CHARLES UNIVERSITY IN PRAGUE
FACULTY OF PHYSICAL EDUCATION AND SPORT
DEPARTMENT OF PHYSIOTHERAPY

"PHYSIOTHERAPEUTIC TREATMENT OF A PATIENT WITH DISC HERNIATION AT L4/L5"

BACHELOR THESIS

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April 2014, Prague

ABSTRACT

Title of the thesis: Physiotherapeutic treatment of a patient with disc herniation at l4/l5

Author: Falidas Konstantinos

Work placement: Ustředni Vojenská Nemocnice in Prague.

Summary

In this bachelor thesis which was written and organized by myself, it is divided in two parts. The general part and the special part.

The general part, which is the theoretical part, it includes all the anatomy of the lower back, specifically the vertebrae of the spine, the muscles, the lumbosacral plexus, joints, ligaments and fasciae of the lower back. The biomechanics of the lumbar spine and intervertebral disk. The kinesiology of the lumbar spine. Then, it is explained in details what is low back pain and disk herniation. Mentioning the common causes, etiology, symptoms, risk factors, physiotherapy examination, conservative and non-conservative treatment.

The second part of the thesis, which it's the special part, it includes the whole case of my patient with low back pain due to disk herniation. In this parts it is also included the whole anamnesis/history of my patient, the whole examination (initial and final examination), and the therapy sessions which were 6. And finally the evaluation of the effect of the therapy sessions.

Keywords

Case study, low back pain, disk herniation, conservative treatment, physiotherapy, exercise.

DECLARATION

I state that this bachelor thesis was managed by me independently and by the instructions of Mgr. Helena Vomáčková. It is an original work which is based on casuistic practice with patient in under the supervising of Mgr. Barbora Grmanová.

I also state that all the information, examination and therapeutic procedures, which are presented on this bachelor thesis, were performed based on my knowledge that I gained from the teachers of the Charles University in Prague, department of physiotherapy. However, certain information was taken from the list of bibliography that exists in the end of this thesis.

Finally a proposed informed approval was assigned by the patient at 6.2.2014, and the patient was informed before every examination and therapeutic procedure.

Konstantinos Falidas

April 2014, Prague

ACKNOWLEDGMENT

I would like to express my great thanks to teachers of the university for all their help, understanding and for all the knowledge they imparted in me during the years of my academic life.

I would also like to give my most grateful thanks to my supervisor Mgr. Helena Vomackova for her valuable help and direction that she gave to me.

Finally, I would like to thanks all my classmates for their cooperation during the years of my studying.

DEDICATE

First of all, I would like to dedicate this thesis to my parents for their big support and the help that they gave to me .I would like to thank them for helping becoming the person that I am today, and giving me the opportunity to study in Prague and fulfil my dream of studying and becoming a physiotherapist.

Moreover I would like also to dedicate this thesis to my best friends Dominic Kalafatis , Emmanouil Kassakis ,Antonios Markantonakis and Minas Kouroglou for supporting me during the my whole academic years, in the good and the bad moments. I am very glad that I met them here in Prague and had together very beautiful moments. I will never forget those memories that I shared with them.

Konstantinos Falidas

Table of contents

1. INTRODUCTION

The objective of this thesis is to highlight the physiotherapeutic approaches for a patient with lumbar disc herniation at L4/L5 segment. The beginning of the thesis starts with the theoretical part which contains the anatomy of the spine and more specifically the anatomy of the lumbar spine, vertebras, intervertebral disc, muscles, ligaments joints of the lumbar spine, kinesiology and biomechanics of the lumbar spine. After that I will discuss the theory concerning the low back pain and more specifically the theory for the lumbar disc herniation, and the conservative and non-conservative treatment of that type of diagnosis. The differential diagnosis of the lumbar disc herniation will be discussed as well.

The main part of this thesis is a case study of patient with the diagnosis of lumbar disc herniation at L4/L5 segment and is explained the examination and the therapy that is applied to the patient. The clinical practice took place at Ustředni Vojenská Nemocnice in Prague at the neurology department. The thesis contains a list of figures, tables and abbreviations where can be found in the supplements.

2. GENERAL PART

2.1. Vertebral column in general

The vertical column is divided into the cervical spine, thoracic spine and lumbar spine. Each spine consists of vertebrae. There are approximately 33 vertebrae which are subdivided into 5 groups. These groups include: seven cervical vertebrae, twelve thoracic vertebrae and five lumbar vertebrae. The vertebral column is separated by intervertebral discs. It protects the spinal cord in the spinal canal. The symphysis between adjacent vertebral bodies is formed by a layer of cartilage on each vertebra body and an intervertebral disc, which is located between the layers of the vertebrae.[8]

