

# Correlations between cervical spine posture and low back pain

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**Abstract.** The aim of the study was to investigate the importance of cervical spine posture rehabilitation in treatment of low back pain. The study also wanted to compare the efficiency of the Williams protocol versus the experimental exercises protocol designed for cervical spine posture rehabilitation. Material and methods: The study was conducted on 81 persons (males and females), aged between 20 and 64. The patients were organized in two homogenous groups, which had received 10 days of physiotherapy, sedative massage and two different physical therapy protocols. The first group received the Williams protocol and the second group received the experimental physical therapy protocol. Results: The posture evolution was assessed with the menton-stern test and wall-tragus test. When evaluating the postural recovery, the statistics revealed that both protocols are alike as far as efficiency is concerned ( $p=0.171$ ).

**Key Words:** low back pain, spine posture, spine rehabilitation, Williams exercises.

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## Introduction

In the last decades there has been a significant increase of the incidence of the lumbar diseases in all its clinical aspects: low back pain and pain associated with sciatic nerve compression. Researches showed a high percentages of these symptoms, 70-80% in adult population (Pope et al 1993).

The causes are especially related to faulty postures, which has increased due to a sedentary life.

Office jobs, driving cars for long periods of time, watching television in supine posture, lacking of regular physical activities lead to changes in posture, in cervical spine biomechanics, all these being reflected on the other spine curves.

Some studies demonstrated the amount of stress induced in lumbar spine at the professional drivers. The researchers established that the physiological vibrations of the lumbar spine are 4-5 Hz, and the professional drivers values are higher than normal. A different pattern of faulty posture is one determined by certain professions (surgeons, desk workers, students, etc.). These professions lead to the onset of low back pain.

The prevalence of low back pain at the teenagers is 46.8% (18.2% chronic and 28.6% acute) (Pope et al 1993; Alsiddiky et al 2015). These biomechanical changes lead to a premature degeneration mainly of the spine structures, but also of the other joints, muscular imbalances, inflammations and faulty movement patterns which compromise the whole body dynamic (Calvosa et al 2008). Modifications of the head posture lead to changing of the levers, perturbation of the muscles force, loss of the scapula thoracic girdle balance, modification of the body gravity-center, which will overuse the lumbar spine. In these conditions the lumbar spine won't be able to balance the body on the pelvis girdle and lower limbs.

Among the physical therapy protocols used in low back pain treatment, we mention Williams, McKenzie, Pilates and lumbar spine stretching exercises.

This study started from the presumption that the improvement of the cervical spine biomechanics and posture will improve the lumbar spine biomechanics and also will decrease the low back symptoms.

The study assesses the posture modifications due to the experimental physical therapy protocol versus the classic Williams one.

## Materials and methods

The study took place at the Recovery Clinical Hospital from Cluj-Napoca during January 2013 and December 2014.

The study includes 81 patients, 41 in the research group and 40 in the control group. All patients suffered from low back pain and sciatic nerve compression. Each patient was prescribed 10 days of treatment which consisted of: physical therapy, pool physical therapy, sedative spine massage and physiotherapy.

The assessment test were: tragus wall test and menton-stern test. The patients were assessed in the first, the fifth and the tenth day of treatment by the PHD student.

Inclusion criteria

- low back pain
- sciatic nerve compression

Exclusion criteria

- hip and knee arthrosis or hip congenital dysplasia
- mental disorders
- rheumatoid arthritis
- stroke
- shoulder impingement

- severe cardiopulmonary diseases
- total hip or knee prosthesis

The actual research was approved by the Ethic Committee from "Iuliu Hatieganu" Medicine Faculty from Cluj-Napoca and given the registration number 284/19.04.2011. Each patient has given his signed approval of being studied in the informed consent. The experimental exercises protocol was made to include especially supine exercises, for spine muscle relaxation. The protocol starts with warm-up close kinetic chain exercises for cervical spine, stretching for cervical spine, isometric and isotonic exercises for anterior-posterior cervical muscles, its goal being the correction of the cervical dorsal spine posture. Also, it included exercises for increasing power of the scapular-thoracic muscles and spine elongation exercises.

