

Received: 2011.02.17  
Accepted: 2011.11.21  
Published: 2012.05.01

**Authors' Contribution:**

- A** Study Design
- B** Data Collection
- C** Statistical Analysis
- D** Data Interpretation
- E** Manuscript Preparation
- F** Literature Search
- G** Funds Collection

## The objective evaluation of effectiveness of manual treatment of spinal function disturbances

Paweł Szulc<sup>1A,B,D,F</sup>, Jacek Lewandowski<sup>2D,G</sup>, Joanna Boch-Kmiecik<sup>1A,E</sup>,  
Paweł Berski<sup>1D,G</sup>, Marta Matusiak<sup>1D,G</sup>

<sup>1</sup> Chair of Functional Anatomy, University of Physical Education in Poznan, Poznan, Poland

<sup>2</sup> Department of Kinesitherapy, University of Physical Education in Poznan, Poznan, Poland

**Source of support:** Departmental sources

### Summary

**Background:**

The aim of this paper is the evaluation of effectiveness of manual therapy in the treatment of functional disturbances of the spine.

**Material/Methods:**

The study subjects were 40 persons aged 45-60 years, in whom degenerative changes in intervertebral discs and physical limitations within the spine were found (NMR), which were manifested as pain. Subjects were randomly divided into 2 groups of 20 persons each. The first group went on a monthly rehabilitation tour, where the manual therapy methods were applied. The second group was treated by means of physical methods. In order to verify the results of effectiveness of the therapies, the examination of the sectional mobility and the evaluation of the spinal curvatures before and after the completion of the therapy were made by means of a tensiometric electrogoniometer.

**Results:**

The percentage differences in significance result from the lower value of parameter  $t_1$  in the group of persons treated physically. The dynamics of changes in the parameters in the sectional mobility in both tested groups was highest in the cervical and lumbar spine. The manually treated group had greater dynamics of changes in functional parameters of the spine.

**Conclusions:**

Manual therapy is an effective method for treatment of functional changes and early structural changes within the spine, and may be used as supplementary therapy in relation to the standard model of treatment of spinal pain.

**key words:**

manual therapy • electrogoniometry • discopathy • spine • mobility

**Full-text PDF:**

<http://www.medscimonit.com/fulltxt.php?ICID=882738>

**Word count:**

2115

**Tables:**

4

**Figures:**

1

**References:**

16

**Author's address:**

Paweł Szulc, Chair of Functional Anatomy of the University of Physical Education in Poznan, Krolowej Jadwigi 27/39 St., 61-871 Poznan, Poland, e-mail: pabblo@onet.eu

## BACKGROUND

The spinal pain syndromes are foremost among the ailments related to the motor system; data from the literature indicate that from 60% to 80% of the European population is affected. Both the variety of these ailments and their scope are significant, and often they are not spine-related [1]. It appears that there is insufficient knowledge in regard to the functioning of the spine as a motor organ and as an organ integrating the psychomotor properties. The proper functioning of all organs and life activities is conditioned by normal biological processes; therefore, the slightest disturbances of the function of peripheral nerves, constituting a connector with the respective organs and the central nervous system, have a negative effect on the functioning of the body [2].

Poor diet and work habits lead to disturbances within the motor system. Changes occur in the respective muscular groups, conditioned by the content of the different muscular fibres (ST or FT) and this leads to the initiation of joint dysfunction. The clinical image created in this way impacts the state of structures building and conditioning the

action of the spinal column and the internal organs [1]. The spine constitutes the substance of the body posture – it rests on the pelvis, which is a connector with the lower limbs [3]. Defining the spine in reference to functional anatomy, one has to take into account the whole osseous-ligamentous system together with the fascial-muscular system, running along from head to sacral bone. It forms a complex set of layers, stabilizing the various movements of the discs. The discs, in spite of their similar shapes, differ from each other in structure and size, causing variation in the range and direction of motion [3,4]. Logical analysis of the biomechanics of the spine as a motor organ requires familiarity with the arrangement of the ligaments, the configuration of joint surfaces, knowledge of the functioning of the fascial-muscular system, and micro- and macroscopic neurology of intervertebral joints. It is also a necessary minimum to understand pathology in reference to the disturbed motor function of the spine [1,4].