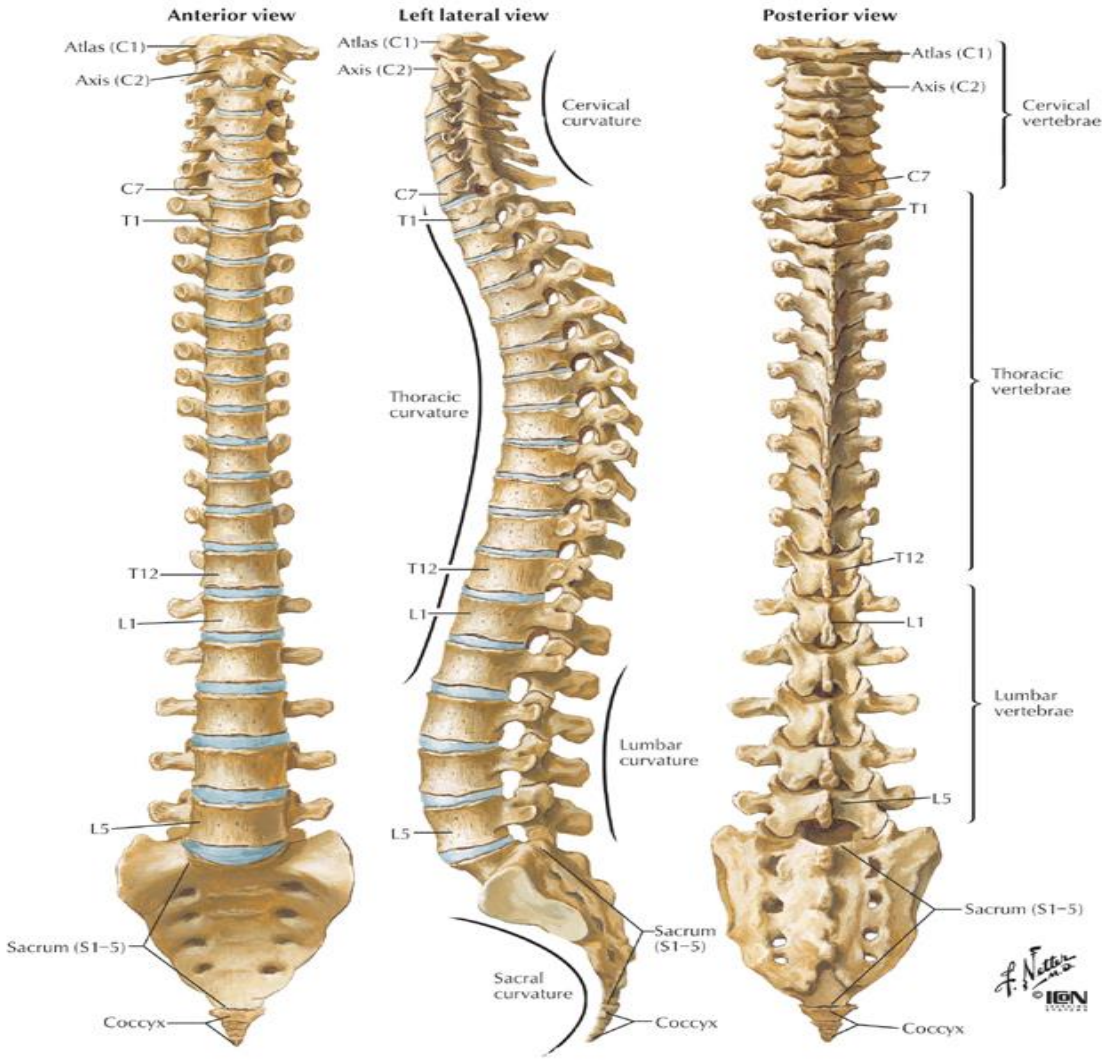

Figure No 1.Anatomy of the spine in anterior, posterior and lateral view. [33]

2.1.1. Curves of the spine

The spine is formed by four segments. When it is viewed from the side, these segments are forming four natural curves. These curves include the cervical curve, the thoracic curve, the lumbar curve and the sacral curve. The curvatures of the spine are also divided into two categories. The primary curvatures and the secondary curvatures. The primary curvatures of the vertebral column are concave in anterior, and are found in the thoracic and sacral regions (thoracic and sacral curvature).The secondary curvatures, which are concave in posterior, are found in the cervical and lumbar regions (cervical and lumbar curvature) and allow the body weight to be in balance on the in a way that expends the least amount of muscular energy to maintain an upright bipedal posture.
If any one of the curves becomes too large or even small, it becomes difficult to stand up straight and make the posture to be abnormal. [8]

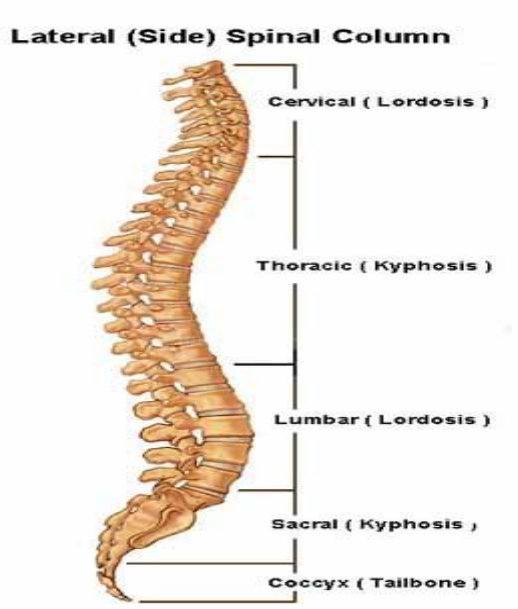

Figure No 2.Curves of the spine [3]

2.1.2. Role of vertebra column

The biggest role of vertebra column is that it supports the mass of the body and head and resists the external forces. Protects the nervous system. In the book of Lewit it is demonstrated that a spinal column with restricted mobility is no longer able to carry out its protective function.

The effects move to the structures of the nervous system, and on the spinal column that is causing the damage to them.

The vertebral column and the soft tissues of the back contain the spinal cord and proximal parts of spinal nerves. It allows mobility and flexibility to absorb energy and also gives protection against impacts. Moreover it allows the movement of flexion, extension, rotation and lateral flexion. The trunk and the ligaments are able to act on each vertebra for giving postural control, balance and spinal stability. [8, 18]

2.2. Vertebra in general

In general vertebra consists of a vertebra body and a vertebral arch. The vertebral body is located anterior and has weight-bearing function. The vertebral arch is located to the posterior surface of the vertebral body and has two pedicles, which form the lateral pillars of the vertebral arch. The anterior part the vertebral arch is formed by right and left lamina. The vertebral arches of the vertebrae form the walls of the vertebral canal, which starts from the first cervical vertebra until the last sacral vertebra. The vertebral arch has a lot of projections, which acts as attachments for muscles and ligaments. They act also as levers to help the action of muscles and they have places for articulation with neighboring vertebras. On every side of the vertebral arch there is a transverse process which extends laterally. From the same place, a superior articular process and an inferior articular process articulate with similar processes on neighboring vertebras. Also each vertebra includes elements of ribs. [8]

