

## **INFLUENCE OF COMPLEX PHYSIOTHERAPY ON THE FUNCTIONAL CONDITION OF THE SPINE IN OLDER PEOPLE**

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**Abstract.** *The aim of the present study was to assess the impact of 21-days comprehensive physiotherapy program on the functional condition of the spine and severity of pain in older people. To achieve this goal, physiotherapeutic procedures were performed on 100 elderly patients suffering from spinal disorders. The comprehensive therapy program consisted of: general improvement exercises, individual exercises with a physiotherapist, exercises in water and physical therapy treatments such as: TENS currents, galvanic current, iontophoresis, laser stimulation, magnetic field on the lumbar spine and hydro massage or mud compresses. Prior and post the therapy program: the Schober's test - 1 (forward flexion), Schober's test - 2 (extension), Ott's test, fingertip-to-floor (FTF) test, pain Visual Analogue Scale (VAS) and the modified Oswestry low back pain questionnaire were evaluated. Statistically significant improvement ( $p < 0.001$ ) in all tested parameters was shown at the end of therapy program. Age, height, body weight and body mass index (BMI) has no impact on results before and after the physiotherapy program in respective tests. In conclusion, the conducted study has shown the effectiveness of applied comprehensive physiotherapy program on the functional condition of*

*the spine and improvement of the quality of life of the treated patients, regardless of their somatic conditions.*

**Keywords:** *old age, physiotherapy, somatic changes, spinal disorders.*

## **Introduction**

Spinal disorders in many developed countries are some of the most common causes of long term disability in adult population and frequent reason of early retirement (Gatchel et al., 2003). The most disabling in spinal disorders is chronic low back pain. The prevalence of chronic low back pain is high and increases in the aging population – most of us will suffer from low back pain at least once during our lifetime (Koes et al., 2006). In general population is estimated to be about 6 % (Juniper et al., 2009), whereas in adults aged 20-69 years old - 13.1 % (Shmagel et al., 2016), and reported lifetime prevalence varies from 49 % to 70 % and point prevalence from 10 % to 27 % (Koes et al., 2006, Gerhardt et al., 2014). The prevalence of low back pain continues to increase dramatically in the last decade and affects both women and men (Freburger et al., 2009). Spinal disorders and especially related pain has a significant impact on personal functional capacity and restricts occupational activities and is a major cause of decreased productivity (Allegri et al., 2016). When spinal disorder with pain occurs, it is most commonly treated in primary healthcare facilities and patients suffering back pain utilise more medical services than the average population (Lim et al., 2006). That is why its economic burden is very high and consist of direct costs of healthcare as well as indirect costs related to absenteeism, reduced productivity and early retirement (Dagenais et al., 2010; Philadelphia & Panel, 2001).

The management of patients with low back pain differs considerably between countries and among healthcare professionals (Koes et al., 2006). Frequently it is resistant to general practitioner treatment, and patients are referred for spinal surgery or for multidisciplinary treatment. Recently, many clinical trials have been conducted and a lot of systematic reviews have been done with the goal to find the best management method for these patients. Based on these results effects of multidisciplinary rehabilitation usually seems to have small to moderate clinical effects (Kamper et al., 2014). In Poland rehabilitation for patients with spinal disorders focuses on reduction of pain and preventing disability, especially in elderly.

The aim of the present study was to assess the impact of 21-days comprehensive physiotherapy program on the functional condition of the spine and severity of pain in older people.

## Materials

Our study was conducted in Rehabilitation Centre in Kudowa Zdrój, Poland. All subjects were examined between November 2016 and January 2017. Our study group consisted of 100 patients (73 women and 27 men) with a mean age of 61.71 years suffering from spinal disorders and admitted to in-patient Rehabilitation Centre for 21-days comprehensive rehabilitation program. General characteristics of our study group has been presented in Table 1. Sixty six of examined subjects were already retired, 34 was still working. Only 24 patients had normal weight, 43 were overweight, and 33 were obese. According to clinical interview: only 33 of them used to be physically active. The inclusion criterion was medical diagnosis of degeneration or discopathy in lumbo-sacral segment of the spine and no clinical contraindications for performing diagnostic functional tests.