The Williams protocol contains mobilization exercises and power increasing exercises for the abdomen in supine, stretching exercises, spine elongation exercises. Also, the Williams protocol includes the Kabat diagonals exercises for improving muscle power or muscle relaxation of lumbar and abdominal region. Statistical analysis was carried out using MedCalc Statistical Software version 15.5 (MedCalc Software bvba, Ostend, Belgium; <https://www.medcalc.org>; 2015). The following tests were used chi-square, ANOVA for repeated measures.

## Results

Each group benefited of different physical therapy protocols. The Williams protocol is especially designed for spine arthrosis and lumbar herniated disc, and the second protocol has focus on the cervical spine posture rehabilitation. We must mention that the experimental group exercises were conceived and adapted by the PHD student. The lots were homogenous as far as the age and sex are concerned (table 1).

Table 1. The repartitions between groups based on sex, age and menopause

Variable	Research group	Control group	P
<b>Female</b>	23 (56.1%)	23 (57.5%)	1
<b>Male</b>	18 (43.9%)	17 (42.5%)	
<b>Age</b>	41 (8.18%)	40 (11.59%)	0.385
<b>Menopause</b>	1 (2.5%)	6 (15%)	0.108

The study followed the environmental origins in order the see if this factor influenced the study result.

The statistics data has shown that environmental origins have no influence on the results:  $p=0.478$ .

In order to exclude the eventual influences of drug administration or of physiotherapy on the efficiency of the physical therapy we also appealed to statistics. It has shown that these have no influence on the physical therapy protocol (table 2).

A very powerful factor was the associated pathology. We have compared both groups, which had spine arthrosis, dorsal kyphosis and dorso-lumbar scoliosis (table 3).

Taking into consideration that the above mentioned pathology is influenced by the individual profession (if he stands or sits down at work) and by habitat (rural or urban), we have compared the statistic data, which revealed that the results of the physical therapy protocols are not influenced by profession and habitat (table 4).

Table 2. Drug and physiotherapy influence

Variable	Procedure	Research group	Control group	P
<b>Physiotherapy</b>	<b>ionization</b>	4 (9.8%)	4 (10%)	1
	<b>ultrasound</b>	24 (58.5%)	13 (32.5%)	0.033
	<b>Diadynamic currents</b>	11 (26.8%)	5 (12.5%)	0.18
	<b>TENS</b>	10 (24.4%)	11 (27.5%)	0.948
	<b>Alternative bathing</b>	3 (7.3%)	1 (2.5%)	0.616
	<b>Lymphatic drainage</b>	2 (4.9%)	0%	0.494
	<b>Laser</b>	16 (39%)	12 (30%)	0.535
	<b>Paraffin</b>	16 (39%)	10 (25%)	0.265
	<b>Pool physical therapy</b>	14 (34.1%)	14 (35%)	1
	<b>Sedative massage</b>	29 (70.7%)	34 (85%)	0.202
<b>Drugs</b>	<b>non steroidal anti inflammatory unguents</b>	6 (14.6%)	10 (25%)	0.372
	<b>Oral non steroidal anti inflammatory</b>	14 (34.1%)	8 (20%)	0.237
	<b>Oral analgesics</b>	14 (34.1%)	6(15%)	0.082

Table 3. Associated pathology evolution and repartition

Pathology	Research group	Control group	P
<b>Spine spondilosis</b>	1 (2.4%)	1 (2.5%)	0.134
<b>Dorso-lumbar scoliosis</b>	6 (14.6%)	0%	0.524
<b>Dorsal kyphosis</b>	17 (17.1%)	10 (10%)	0.167

Table 4. Profession type and habitat

Variable	Research group	Control group	P
<b>Office work</b>	47.50%	50%	0.568
<b>Standing work</b>	52.50%	50%	
<b>Rural</b>	12 (29.3%)	8 (20%)	0.478
<b>Urban</b>	29 (70.7%)	32 (80%)	

When evaluating the postural recovery, the statistics revealed that both protocols are alike as far as efficiency is concerned ( $p=0.171$ ). If we take into consideration that the start values of wall-tragus test at the research group were worse than the start values of the control group, than we must draw the conclusion that the research protocol has higher efficiency than the Williams protocol.

The smaller values of the wall-tragus test at the patients from the control group shows that these patients have had a better posture than the research group patients (table 5).