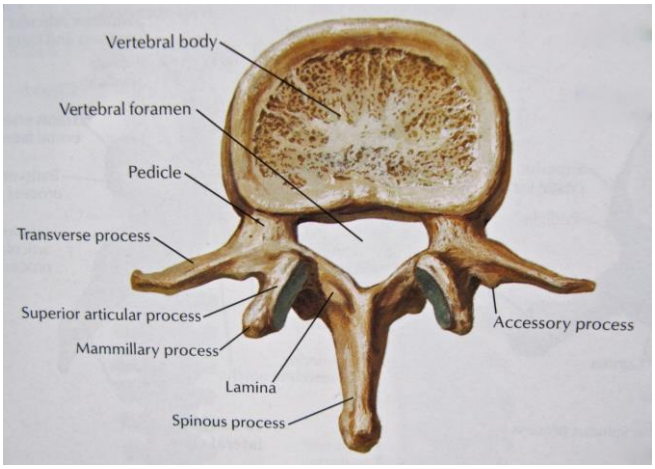

Figure No 3. Anatomy of vertebra (lumbar vertebra) [22]

2.2.1. Intervertebral Disc

The intervertebral Discs consist of an outer annulus fibrosus, which surrounds the inner nucleus pulposus. The annulus fibrosus consists of several layers of fibro cartilage. The annular fibers contain the nucleus pulposus and distribute the pressure that is applied to them along the disc. The nucleus pulposus contains loose fibers suspended in a mucoprotein gel with the consistency of jelly.

The nucleus of the disc has a shock absorber function, absorbing the impact of the body's daily activities and keeping the two vertebrae separated. [8]

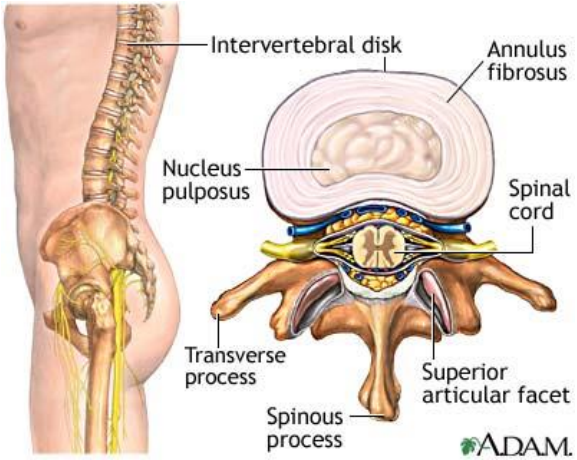

Figure No 4. Intervertbral disk [12]

2.3. Anatomy of lumbar spine

2.3.1. Lumbar vertebra

The lumbar spine specifically consists of 5 lumbar vertebra and they are different from the vertebras because of their large size. Also, they don’t have facets for articulation with ribs. The transverse processes are thin and long except those that are on vertebra L5, which are massive and cone-shaped because they are used for the attachments of iliolumbar ligaments to connect the transverse processes to the pelvic bones. The vertebral body of a typical lumbar vertebra is cylindrical and the vertebral foramen is triangular in shape and bigger than the thoracic vertebrae. Picture of lumbar vertebra is showed before (Figure No 3) [8]

2.3.2. Sacrum

The sacrum is a single bone that consists of five sacral vertebrae. It has triangular shape and his apex pointed inferiorly. It has a concave anterior surface and a convex posterior surface. It articulates above with vertebra L5 and below with the coccyx. It consists also from two large L-shaped facets, one on each lateral surface, and this is for the articulation with the pelvis bone.

The posterior surface of the sacrum has four pairs of posterior sacral foramina, and the anterior surface has four pairs of anterior sacral foramina for the passage of the posterior and anterior rami, respectively of S1 to S4 spinal nerves. [8]

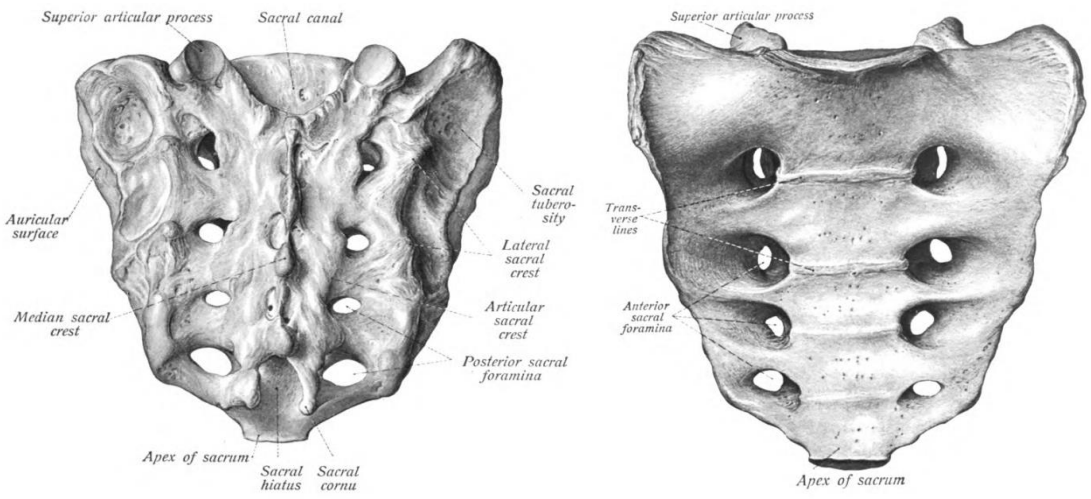

Figure No 5. Sacrum [28]