### *Ethics approval and consent to participate*

All patients gave the consent to take part in the study. The study was conducted with the permission nr 325/2016 of The Ethical Committee of Opole Medical School.

Table 1 Patient's general characteristics (n = 100)

Variable [units]	Mean	Minimum	Maximum	SD	Median
Age [years]	61.71	42	79	± 8.86	60.81
Body weight [kg]	75.93	48	140	± 15.57	75.00
Height [cm]	165.72	150	194	± 9.52	164.00
BMI [kg/m <sup>2</sup> ]	27.54	19.03	40.01	± 4.28	27.18

SD – Standard Deviation, BMI - Body Mass Index

## Methods

### *Functional tests*

All patients were examined twice using: the Schober's test - 1 (forward flexion), Schober's test - 2 (extension), Ott's test, fingertip-to-floor (FTF) test, pain visual analogue scale (VAS) and the modified Oswestry low back pain questionnaire. First examinations were conducted before the comprehensive

rehabilitation program. The second evaluation was done after completing the rehabilitation.

Schober's tests were used in aim to evaluate mobility in lumbo-sacral part of the spine. We have evaluated: the elongation of the spine in lumbar part during maximal forward flexion in sagittal plane (the Schober's Test - 1) and the shortening of the spine in lumbar part during maximal backward extension in sagittal plane (the Schober's Test - 2) (Schober, 1937).

Ott's test was carried out to measure the range of movement of the thoracic spine in sagittal plane (Schmidt, 2002). The measurement in sagittal plane was taken during elongation of the thoracic spine during maximal forward flexion and standing position with straight knees.

All subjects underwent also Fingertip-to-Floor test (FTF) in order to evaluate lumbar flexion all together with pelvic, hip, thoracic spine and shoulder mobility. FTF was used as an outcome measure, because forward bending is one of the more painful and limited movements. The FTF test has been shown to have excellent reliability without the use of standardized instructions and patient positioning (Gauvin et al., 1990). FTF test measures in sagittal plane the distance between the fingertip of the longest finger and the floor during standing position with straight knees and maximal forward flexion with arms dropped down.

Every patient also has evaluated the severity of spine pain using the 10 points Visual Analogue Scale (VAS), which consisted of a straight line with the endpoints defining extreme limits such as '0 - no pain at all' and '10 - pain as bad as it could be'. Each patient was asked to mark its pain level on the line between the two endpoints.

All examined patients filled in the modified Oswestry Low Back Pain Disability Questionnaire (also known as Oswestry Disability Index), which is an extremely important tool that measures the patient's permanent functional disability. The questionnaire is considered the 'gold standard' for low back functional outcome tools (Fairbank & Pynsent, 2000; Davidson & Keating, 2001). It judged the patient's disability and the severity of lumbo-sacral spinal pain and consists of 10 questions about pain intensity and its changes or induction during: lifting heavy things, sitting, sleeping, travelling, personal care activities (washing, dressing etc.), walking, standing, social life activities, sex life (if applicable). For each question patients selected one of the six answers scored from 0 to 5 points. All points were summed up to the maximal number of 50 points (100 %).

Interpretation of results was as follows:

- 0 % to 20 % - minimal disability - the patient can cope with most living activities, usually no treatment is advised apart recommendation concerned with lifting, sitting and exercise;
- 21 % to 40 % - moderate disability - the patient experiences more pain and difficulty with sitting, lifting and standing; travel and social life are

more difficult and they may be disabled from work; personal care, sexual activity and sleeping are not grossly affected and the patient can usually be managed by conservative means;

- 41 % to 60 % - severe disability - pain remains the main problem in this group but activities of daily living are affected; these patients require a detailed examination;
- 61 % to 80 % - handicap - back pain impinges on all aspects of the patient's life, positive intervention is required;
- 81 % to 100 % - patients are either bedridden or exaggerating their symptoms.