One of the methods of treatment, which is based on the above-mentioned way of thinking, is manual therapy, which may be one of the methods for treatment of spinal pains [5]. Therefore, the aim of this paper is to assess the effectiveness

**Table 1.** The significance of differences between spondylometric parameters for periods 1 and 2 of the female group, performed by means of the t-Student and Wilcoxon test, where  $p \leq 0.01^{**}$ ,  $p \leq 0.05^*$ .

| Parameters period 1 & 2 | $\bar{x} \pm SD$ |              | Test value | p value  |
|-------------------------|------------------|--------------|------------|----------|
|                         | Before           | After        |            |          |
| LRC_1 & LRC_2           | 41.91±4.346      | 38.55±1.128  | 2.82       | 0.0182*  |
| FLC_1 & FLC_2           | 13.55±5.733      | 37.55±6.362  | 2.93 W     | 0.0033** |
| FRC_1 & FRC_2           | 16.27±7.377      | 37.91±6.008  | -6.35      | 0.0001** |
| RLC_1 & RLC_2           | 45.09±19.685     | 62.73±11.359 | 2.80 W     | 0.0051** |
| RRC_1 & RRC_2           | 37.82±23.056     | 62.45±11.665 | -4.20      | 0.0018** |
| FC_1 & FC_2             | 30.64±16.901     | 52.27±7.786  | -5.25      | 0.0004** |
| EC_1 & EC_2             | 32.45±11.894     | 45.00±7.253  | -5.68      | 0.0002** |
| KFTh_1 & KFTh_2         | 33.00±3.715      | 32.55±2.945  | 1.17       | 0.2708   |
| FLTh_1 & FLTh_2         | 13.09±6.534      | 14.82±6.047  | -2.67      | 0.0237*  |
| FRTh_1 & FRTh_2         | 12.18±5.980      | 15.00±6.164  | 2.20 W     | 0.0277*  |
| RLTh_1 & RLTh_2         | 20.27±6.842      | 22.27±6.101  | -2.58      | 0.0273*  |
| RRTTh_1 & RRTTh_2       | 19.64±7.514      | 21.91±6.139  | -2.46      | 0.0339*  |
| FTh_1 & FTh_2           | 15.09±7.148      | 19.55±6.609  | -5.02      | 0.0005** |
| ETh_1 & ETh_2           | 13.36±7.737      | 17.00±5.040  | -3.17      | 0.0100** |
| LRL_1 & LRL_2           | 36.73±4.819      | 35.82±3.970  | 1.61       | 0.1377   |
| FLL_1 & FLL_2           | 15.36±9.025      | 17.55±8.870  | -3.39      | 0.0069** |
| FRL_1 & FRL_2           | 11.73±9.023      | 17.36±8.812  | 2.67 W     | 0.0077** |
| RLL_1 & RLL_2           | 6.27±2.649       | 7.82±2.639   | -4.22      | 0.0018** |
| RRL_1 & RRL_2           | 7.45±2.979       | 8.00±2.720   | -1.49      | 0.1669   |
| FL_1 & FL_2             | 27.73±13.252     | 50.91±8.905  | 2.93 W     | 0.0033** |
| EL_1 & EL_2             | 13.00±6.245      | 21.09±6.074  | -4.25      | 0.0017** |

W – Wilcoxon, other T-student.