2.4. Joints of Lumbar spine

2.4.1. Intervertebral joint

The definition of the intervertebral joint is that the intervertebral joint is the space that is located between two vertebras. This space helps the movements to occur in the spine. The meeting points of the two spinal bones involved in forming an intervertebral joint are the vertebral body (the front portion) and the vertebral arch (the back portion). Between the vertebral bodies, the intervertebral discs absorb any forces applied to them. [8]

2.4.2. Zygapophysial joints

Zygapophysial joints or else known as facets joints are synovial joints and they are located between superior and inferior articular processes on vertebras. A thin articular capsule attached to the margin of the articular facets and encloses each joint. In lumbar regions, the joint surfaces are curved and adjacent processes interlock, thereby limiting range of movement, thought flexion and extension are still major movements in the lumbar region. [8]

2.4.3. Lumbosacral and sacroiliac joints

The lumbosacral joint is located between the first sacral segment and the last lumbar vertebra. It has to be mentioned that it bears the most the human body and stress. The sacroiliac joint is a joint which is located between the Ilium of the pelvis and sacrum. Every person has 2 sacroiliac joints, one on right and one on the left side. The sacroiliac joints transmit forces from the lower limbs to the vertebral column. They are synovial joints between the L-shaped articular facets on the lateral surfaces of the sacrum and similar facets on the iliac parts of the pelvic bones. The joint surfaces resist movement. Each sacroiliac joint has three ligaments. The anterior sacroiliac joint, the interosseous sacro-iliac ligament and the posterior sacroiliac ligament. [8]

2.5. Ligaments and connective tissues

Joints between vertebrae are braced and they are supported by numerous ligaments, which pass between vertebral bodies and interconnect components of the vertebral arches.

2.5.1. Anterior, Posterior longitudinal ligaments and ligamenta flava

The anterior and posterior longitudinal ligaments are located on the anterior and posterior surfaces of the vertebral bodies and pass through most of the vertebral column. Another ligament is called Ligamenta flava. It is located on each side and passes between the laminae of adjacent vertebrae. It is thick and consists of elastic tissue and forms a part of the posterior surface of the vertebral canal. [8]

Each ligamentum flavum passes between the posterior surfaces of the lamina on the vertebra below to anterior surface of the lamina of the vertebra above. The ligament flava resist in flexion and assists in extension. [8]

2.5.2. Supraspinous and Interspinous ligaments

The Supraspinous ligament connects and comes along and over the tips of the vertebra spinous processes from cervical vertebra to the sacrum. The Interspinous ligaments pass between adjacent vertebral spinous processes. [8]

They attach from the base to the apex of each spinous process and bend with the Supraspinous ligament posteriorly and the ligament flava anteriorly on each side. [8]

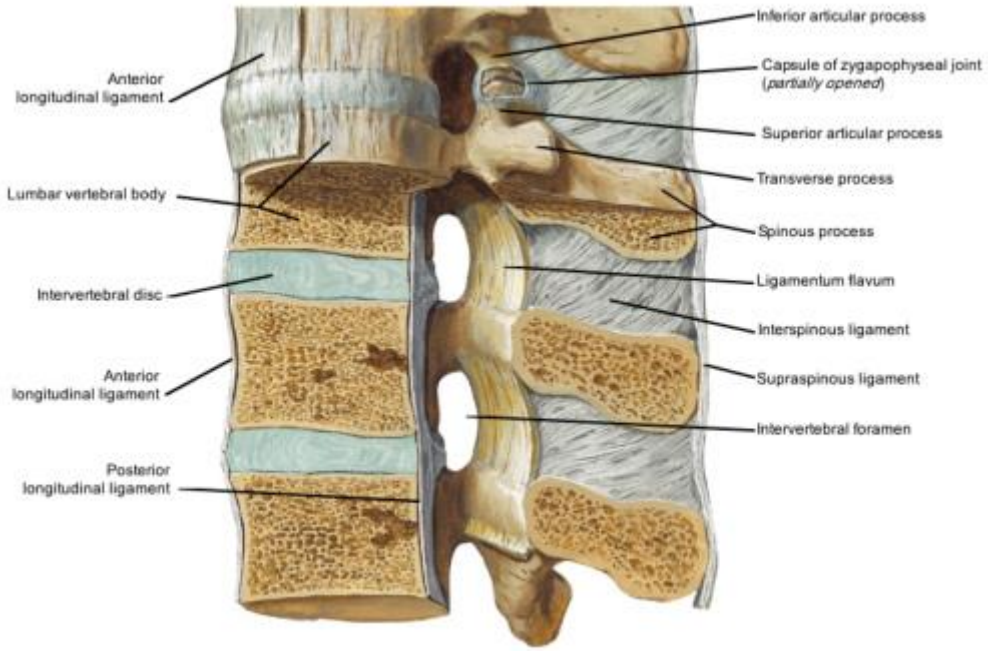

Figure No 6. The spinal ligaments in the lumbar region seen from the side with the lower two and half vertebrae partially excised. [23]

2.6. Fascia of lumbar spine

2.6.1. Thoracolumbar fascia

The thoracolumbar fascia (lumbodorsal fascia) is a membrane which covers the deep muscles of the back of the trunk. It consists of three layers, the anterior, posterior and the middle. The thickest layer of the thoracolumbar fascia is the posterior layer and the thinnest layer is the anterior. [8]