### ***Rehabilitation program***

A comprehensive therapy program for each patient was individually established after doctor's medical evaluation and consisted of: general improvement exercises, individual exercises with a physiotherapist, exercises in water and physical therapy treatments such as: transcutaneous electrical nerve stimulation (TENS) currents, galvanic current, iontophoresis, laser stimulation, magnetic field on the lumbar spine and hydro massage or mud compresses. Each patient during whole rehabilitation program received all together 85 treatments. Exercises were conducted 3 to 5 times a week.

Every single treatment consisted of: general improvement exercises – 30 minutes, individual exercises with a physiotherapist – 30 minutes, water exercises – 40 minutes and physical therapy treatments such as: TENS currents – 10 minutes, galvanic current – 10 minutes, iontophoresis – 10 minutes, laser stimulation – 8 minutes, magnetic field on the lumbar spine – 15 minutes, hydro massage – 15 minutes and mud compresses – 15 minutes.

All patients received kinesitherapy: general improvement exercises, individual exercises with a physiotherapist and water exercises.

General improvement exercises and individual exercises with a physiotherapist aimed at: elongation of lumbar muscles, elongation of hamstrings, mobilisation of thoraco-lumbar spine, improving twists mobility of thoraco-lumbar spine, stretching of thoracic and lumbar muscles, strengthening abdominal, gluteal, thighs and back muscles.

Water exercises also aimed in strengthening of the abdominal, gluteal and back muscles, elongation of thoracic and lumbar spine. They were conducted during standing or floating and conditioning using specialized equipment, such as flotation devices and resistive devices for the hands or feet.

### ***Statistical methods***

The analysis was made with the use of descriptive statistics. The Wilcoxon signed-rank test was used to assess statistical significant differences between results prior and after the rehabilitation program. The correlation of age, body

weight, height and BMI with functional tests was evaluated using Pearson's correlation coefficient. The level of significance was set at  $p < 0.05$ .

## Results

After the treatment program the mobility of thoracic and lumbar spine was significantly better than prior rehabilitation. All specific results in consecutive functional tests performed prior and after rehabilitation program are presented in Table 2. The forward flexion and backward extension in Schober's tests were significantly better ( $p < 0.001$ ). The forward flexion in thoracic spine evaluated in Ott's test also was significantly improved after rehabilitation treatment ( $p < 0.001$ ). The mobility of lumbar spine together with pelvic, and hip mobility evaluated in FTF was also greater ( $p < 0.001$ ) after finishing comprehensive rehabilitation program. Analysis of pain intensity evaluated using VAS showed significant improvement in pain severity as a result of conducted therapy ( $p < 0.001$ ). The degree of disability measured using Oswestry questionnaire was also significantly reduced; it was about 10.3 % after comprehensive rehabilitation program.

We found significant linear correlation of height and difference in range of thoracic spine movement measured in Ott's test prior and after the therapeutic program ( $p < 0.05$ ). There were no other significant correlation evaluated with Pearson's linear correlation coefficients between age, body weight, height, BMI and results of functional tests. All correlation results are presented in Table 3.

Table 1 Functional tests done prior and after treatment (n=100)

Functional test [units]	Prior treatment		After treatment		Difference		Z	p value
	Mean	SD	Mean	SD	Mean	SD		
Schober's Test – 1 [cm]	4.1	± 1.1	5.8	± 1.3	1.7	± 1.0	-8.357	0.001
Schober's Test – 2 [cm]	2.5	± 0.7	1.7	± 0.7	-0.8	± 0.6	-7.797	0.001
Ott's Test [cm]	2.0	± 0.7	2.9	± 1.0	0.9	± 0.6	-8.010	0.001
FTF [cm]	13.5	± 1.3	9.1	± 9.5	-4.4	± 4.5	-7.486	0.001
VAS [points]	4.7	± 1.7	2.5	± 1.5	-2.2	± 1.3	-8.408	0.001
Oswestry Questionnaire [%]	35.8	± 0.5	25.4	± 9.6	-10.3	± 8.0	-8.113	0.001