**Table 2.** The significance of differences between spondylometric parameters for periods 1 and 2 of the male group, performed by means of the t-Student and Wilcoxon test, where  $p \leq 0.01^{**}$ ,  $p \leq 0.05^*$ .

| Parameters period 1 & 2 | $\bar{x} \pm SD$ |              | Test value | p value  |
|-------------------------|------------------|--------------|------------|----------|
|                         | Before           | After        |            |          |
| LRC_1 & LRC_2           | 42.67±3.937      | 39.11±1.900  | 3.89       | 0.0046** |
| FLC_1 & FLC_2           | 14.56±6.803      | 40.11±9.075  | -8.44      | 0.0000** |
| FRC_1 & FRC_2           | 15.33±7.297      | 40.67±8.631  | -6.13      | 0.0003** |
| RLC_1 & RLC_2           | 37.00±19.881     | 61.78±13.274 | -4.28      | 0.0027** |
| RRC_1 & RRC_2           | 34.00±20.952     | 61.11±13.642 | -6.21      | 0.0003** |
| FC_1 & FC_2             | 32.67±14.756     | 57.89±5.372  | -5.98      | 0.0003** |
| EC_1 & EC_2             | 32.44±16.455     | 45.33±8.944  | -3.94      | 0.0043** |
| KFTh_1 & KFTh_2         | 34.11±4.285      | 32.89±3.732  | 1.83 W     | 0.0679   |
| FLTh_1 & FLTh_2         | 12.67±5.831      | 17.89±4.910  | -5.95      | 0.0003** |
| FRTh_1 & FRTh_2         | 11.11±5.231      | 18.00±4.213  | -4.67      | 0.0016** |
| RLTh_1 & RLTh_2         | 21.56±7.282      | 24.56±4.667  | -2.78      | 0.0240*  |
| RRTh_1 & RRTh_2         | 18.89±5.988      | 24.22±4.738  | -4.88      | 0.0012** |
| FTh_1 & FTh_2           | 17.56±9.071      | 18.00±4.213  | 0.06 W     | 0.9528   |
| ETh_1 & ETh_2           | 12.89±6.092      | 19.22±3.346  | -3.48      | 0.0083** |
| LRL_1 & LRL_2           | 40.33±6.633      | 38.78±4.893  | 2.33       | 0.0485*  |
| FLL_1 & FLL_2           | 12.11±10.240     | 20.56±5.593  | 2.49 W     | 0.0129*  |
| FRL_1 & FRL_2           | 11.67±8.631      | 20.44±4.876  | 2.43 W     | 0.0152*  |
| RLL_1 & RLL_2           | 7.33±5.220       | 9.11±2.804   | 1.35 W     | 0.1763   |
| RRL_1 & RRL_2           | 7.45±2.979       | 8.00±2.720   | -1.49      | 0.1669   |
| FL_1 & FL_2             | 29.56±20.274     | 57.33±11.391 | 2.67 W     | 0.0077** |
| EL_1 & EL_2             | 17.67±13.638     | 25.33±8.016  | -3.24      | 0.0119*  |

W – Wilcoxon, other T-student.

of this therapy in treatment of clinical disturbances such as limitations in spinal mobility and structural changes in NMR image by means of the tensiometric electrogoniometer, evaluating the functional changes within the spine.

## MATERIAL AND METHODS

The study subjects were 40 persons aged 45–60 years (18 men and 22 women) referred to the rehabilitation outpatient clinic because of chronic spinal pain. They were randomly divided into 2 groups of 20 persons each. The first group went on a monthly rehabilitation tour in which manual therapy methods were applied. The second (control) group was treated by means of physical methods in the same period of time. In the case of the above-mentioned group, the interference currents as well as magnet and laser therapies were applied in a series of 10–15 operations alternately. Within the studied groups there were early multi-level degenerative changes in the spine with characteristics of discopathy diagnosed on the basis of the NMR image. The dominant ailments were radiating pains, pains related to movements and motor limitations accompanying

them. Additionally, the weakening of muscular strength and the presence of disturbances of angular physiological spinal curvatures was observed. All these persons were professionally active (static effort). The pains lasted 1.5 years on average. Based on interviews and examination, the dominating ailments were: pains and back stiffness, back pains with accompanying headaches, back pains radiating along the shoulder, thoracic pains (between shoulder-blades), low back pains, low back pains radiating to the buttock, and low back pain radiating to the backside of a thigh. In the group treated by means of the manual therapy, 16 persons (80%) experienced pain in the lumbar spine and nearby innervated lumbar sections, while in the control group there were 15 persons (75%) thus affected. Pains located in the cervical spine and nearby were noted in 14 persons treated by means of manual therapy (70%), and in 12 patients (60%) from the control group. The multi-sectional spinal pains were present in both groups.

