JB. Orthotic treatment for injuries and diseases of the spinal column. Phys. Med. Rehabil., 2000; 14:471-484.

Anema JR, Steenstra IA. Multidisciplinary rehabilitation for subacute low back pain: graded activity or work-place intervention or both? a randomized controlled trial. Spine, 2007; 32(3):291-298.

Badke MB, Boissonnault WG. Changes in disability following physical therapy intervention for patients with low back pain: dependence in symptom duration. Arch. Phys. Med. Rehabil., 2006; 87(6):749-756.

Bonetti F, Curti S, Mattioli S, Mugnai R, Vanti C, Violante FS, Pillastrini P. Effectiveness of a „Global Postural reeducation" program for persistent low back pain: a non-randomized controlled trial. BMC Musculoskelet. Disord. 2010; 11:285

Cacciatore TW, Gurfinkel VS, Horak FB, Cordo PJ, Ames KE. Increased dynamic regulation of postural tone through Alexander Technique training. Hum.Mov.Sci. 2011; 30(1):74-89.

Cacciatore TW, Horak FB. Improvement in automatic postural coordination following Alexander technique lessons in a person with low back pain. Phys.The. 2005; 85(6):565-578.

Ceran F, Ozcan A. The relationship of the Functional Rating Index with disability, pain and quality of life in patients with low back pain. Med.Sci.Monit.m 2006; 12(10):CR435-439.

Dallolio V. Lumbar spinal decompression with a pneumatic orthesis (Orthotrac): preliminary study. Acta. Neurochir. Suppl., 2005; 92:133-137.

Dimulescu DM, Chiriţi G. Posturarea. Principii şi tehnici de posturare. Rev. de Recuperare, Medicină Fizică şi Balneologie. 2007; 3-4:122-123

Dimulescu DM, Chiriţi G. Terapia posturală în afecţiunile aparatului locomotor. Ed. Universităţii din Bucureşti. 2008; 132-134.

Dunk NM, Callaghan JP. Lumbar spine movement patterns during prolonged sitting differentiate low back pain developers from matched asymptomatic controls. Work, 2010; 35(1):3-14.

Faber E, Burdorf A. Determinants for improvement in different back pain measures and their influence on the duration of sickness absence. Spine, 2006; 31(13):1477-1483.

Fisher C. Outcome evaluation of the operative management of lumbar disc herniation causing sciatica. Neurol Med Chir (Tokio), 2004; 44(3):118-122.

Fisher SV, Winter RB. Spinal orthoses in rehabilitation. In Braddom R. Phys. Med. and Rehabil. 2-nd Ed. Philadelphia, WB Saunders, 2000; 353-369.

Friedrich M, Gittler G. Long-term effect of a combined exercise and motivational program on the level of disability of patients with chronic low back pain. Spine, 2005; 30(9):995-1000.

Frisch SA, Widder B. Radicular LBP: Evaluation of Conservative Multimodal Treatment. Occup Environ Med. 2003; 60(10):715-721.

Gimigliano. Physical therapy in lumbar spinal stenosis. 2 nd. World Congr. of ISPRM, Prague, May, Abstracts 2003; 44.

Goldby LJ, Moore AP. A randomized controlled trial investigating the efficiency of musculoskeletal physiotherapy of chronic low back disorder. Spine, 2006; 31(10):1083-1093.

Granger C. An analysis of the rate per day of pain improvement and factors affecting improvement in outpatients with LBP. 2nd World Congr. of ISPRM, Prague, May Abstracts, 2003; 3.

Guven S. Effectiveness of lumbo-pelvic stabilization exercise education on chronic mechanical LBP. 2nd World Congr. of ISPRM, Prague, May, Abstracts, 2003;180.

Harrison DE, Cailliet R, Betz JW. A non-randomized clinical control trial of Harrison mirror image methods for correcting trunk list (lateral translations of the thoracic cage) in patients with chronic low back pain. Eur. Spine, 2005; 14(2):155-162.

Hurley DA, Mcdonough SM. A randomized clinical trial of

manipulative therapy and interferential therapy for acute low back pain. Spine, 2004; 29(20):2207-2216.

Jellema P, Bierma-Zeinstra SM. Feasibility of lumbar supports for home care workers with low back pain. Occup. Med. 2002; 52(6):317-323.

Jones SL, Henry SM, Raasch CC, Hibs JR, Bunn JJ. Individuals with non-specific low back pain use a trunk stiffening strategy to maintain upright posture. J.Electromyogr.Kinesiol. 2012; 22(1):13-20.

Jousset N. Functional restauration versus active individual therapy in LBP controlled, randomised trial. 2nd World Congr. of ISPRM, Prague, May Abstracts, 2003; 24.

Kaapa EH, Frantsi K. Multidisciplinary group rehabilitation versus individual physiotherapy for chronic nonspecific low back pain: a randomized trial. Spine, 2006; 31(4):371-376.

Kressig RW, Beauchet O. Tai chi in the elderly: practical aspects. Rev. Med. Suisse. Romande, 2003; 123(11):671-675.

Krismer M, Van Tulder M. Low back pain. Best Pract. Res. Clin. Rheumatol. 2007; 21(1):77-91.

Lang E, Liebig K. Multidisciplinary rehabilitation versus usual care for chronic low back pain in the community: effects on quality of life. Spine, 2003; 3(4):270-276.

Lauridsen HH, Hartvigsen J, Manniche C, Korsholm L, Grunnet-Nilsson N. Responsiveness and minimal clinically important difference for pain and disability instruments in low back pain patients. BMC. Musculoskelet. Disord. 2006; 7:82-84

Li XY, Huang ZM. Therapeutic effect of compositive rehabilitation on lumber disc herniaton. Zhong. Nan. Da. Xue, 2007; 32(1):144-147.

Lucescu V. Afecţiunile degenerative ale coloanei vertebrale-Clinica, diagnosticul şi tratamentul de recuperare. Ed. Dobrogea, 2009; 148-153, 206-210

Marshall P, Murphy B. Changes in the flexion relaxation response following an exercise intervention. Spine, 2006; 31(23):E 877-883

Mendez FJ, Gomez-Conesa A. Postural hygiene program to prevent low back pain. Spine, 2001; 26(11):1280-1286.

Pengel LH, Herbert RD, Maher CG, Refshange KM. Acute low back pain: systematic review of its prognosis. Am.J.Orthop., 2003; 32(8):392-394.

Roques C. Chronic LBP patients quality of life, clinical correlations. 2nd World Congr. of ISPRM, Prague, May Abstracts, 2003; 38.

Rydeard R, Leger A. Pilates-based therapeutic exercise: effect on subjects with nonspecific low back pain and functional disability: a randomized controlled trial. J. Orthop. Sports. Phys. Ther. 2006; 36 (7):472-484.

Sancho S. Functional restauration in LBP-patients: outcome at two-year follow-up. 2nd World Congr. of ISPRM, Prague, May, Abstracts, 2003; 185.

Scheel IB, Hagen KB. Blind faith ? The effects of promoting active sick leave for back pain patients: a cluster-randomized controlled trial. Spine, 2002; 27(23):2734-2740.

Verfaille S, Delarue Y, Demangeon S, Beuret-Blanquart F. Evaluation after four years of exercise therapy for chronic low back pain. Ann.readapt.Med.Phys. 2005; 48(2):53-60