FTF – Fingertip to Floor Test; VAS - Visual Analogue Scale; SD – Standard Deviation

Table 3 The linear correlation of age and body parameters with functional tests

Variable [units]	Schrober's Test - 1	Schrober's Test - 2	Ott's Test	FTF	VAS	Oswestry Quest.
Age [years]	-0.159	0.018	-0.191	-0.020	0.092	0.179
Height [cm]	0.070	-0.136	0.197*	-0.072	0.118	0.087
Body weight [kg]	0.058	-0.138	0.159	0.050	0.021	0.106
BMI [kg/m <sup>2</sup> ]	0.007	-0.064	0.044	0.025	-0.049	0.083

FTF – Fingertip to Floor Test; VAS - Visual Analogue Scale, BMI – Body Mass Index;

\*-  $p < 0.05$

## Discussion

More than 1000 randomised controlled trials have been published evaluating all types of treatments for low back pain commonly caused by spinal disorders (Koes et al., 2006). Systematic reviews comparing varying forms of generic exercise with no exercise or other exercise programs suggest that exercises improve function and decreases pain compared with no exercise in people with chronic low back pain (Ferreira et al., 2006; Slade & Keating, 2006; Slade & Keating, 2007). Whereas the other review concluded that there is an evidence that specific back exercises (strengthening, flexibility, stretching, flexion, and extension exercises) are not effective. This last paper suggests that specific back exercises were equally as effective as a variety of placebo, sham, or as no treatment at all (Van Tulder & Koes, 2002) what is in opposition to prior cited reviews as well as to our results. In our program every patients received specific back exercises, and we showed that this special program improve function and reduce pain and disability.

The clinical evidence regarding the effectiveness of TENS and massage in reducing pain and improving functional status in patients with chronic low back pain is inconsistent (Khadilkar et al., 2005; McIntosh & Hall, 2008). Despite these results, our patients with spinal disorders received TENS currents as well as massage in their comprehensive rehabilitation program and in opposition to cited research we conclude that clinical results of the whole program including TENS currents and massage were satisfactory.

The present study indicates that older people with spinal disorders usually have excessive body weight, which is an important risk factor of developing the spinal diseases (Koes et al., 2006). In all cases it should be taken into consideration during establishing a comprehensive therapy program. Despite the

fact that the program restricting the supply of calories and weight loss has not been implemented during the treatment period, we have observed good results of comprehensive 21-days rehabilitation program.

Our current study has had some limitations worth to note. Firstly, it was an observational study without randomisation, which could limit the generalization of our results. Secondly, we only collected data at the end of 21-days of the comprehensive rehabilitation program. Especially, it can be expected based on data published by Görge et al. (2017), that our patients will utilise healthcare services less frequently after effective rehabilitation program. Along-term follow-up evaluation could support different data. Thirdly, we did not include a no-treatment control group in our study, so it cannot be determined if the improvements seen can be attributed only to the interventions or simply to the passage of time (Polish legislation on ethics and the Declaration of Helsinki for clinical trials do not allow patients with a disabling disorders to remain without treatment if other techniques that could improve clinical condition are available).

Future studies should continue to examine the effectiveness of comprehensive rehabilitation programme on the functional condition of the spine, pain reduction and improvement the quality of life including spinal manipulative therapy, cognitive behaviour therapy, educational interventions (especially diet), psychosocial treatment and functional technique in conjunction with other physical therapy interventions. We also think that it would be useful to include in the future studies a control group to find which intervention has the most powerful effect and collect data over a long-term follow-up period.

## **Conclusions**

In conclusion, spinal disorders are common conditions motivating older patients to seek medical consultation. Their impact on society are significant, both epidemiologically and economically. All the guidelines currently available stress the importance of special therapeutic strategies in order to solve the problem. This study has shown the effectiveness of applied comprehensive physiotherapy program on the functional condition of the spine and improvement of the quality of life of the treated patients, regardless of their somatic conditions. Our therapeutic strategy seems to be worth testing in future long-term studies.

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