In all patients the NMR test was performed, on the basis of which, multi-level constrictions of gaps of intervertebral joints as well as presence of degenerative changes in the form of

**Table 3.** The significance of differences between spondylometric parameters for periods 1 and 2 of the female control-group, performed by means of the t-Student and Wilcoxon test, where  $p \leq 0.01^{**}$ ,  $p \leq 0.05^*$ .

| Parameters period 1 & 2 | $\bar{x} \pm SD$ |              | Test value | p value |
|-------------------------|------------------|--------------|------------|---------|
|                         | Before           | After        |            |         |
| LRC_1 & LRC_2           | 40.90±4.592      | 39.72±4.002  | 4.48 W     | 0.001** |
| FLC_1 & FLC_2           | 23.72±7.058      | 37.18±5.325  | -5.33      | 0.000** |
| FRC_1 & FRC_2           | 23.18±6.046      | 35.72±5.120  | -6.15      | 0.000** |
| RLC_1 & RLC_2           | 50.63±13.544     | 60.36±12.508 | -2.92      | 0.015*  |
| RRC_1 & RRC_2           | 45.63±16.200     | 60.36±12.508 | -4.99      | 0.000** |
| FC_1 & FC_2             | 39.27±13.580     | 51.18±7.600  | -5.06      | 0.000** |
| EC_1 & EC_2             | 36.63±7.228      | 44.45±7.514  | 5.069      | 0.000** |
| KFTh_1 & KFTh_2         | 32.00±3.768      | 31.72±3.797  | 1.150      | 0.276   |
| FLTh_1 & FLTh_2         | 13.09±5.109      | 14.54±5.538  | -1.92      | 0.083   |
| FRTh_1 & FRTh_2         | 12.36±4.924      | 14.00±5.692  | -3.00w     | 0.013*  |
| RLTh_1 & RLTh_2         | 19.36±5.835      | 21.27±5.798  | -3.38      | 0.006** |
| RRTh_1 & RRTh_2         | 19.09±5.940      | 21.27±5.790  | -3.54      | 0.005** |
| FTh_1 & FTh_2           | 16.36±6.756      | 19.36±6.756  | -4.405     | 0.001** |
| ETh_1 & ETh_2           | 13.90±4.887      | 16.72±4.880  | -5.429     | 0.000** |
| LRL_1 & LRL_2           | 36.45±4.885      | 36.181±4.707 | 1.399      | 0.192   |
| FLL_1 & FLL_2           | 15.81±7.960      | 17.63±8.628  | -5.164     | 0.000** |
| FRL_1 & FRL_2           | 13.72±7.988      | 16.72±7.630  | -4.743     | 0.000** |
| RLL_1 & RLL_2           | 7.18±2.182       | 8.54±2.733   | -2.303 W   | 0.004*  |
| RRL_1 & RRL_2           | 727.00±2.053     | 8.909±2.343  | -4.845 W   | 0.007** |
| FL_1 & FL_2             | 35.72±11.696     | 47.18±9.474  | -3.828     | 0.003** |
| EL_1 & EL_2             | 14.18±4.665      | 19.45±6.772  | -4.512     | 0.001** |

W – Wilcoxon, other T-student.

osteophytes on bodies of discs and intervertebral joints were observed. The symptoms of falling out of the nucleus pulposus and protrusion of the intervertebral disc were not diagnosed in any of the patients. There was no presence of focal changes within the spinal cord. On the other hand, the multi-level constrictions of intervertebral spaces and bulging of the fibrous ring were visible. Obvious stenosis of the spinal canal was not observed. Thus, these patients had disturbed spinal function and early degenerative changes within the spine.

In the neurological examination, no disturbances in sensitivity were diagnosed within the respective dermatomes, nor was there any cancellation of tendinous-muscular reflexes. Additionally, the spondylometric features in the form all spinal sections and angular values of its physiological curvatures were tested by means of the tensiometric electrogoniometer produced by the Penny & Giles Company in Boocock's modification, according to the methodology developed by Lewandowski and Szulc [6,7].