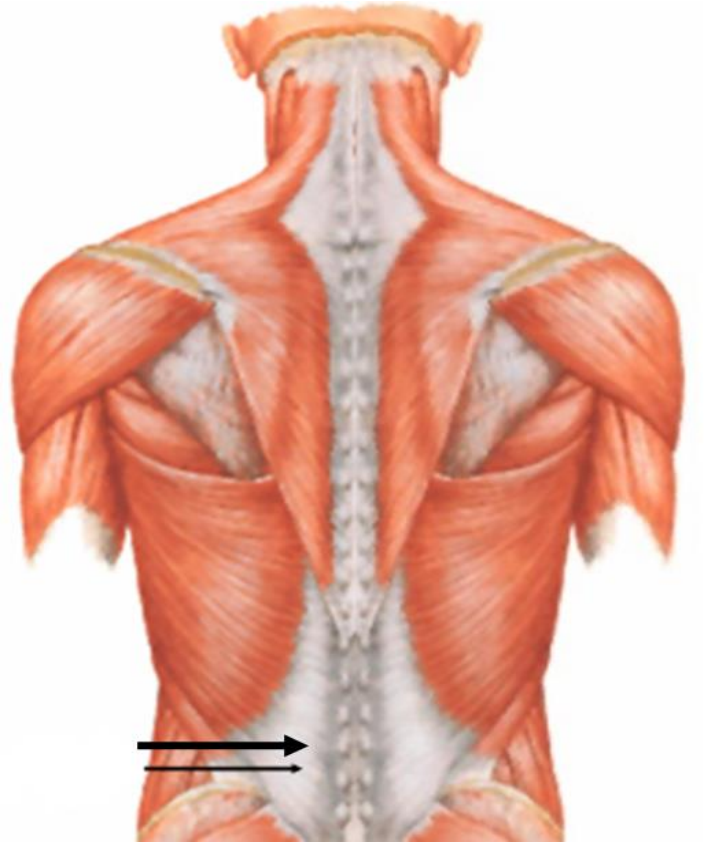

Figure No 7.Thoracolumbar fascia [13]

2.7. Muscles of the back anatomy and function

Muscles of the back consist of extrinsic and intrinsic groups. The extrinsic muscles of the back move the upper limbs and the ribs. The intrinsic muscles of the back maintain posture and move the vertebral column. The movements of the vertebral column include flexion, extension, lateral flexion and rotation. [8]

Muscles of the back are organized into superficial, intermediate and deep groups. The muscles in the superficial and intermediate groups are extrinsic muscles because they originate embryo logically from locations other than the back.

They are innervated by the anterior rami of spinal nerves. Muscles of the deep group are intrinsic muscles because they develop in the back. They are innervated by posterior rami of spinal nerves and are directly related to movement of the vertebral column and head. There are four functional groups of muscles that govern the lumbar spine and can be divided into extensors, flexors, lateral flexors, and rotators. Synergistic muscle action from both the left and right side muscle groups exist during flexion and extension of the L-spine. [8]

2.7.1. Extensors

The muscles which apply extension are divided into three layers. The most important muscle for the extension is the erector spine muscle. The erector spine muscle it starts in area of lumbar spine as single muscle (one muscle) and in the area of upper vertebra it is separated into three muscles. Those three muscles are the iliocostalis, the longissimus and the spinalis muscle. [16]

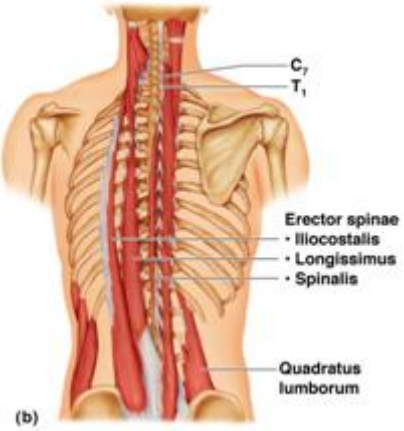

Figure No 8.Muscles of the back, extensor muscles [8]

Another group of muscle of the back is called transversospinal muscles. Their function is the extension and the rotation of the vertebral column. It has to be mentioned that their size is small and they have a small role during motion.

The transversospinal group of muscles contains the following muscles: the semispicalis (cervicis, thoracis and capitis), the multifidus muscle, the rotators lumborum and the rotator (thoracis and cervicis). [16]

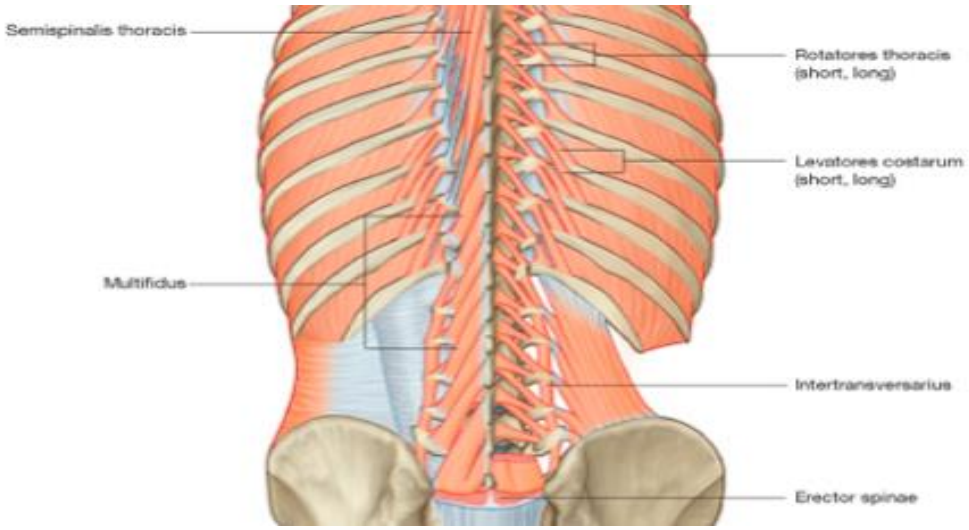

Figure No 9: Transversospinal muscles. [8]

The deepest layer of the lumbar spine extensors consists of big variety of small muscles. They are divided into two groups. The first group consists of the muscles called levatores costarum, and the second group consists of the interspinales and intertransversarii muscles. Their function is stabilization of posture and they help the efficiency of the action of the bigger muscles. [16]

2.7.2. Flexors

The flexors of the lumbar spine consist of the iliothoracic group of muscles, which belong to the extrinsic muscles, and the femorospinal group of muscles, which belongs to the intrinsic muscles.