Table 5. Assessing the cervical spine posture with wall-tragus test

Test	Group	Mean	Std. Deviation
Wall-tragus test (cm) day 1	Research	13.634	1.884
	Control	13.05	1.836
Wall-tragus test (cm) day 5	Research	13.232	1.732
	Control	13.05	1.605
Wall-tragus test (cm) day 10	Research	13.268	1.632
	Control	12.685	1.446

The more obvious posture modifications were registered at the wall-tragus test between day 1 and day 10 ( $p=0.009$ ). There were not significant changes between day 1 and day 5 ( $p=0.097$ ) and between day 5 and day 10 ( $p=0.149$ ).

The other test for cervical spine posture rehabilitation is the menton-stern test. This test also underlines the regain of the cervical muscle tone balance and of the length between flexors and neck extensors. The higher flexion mobility is due to the decreased extensor muscles contracture (table 6).

The statistics showed that the research protocol is as good as the Williams protocol ( $p=0.584$ ).

Table 6. Cervical spine mobility assessment with menton-stern test

Test	Group	Mean	Std. Deviation
Menton-stern test Day 1	Control	3.525	1.235
	Research	3.549	0.893
	Total	3.537	1.069
Menton-stern test Day 5	Control	3.425	0.910
	Research	3.317	0.669
	Total	3.37	0.794
Menton-stern test Day 10	Control	3.313	0.889
	Research	3.329	0.803
	Total	3.321	0.842

As well as at the wall-tragus test we compared the evolution of the menton-stern test between day 1-5, day 5-10, day 1-10. The data shows that the flexion mobility of the neck has an obvious improvement starting with day 5 to day 10 (table 7).

Table 7. Cervical spine mobility evolution at the menton-stern test

Day	1-5	5-10	1-10
P	0.03	0.356	0.01

## Discussions

Putz & Muller-Gerbl (1996) said that the cervical spine has three main functions: it has to support the body and allow it to freely move into space, it has to protect the spinal cord and the spinal nerves root. The structure of the cervical spine is especially designed to simultaneously sustain the three above mentioned functions (Cramer et al 2014).

The cervical spine integrity and the correct posture is mandatory for an adequate biomechanics and for the prevention of inadequate and premature over use and deterioration of the active and passive spine structures.

Among the movements of flexion-extension, rotation and side flexion, the spine has coupled motions. For example, at the cervical level, the side flexion of the spine is associated with vertebral body rotation towards the concavity of the curvature and at the lumbar spine, the mechanism is in the opposite direction (the vertebral body rotates towards the convexity of the curvature) (Cramer et al 2014).

The spinal ligaments allow a smooth movement with the minimum resistance and with the maximum conservation of energy on the condition that the movements take place in the physiological range of movement.

The degeneration of the spine structures determined an increased mobility (on the first stages). This leads to ligament injury, faulty proprioception and a poor cervical spine stability (Cramer et al 2014).

These facts shows the fragility of the spine balance and demonstrates the importance of the posture recovery program in prevention of the deterioration and of the irreversible spine modification.

This study underlines the importance of the cervical spinal curve realignment, and demonstrates the efficiency of the posture and cervical spine mobility rehabilitation in avoiding the deterioration of lumbar biomechanics and lumbar overuse.

In the last years, the researchers have tried to locate and to define the way in which the biomechanical changes lead to the onset and the evolution of low back pain. Some of them sustain that the influence of the biomechanics over the clinical manifestation of low back pain is uncertain (Mitchell et al 2008), others demonstrate the way in which a faulty posture determines the onset or the aggravation of the lumbar pathology (Alsiddiky et al 2015; Minghelli et al 2014).

The most recent study related to the forward head posture and low back pain shows a significant improvement of posture and lumbar symptomatology due to postural rehabilitation exercises (Moustafa et al 2015).

## Conclusions

A healthy posture is essential for a good biomechanics and optimum function of the spine;

A very early rehabilitation of the bad posture habits is mandatory for prevention of premature degeneration of the spine active and passive structures;

Besides the prevention and treatment of the postural disorders, it is very important to exercise physical therapy protocol as much as possible. The physical therapy must be completed with a weekly routine of dynamic sport, for increasing the whole body stamina.

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