Patients in the manually treated group were subjected to 15 operations in the form of traction and mobilization of

intervertebral discs, muscular energy techniques and fascial techniques related to searching for muscular-fascial release points; electrotherapy and self-therapy education were performed.

Often, the restoration of correct movability by means the fascia, and calming the release points contributed to the restoration of the correct function to given sections (in the case of mild disturbances), but often constituted the preparation for an examination in deeper tissue layers or was a condition allowing the detailed examination of sectional mobility to be carried out. In the case of significant mobility disturbances, when interlocked discs were felt during the examination of sections, the first choice therapies were muscular energy techniques and mobilizations directed to a specific section. In the case of disturbances of the activity of spinal sections resistant to the therapy detailed above, a manipulation was performed (in the case of lack of any contraindications). The therapy was directed to a removal or a decrease in pain and to improvement of the spinal functions. In both groups, after finishing the therapy, in order to assess the progress in treatment objectively,

**Table 4.** The significance of differences between spondylometric parameters for periods 1 and 2 of the male control-group, performed by means of the t-Student and Wilcoxon test, where  $p \leq 0.01^{**}$ ,  $p \leq 0.05^*$ .

| Parameters period 1 & 2 | $\bar{x} \pm SD$ |              | Test value | p value  |
|-------------------------|------------------|--------------|------------|----------|
|                         | Before           | After        |            |          |
| LRC_1 & LRC_2           | 41.33±3.807      | 40.44±3.609  | 3.41       | 0.009*   |
| FLC_1 & FLC_2           | 25.54±7.178      | 39.44±7.699  | -4.61      | 0.001**  |
| FRC_1 & FRC_2           | 23.00±5.385      | 39.00±7.071  | -7.81      | 0.000**  |
| RLC_1 & RLC_2           | 43.00±17.014     | 57.33±13.747 | -2.92      | 0.01*    |
| RRC_1 & RRC_2           | 39.44±15.092     | 57.33±13.747 | -5.84      | 0.001**  |
| FC_1 & FC_2             | 40.00±12.599     | 57.33±6.442  | -5.61      | 0.000**  |
| EC_1 & EC_2             | 38.33±10.473     | 45.33±8.366  | -5.66 W    | 0.000**  |
| KFTh_1 & KFTh_2         | 34.00±4.444      | 33.44±4.126  | 2.29 W     | 0.05*    |
| FLTh_1 & FLTh_2         | 14.77±5.472      | 18.11±4.755  | -5         | 0.001**  |
| FRTh_1 & FRTh_2         | 13.66±3.674      | 17.77±4.055  | -6.72      | 0.03*    |
| RLTh_1 & RLTh_2         | 21.77±6.722      | 23.88±5.158  | -2.61 W    | 0.001**  |
| RRTh_1 & RRTh_2         | 19.88±5.134      | 23.66±5.220  | -4.97      | 0.04*    |
| FTh_1 & FTh_2           | 18.66±7.399      | 21.88±7.149  | -2.38      | 0.002**  |
| ETh_1 & ETh_2           | 14.77±4.763      | 18.44±3.778  | -4.49      | 0.195    |
| LRL_1 & LRL_2           | 40.22±6.359      | 39.88±5.710  | 1.41       | 0.000**  |
| FLL_1 & FLL_2           | 15.88±7.801      | 20.44±6.043  | -6.09      | 0.000**  |
| FRL_1 & FRL_2           | 14.44±5.502      | 20.11±5.230  | -5.51      | 0.0077** |
| RLL_1 & RLL_2           | 7.44±2.505       | 9.33±2.738   | -4.16 W    | 0.003**  |
| RRL_1 & RRL_2           | 7.77±2.108       | 9.33±2.449   | -6.42      | 0.000**  |
| FL_1 & FL_2             | 38.88±15.39      | 52.00±11.434 | -4.67      | 0.001**  |
| EL_1 & EL_2             | 19.44±9.593      | 24.55±8.690  | -5.07      | 0.001**  |