The iliothoracic group is made up of the abdominal wall muscles. The abdominal wall muscles consists of the rectus abdominis, the external oblique, internal oblique, and the transverse abdominis muscle.

The femorospinal is made up from the psoas major muscle and the iliacus muscles, which their function is the flexion of the hip and flexion of the trunk. [16]

2.7.3. Lateral flexors

Concerning the lateral flexion it can be described as a side bending and rotation motion. During side bending there is contraction of the ipsilateral oblique, transverse abdominal muscle and quadratus lumborum muscle.

The unilateral contraction of quadratus lumborum can assists in lateral flexion and in elevation of the ilium, while the bilateral contraction can assist in the extension of lumbar spine. [16]

2.7.4. Rotators

It has to be mentioned that the rotation of the lumbar spine can be done by unilateral contraction of muscles that follow an oblique direction of pull. Most of the lateral flexors and extensors can produce an oblique course and as a consequence produce rotation.

The transversospinal group of muscles if they are contracted unilaterally they help the trunk to rotate. [16]

2.8. Anatomy of lumbosacral plexus

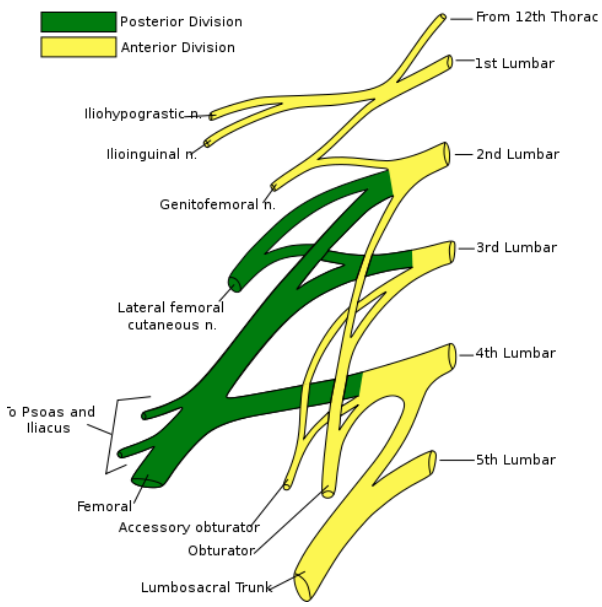

Figure No 10. Lumbar plexus. [8]

The Lumbar plexus is formed by the ventral primary rami of L1, L2, L3 and a part of L4 and a part of L4 and frequently with a small contribution from TH12. Within the substance of the psoas major muscle, the rami branch into anterior and posterior divisions. Peripheral nerves from the anterior divisions innervate adductors muscles on the medial side of the thigh and those from the posterior divisions innervate the hip flexors and knee extensors on the anterior aspect of the thigh. [15, 8]

The sacral plexus arises from the smaller part of the ventral primary ramus of L4 and from the entire ventral rami of L5, S1, S2 and S3.The L4 and L5 ventral rami unite to form the lumbosacral trunk, which enters the pelvic cavity.

There, it is joined to by the ventral rami of S1, S2 and S3 forming the plexus, which then branches into anterior and posterior divisions. The anterior divisions and the peripheral nerves arising from them, innervate the posterior aspect of the thigh and the leg as well the plantar surface of the foot. The posterior divisions and the peripheral nerves arising from them, innervate the abductor muscles of the lateral side of the thigh, a hip extensor muscle posteriorly and the extensor, dorsiflexor muscle of the ankle and the toes anteriorly. [15, 8]

2.9. Biomechanics of Lumbar spine and intervertebral disc

The lumbar vertebras in comparison with the thoracic and cervical vertebra are larger in size. The reason is that they reduce the amount of stress that is applied to the lumbar spine .They act as a weight –bearing component of the spine and assists also in load bearing. As it is described in the next paragraph the intervertebral discs and the facet joints help the spine to resist in tear and torsion forces. [10, 11]

The main role of the disc in the spine is to allow the motion and the flexibility of the spine. Another important role is that together with the facets joints, the carry all the load that is applied to the trunk. There are different types of loads and stresses that are applied to discs such as dynamic or static loads and shear stresses. [14]

2.9.1. Loads and pressure of lumbar spine and intervertebral discs during movement of spine.

Here there is a research that is done to intervertebral disc. The aim of the research was to show the pressure that is applied to the discs under certain loads and movements.

According to research in an upright standing posture, the average pressure at all levels (L1/L2 to L4/L5) was approximately 0.2 MPa under a preload of 300 N, and was 0.324 MPa and 0.42275 MPa under preloads of 460 N and 600 N, respectively. In flexion, the pressure increased noticeably compared with other postures and had a value of approximately 0.9 MPa at level L1/L2 under a forward bending (flexion) moment of 20 Nm. In the case of left and right rotations, the intradisc pressures were relatively larger at level L1/L2 than those at other levels under the same loading and different preloads. For the left rotation, levels L1/L2 and L4/L5 had values higher than levels L2/L3 and L3/L4. [5]

Level L2/L3 did not appear to be affected by the left/right rotation postures and maintained a value of approximately 0.2 MPa when subjected to a rotation moment of less than 15 Nm. Similarly results were obtained for level L3/L4 under a rotation moment of less than 10 Nm. As in the case of extension, initially the intradisc pressures at levels L2/L3 and L3/L4 were reduced temporarily, then after the backward bending moment exceeded 10 Nm or 15 Nm, the pressures gradually increased. [5]

2.10. Kinesiology of lumbar spine

While a healthy person is standing, the lumbar spine typically exhibits about 40 to 50 degrees of lordosis. From this neutral position, the lumbar spine can move in three degrees of freedom. The approximate Range of motion for the three planes of movement for the lumbar region is that:

The flexion and extension in sagittal plane is 40 -50 degrees for flexion and 15-20 degrees for extension while the total range of motion is about 55 -70 degrees

For axial rotation in horizontal plane the degrees are 5 to 7 and in lateral flexion, in frontal plane, the degrees are about 20. [24]

2.10.1. Flexion of lumbar spine

During flexion between 2 vertebral segments, the inferior articular facets of the upper vertebra segment slide superiorly and anteriorly, relative to the superior facets of the lumbar vertebra. As a consequence forces from body weight are transferred away from the apophyseal joints (which normally support 20% of total spinal load in erect standing) and more towards the discs and vertebral bodies. This is one reason of disc prolapsed. [24, 1]

The intervertebral joints have the tendency to resist when flexion movement is applied to the lumbar spine. It is important to mention that excessive or prolonged flexion of lumbar region generates increased compression force on the anterior side of the disc, ultimately deforming the gel-like nucleus pulposus in a posterior direction. [24, 2]

In the healthy spine the magnitude of the posterior deformation is small and usually of no consequence. In some cases the nuclear material may impinge against the spinal cord or nerve root. This potentially painful impairment is frequently referred to as a herniated or prolapsed disc or more formally a herniated nucleus pulposus. [24]

2.10.2. Extension of lumbar spine

Extension of the lumbar region is essentially the reverse kinematics of flexion and it increases the natural lordosis. When lumbar extension is combined with full hip extension, the increased passive tension in the stretched flexor muscles and capsular ligaments of hip promotes lumbar lordosis by generating an anteriously tilting force on pelvis. Extension between 2 vertebras occurs as the inferior articular facets of the upper

vertebra slide inferiorly and slightly posteriorly relative to the support facets of the lower lumbar vertebra.

As with flexion, extension of the lumbar spine significally affects the diameter of the intervertebral foramina and the potential for deforming the nucleus pulposus. Full extension, tends to deform the nucleus pulposus in an anterior direction. [24]

However, full lumbar extension has been shown to reduce pressure within the disc and in some cases to reduce the contact pressure between the disc placed nuclear materials and the neural tissues. [21]

The reduced contact pressure after sustained full extension may occur because the nuclear material is pushed forward and away from the neural tissues, because the neural tissues are pulled posteriorly and away from the nuclear material. Robin Mc Kenzie popularized and emphasized lumbar extension exercises and postures as a way to reduce radiation pain and radiculopathy from posterior herniated nucleus pulposus. [21]

2.10.3. Lateral flexion

Ligaments on the side opposite the lateral flexion limit the motion. Normally the nucleus pulposus deforms slightly away from the direction of the movement or stated differently, toward the convex side of the bend. [24]

2.10.4. Axial rotation

Rotatory degrees ($5^{o} – 7^{o}$) in horizontal plane occur to each side thought the lumbar region. For example axial rotation between L1 and L2 to the right occurs as the left inferior articular facet of L1 approximated or compressed against the left superior articular facet of L2. Simultaneously, the right inferior articular facet of L1 separates slightly from the right superior articular facet of L2.It is remarkable that just over 1 degree of unilateral axial rotation has been measured at L3-L4 intervertebral joint. [24]

2.11. Low back pain

As far as the low back pain is concerned, it affects big amount of people around the world. It is a case which can be caused by many factors. Low back pain is a common symptom in general population and in sports-people also. [39]

Concerning the epidemiology the pain in the low back area affects up to 85% of the population during their life. The 90% of the majority of people have improvement over a three-month period, but it has to be mentioned that almost the 50% will have at least one recurrent episode. Low back pain is one of the most common disabilities in people under the age of 45, and also the most expensive health care problem in people the ages between 20 and 50 years old. [4]

Risk factors that have been associated with low back pain named above: [4, 19, 20]

- age
- gender
- obesity
- height
- posture
- smoking
- physical work
- sedentary occupation: risk is increased while sitting for a long time. Driving a motor car may cause Low back pain or herniated disc , jobs involving all standing or all sitting show higher incidence of low back pain.
- decreased fitness
- psychological factors such as stress, anxiety and depression

2.11.1. Etiology of low back pain

As it was said above low back pain can be appear due to a great variety of causes. The most common causes of low back pain include: [4, 19]

- somatic injuries in the intervertebral discs and apophyseal joint or else known as zygapophysial joints or facet joints
- sacroiliac joint injury or inflammation
- paravertebral and gluteal muscle triggers points

- intervertebral disk prolapse (intervertebral disc herniation), this cause will be discussed beneath in details.
- spondylolisthesis
- lumbar hypermobility
- spinal canal stenosis
- vertebral fracture
- hip joint pathology
- fibromyalgia
- rheumatologic causes
- gynecological causes
- gastrointestinal causes
- genitourinary causes

2.12. Disk herniation

Herniation of the nucleus pulposus can happen when the nucleus pulposus breaks and passes through the annulus fibrosus of an intervertebral disc. A herniated disc usually happens in the lumbar region of the spine at the L4-L5 and L5-S1 levels .As it is said before the lumbar spine carries most of the body load. People at the ages between of 30 and 50 appear to have disc herniation because the elasticity and water content of the nucleus decreases as people grow up. [6, 20]

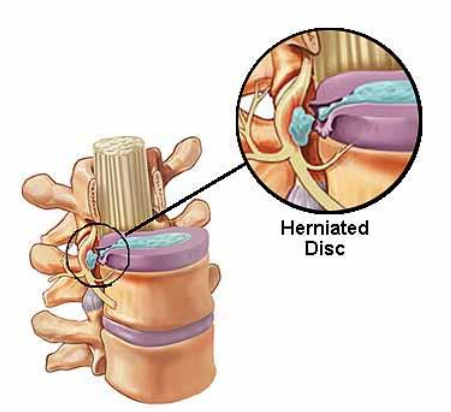

Figure No 11. Disc herniation. [26]

Lumbar disc herniation is a common spinal disc condition that causes lower back pain and other symptoms throughout a patient's lower body. [27]

Disc herniation can cause also cause pain in the lower extremity of the same side that the disc herniation is located. This condition is described as a term with the name Sciatica. Spinal disc herniation pressing on one of the lumbar or sacral nerve roots is the primary cause of sciatica, being present in about 90% of cases. [38]

In lumbar spine is most common for someone to have disc herniation because it is the base of support of body's weight and is also very flexible.