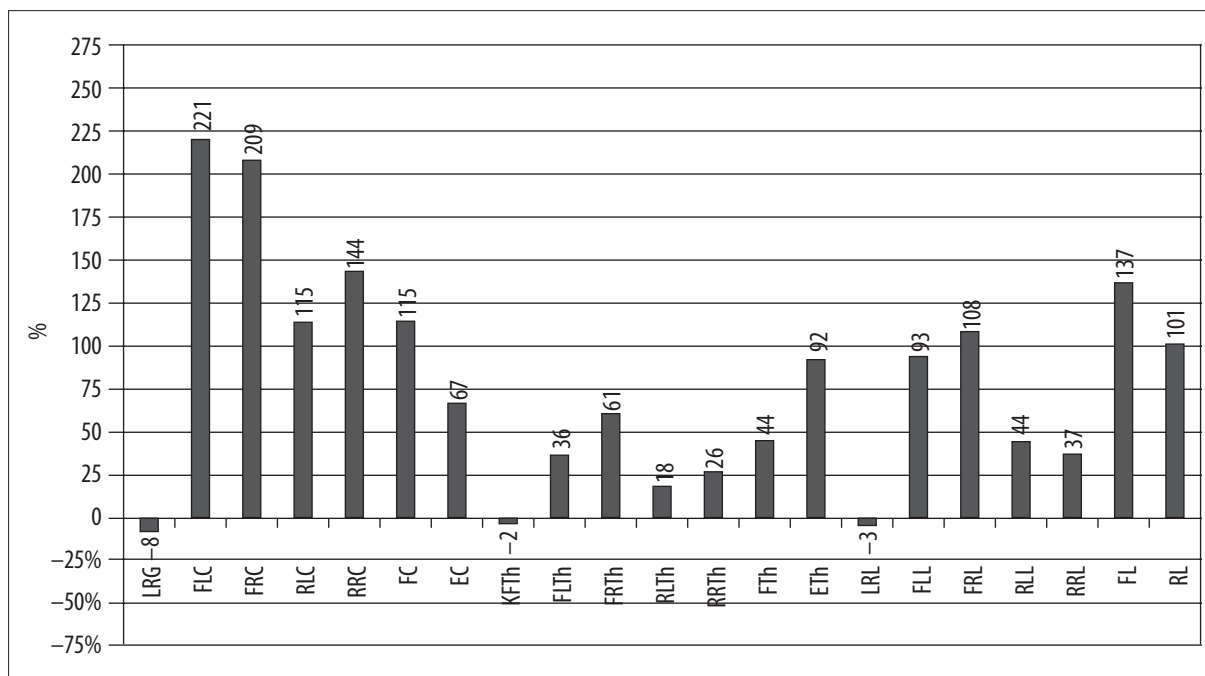
W – Wilcoxon, other T-student. LRC – cervical spine lordosis; FLC – left-sided cervical spine flexure; FRC – right-sided cervical spine flexure; RLC – left-sided axial rotation of the cervical spine; RRC – right-sided axial rotation of the cervical spine; FC – forward cervical spine flexure; EC – backward cervical spine flexure; KFTh – thoracic spine kyphosis; FLTh – left-sided thoracic spine flexure; FRTh – right-sided thoracic spine flexure; RLTh – left-sided axial rotation of the thoracic spine; RRTh – right-sided axial rotation of the thoracic spine; FTh – forward thoracic spine flexure; ETh – backward thoracic spine flexure; LRL – lumbar spine lordosis; FLL – left-sided lumbar spine flexure; FRL – right-sided lumbar spine flexure; RLL – left-sided axial rotation of the lumbar spine; RRL – right-sided axial rotation of the lumbar spine; FL – forward lumbar spine flexure; EL – backward lumbar spine flexure.

the examination of the spondylometric features was performed again.

The obtained results in both groups were subjected to statistical analysis. For each parameter, normal distribution was checked by means of the Shapiro-Wilk test. The basic statistical characteristics and the dynamics of changes for periods 1 and 2 were calculated for all parameters. The critical significance limit was assumed at the level of  $p \leq 0.05$ . The significance of mean values between 2 periods of examinations in both groups for parameters with normal distribution was checked by means of Student's T test, and for characteristics with a distribution other than normal by means of the Wilcoxon test. The significance of differences between both groups for parameters which did not have normal distribution was checked by means of the Mann-Whitney U test.

## RESULTS

The statistical analysis shows that the differences in the values of the studied parameters for both periods and sexes in the group treated manually are statistically significant at the level of  $p \leq 0.01^{**}$  for 60%,  $p \leq 0.05^*$  for 24%, and insignificant for 16% of marked parameters, whereas for the group treated by means of physical methods, these values were 90.5%, 6.5% and 4%, respectively (Tables 1–4). The percentage differences in the significance result from the lower value of parameter  $t_1$  in the group of persons treated physically. Also, it is justified by the values of the coefficient of significance of differences from the Mann-Whitney U test for parameters  $t_1-t_1$  and  $t_2-t_2$  between the studied groups. The dynamics of changes in the parameters with regard to the sectional mobility in both studied groups was of the highest level



**Figure 1.** Mean values of the dynamics of changes for the respective parameters.

in the case of the cervical spine, which may be explained by many disturbances in this vicinity, and in the case of the lumbar spine, achieving low values for rotational motions. The thoracic spine had the smallest changes. The greater dynamics of changes in functional parameters of the spine characterized the manually treated group. On this basis, a conclusion may be drawn that the manual therapy achieves faster healing effects than the physical therapy (Figure 1). On the basis of the analysis of descriptive statistics and unit analyses, the effectiveness of the manual treatment in the case of patients with a disturbed spinal function and early degenerative changes within the spine is observed.

## DISCUSSION

The results of studies presented in this paper depict the effectiveness of the manual therapy in the treatment of patients with a disturbed spinal function and early degenerative changes within the spine [8,9,10], an expression of the joint dysfunction and dysfunction of the muscular-fascial complex. In all likelihood, the existing joint dysfunction impacts the muscular-fascial complex and vice versa, creating a feedback loop [11].

The impact of muscles on the state of intervertebral joints and intervertebral discs may be presented as the following sequence of changes:

1. Torsion caused by overstrain, violent stretch or disturbance in the dynamic balance within the joint leads to the muscular contraction as a response to the form of myotatic stretch reflex (eg. part of the back extensor);
2. The myotatic stretch reflex is an expression of defence of the joint from damage;
3. The muscular contraction limits the range of motion in joints where attachments are located, leading to compression of joint surfaces, bulging of the fibrous ring, and overstraining the intervertebral joints;

4. Bulging may press on the nerve root, causing neurological symptoms.
5. Overstrained intervertebral joints are subjected to the action of an increased intra-articular pressure, leading to joint capsule stretching and irritation;
6. The nerves supplying the joint capsule (sinuvertebral) may be irritated, causing defensive muscular contraction [12].

This leads to disturbance of joint play, which is further magnified by an increased tonus of periarticular tissues, causing joint block, which in consequence leads to the functional spinal disturbances and further structural changes [1]. The subluxated joint, behaving pathologically for a longer period of time, causes degeneration of tissues and disturbances in its innervation [2]. The joint block impacts their irregular function, which disturbs joint play and causes great muscular tension, leading to the sense of pain. Therefore, normalization of function is related to the regression of pain and, vice versa, it allows the joint play to be restored [1,9,13]. The removal of blocks restores mobility, decreases the forces compressing the intervertebral disc, and restores physiological conditions within the intervertebral disc, preventing its further degeneration. The results of our studies confirm the above-mentioned observations and indicate that the spinal mobility is a sensitive indicator of pathological changes occurring within the spine. Similar conclusions were drawn by Pool, Zaproudina, Bell and Walker [5,8–10]. In the case of this type of disturbance, manual therapy is a valuable complement to the complex treatment process, that is, combined physiotherapy, pharmacology, and kinesiotherapy (including self-therapy education) [14]. Among other authors describing the significance of treatment of the spinal pain by means of the manual therapy, there is an opinion that it is important, mainly because of its analgesic effect based on placebo, whose percentage share among other therapeutic factors is difficult to determine [15,16].



However, examination of the sectional mobility of the spine expressed in degrees is an objective measure of return of the axial organ to its correct functioning, which improved greatly after the manual treatment therapy. This is proved by the randomized results of our examinations and those of another author [14]. The functioning of the spine is disturbed in the initial period by the reversible functional changes such as increased muscular tension [5] and no joint play [12], which can later become structural disturbances, further increasing the dysfunction within the spine. Therefore, the early diagnosis and treatment of functional changes is important, which, as a consequence, prevents the structural changes in the form of advanced degenerative disease of intervertebral discs, osseous degenerations of the spine, and stenoses [11].

## CONCLUSIONS

1. Manual therapy is an effective method of treatment of the functional changes and early structural changes within the spine; therefore, it may also be applied as a prophylactic method.
2. The manual treatment may be a therapy supplementing the standard model of treatment of spinal pain, and its advantage is non-invasiveness and lack of necessity for specialist equipment, which makes it cheap to use.

## REFERENCES:

1. Maigne R: Douleurs d'origine vertebrale et traitements par manipulations. Expansion Scientifique, Paris, 1975 [in French]
2. Ackermann WP: Chiropraktyka ukierunkowana. Diagnoza i technika. Wydawnictwo Natura Medica, Poznań, 1997 [in Polish]
3. Kapandji IA: The Physiology of the Joints – vol. 3. The trunk and vertebral column. Churchill Livingstone, 2008
4. Schultz RL, Feitis R: Nieskończona sieć. Anatomia powięzi w działaniu. Wydawnictwo VIRGO, Warszawa 2009 [in Polish]
5. Pool JJ, Ostelo RW, Knol DL et al: Is a behavioral graded activity program more effective than manual therapy in patients with subacute neck pain. Results of a randomized clinical trial. *Spine*, 2010; 35(10): 1017–24
6. Boocock MJ, Jackson JA: Continuous measurement of lumbar posture using flexible electrogoniometers. *Ergonomics*, 1994; 37(1): 175–85
7. Lewandowski J, Szulc P: Application of tensometric electrogoniometry to survey of curvatures and analysis of three-dimensional spine motion. *Acta Bioeng Biomech*, 2003; 298–302
8. Zaproudina N, Hietikko T, Hänninen O, Airaksinen O: Effectiveness of traditional bone setting in treating chronic low back pain: a randomised pilot trial. *Complement Ther Med*, 2009; 17(1): 23–28
9. Bell J: Massage therapy helps to increase range of motion, decrease pain and assist in healing a client with low back pain and sciatica symptoms. *J Bodyw Mov Ther*, 2008; 12(3): 281–89
10. Walker MJ, Boyles RE, Young BA: The effectiveness of manual physical therapy and exercise for mechanical neck pain: a randomized clinical trial. *Spine*, 2008; 33(22): 2371–78
11. Janda V: Janda Compendium Vol. 1 selected articles. OPTP. Minneapolis, 1998
12. Steiner C: Osteopathic Manipulative Treatment – what does it really do? *J Am Osteopath Assoc*, 1994; (10): 85–87
13. Hartman L: Podejście osteopatyczne do somatycznych dysfunkcji ciała. Tom II nr 1/1998, *Kwartalnik Polskiego Towarzystwa Medycyny Manualnej, Biomed*, Głogów 1998, s. 1–6 [in Polish]
14. Martel J, Dugas C, Dubois JC, Descarreaux M: A randomized controlled trial of preventive spinal manipulation with and without a home exercise program for patients with chronic neck pain. <http://www.biomedcentral.com/1471-2474/12/41>
15. Hancock MJ, Maher CG, Latimer J, McAuley JH: Selecting an appropriate placebo for a trial of spinal manipulative therapy. *Aust J Physiother*, 2006; 52(2): 135–38
16. Kawchuk GN, Haugen R, Fritz J: A true blind for subjects who receive spinal manipulation therapy. *Arch Phys Med Rehabil*, 2009; 90(2): 366–68