This is reason why it has big chance of degeneration and injury in comparison with the neck and rest of the back. [27]

Disc herniation can cause an inflammation response that can affect the nerve root or there can be mechanical compression, both of which can cause radicular symptoms. However, disc herniation can cause solely axial pain. Diagnosing discogenic low back pain is a challenge, because it also known that asymptomatic subjects can have disc herniation present on MRI examination.

2.12.1. Types of disc herniation

Disc herniation is very specific case. Disc herniation has several types according to the place of location in the intervertebral disc and according to the stages that the disc is herniated in the intervertebral disc. As far as the place of location is concerned it can be appeared at lateral, poster lateral, central, paracentral and posterior to the spinal column. [27]

The development of a disc herniation varies from slow to sudden onset of symptoms. Concerning the stages that a disc herniation has, there are four: [6]

- The first is called disc protrusion. During that stage the disc bulges posteriously without causing any rupture of the annulus fibrosus.
- The second stage is the prolapsed disc. During that stage the nucleus pulposus goes into the layer of the annulus fibrosus.
- The third stage is called extrusion of the disc. During that stage there is pierced and part of nucleus pulposus is moved into the epidural space of the spinal canal.
- The fourth stage is called sequestration of the disc. During that stage the annulus fibrosus and the nucleus pulposus go outside of the disc.

The 1st and the 2nd stage are incomplete herniations and the 3rd and 4th stage are described as complete herniations.

All these injuries can cause pressure to the spinal cord and can lead to myelopathy , pressure to cauda equine , which leads to cauda equine syndrome and the person need immediately surgery, or they can lead to the (most common) pressure of nerve roots. Important is to mention that the pain that results from a herniated disc may cause also neurological deficit.

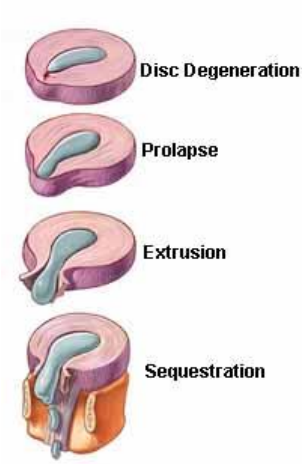

Figure No 12.Stages of disc herniation. [6]

The pain resulted from disc herniation can affect the extremities of the body. That depends on the location of the herniation at the spine. If the herniation is located at the cervical spine then there will be probably pain in the neck, shoulders and arms. If it is located at the thoracic vertebra then the pain will be into the chest. If the herniation is located at lumbar vertebra then the pain will be at the buttocks, thigh and legs.
[6, 17, 20]

A serious syndrome that may result from disc herniation is known as the Cauda Equina Syndrome. This syndrome can happened when there is compressure of the nerves roots in the lumbar spine and can lead to loss of sensation between legs and movement, buttocks, thighs, back side of legs, feet. Also the most serious symptom is the bladder and bowel dysfunction that can lead to retain of urine.

2.12.2. Etiology and epidemiology

The etiology of the disc herniation is that the nucleus that is located inside the disc is pushed or pressed out towards outer space which is called annulus fibrosus. This effect can be caused by a sudden injury or heavy weight lift, which is the most common cause. Also disc herniation may be caused because of disk degeneration.

As it is mentioned disc herniation can lead to pain to the lower back and radiation of the pain to the lower extremities on the same side that the herniation is appeared. This symptom is also known as sciatica. [20, 19]

2.12.3. Clinical picture

The most common region of lumbar disc herniation is between the segments of L4/L5 and L5/S1. When the herniation is located for example at L4/L5 segment it usually affects the nerve root of the lower vertebra which in this case is nerve root of L5. [20, 17]

Patients suffering from Lumbar disc herniation have usually the beneath clinical picture:

- pain in the area of low back (lumbar spine)
- pain that radiates down towards the lower extremities
- sciatica
- decrease deep tendon reflexes of patella and achilles tendon on the affected side
- decrease sensation of the dermatomes or dermatome that is affected
- muscle weakness and numbness in the areas that pass the affected nerve root of lumbar spine
- poor posture (antalgic or revealing posture). in acute cases there is a characteristic antalgic (or relieving) posture that is also adopted in response to radicular pain. [19, 18]

2.12.4. Physiotherapy examination

- anamnesis
- muscle tone examination by the means of palpation
- postural examination
- gait examination
- anthropometric measurements
- range of motion
- muscle length test by janda
- muscle strength test by kendall
- examination of soft tissue and fascia by lewit
- examination of joint play by lewit
- neurological examination
  - examination of dermatomes
  - examination of deep tendon reflexes
  - position sense
- special tests
  - trendelenburg
  - romberg
  - 2 scale test
  - dynamic test

2.12.5. Complete examination for patient with disk herniation in lumbar spine

When a patient is presented his low back pain, a complete lumbar spine exam should be performed in order to determine the causes of the patient's symptoms. During the examination multiple orthopedic should be performed to distinguish the possibility of disc involvement.

The examination include the Straight leg raise (SLR), Braggart's test, Sicard's, Well Leg Raising test of Fajersztajn (WLR), Bechterew's test, Milgram's, Valsava, Dejerine's triad, Kemp's and heel or toe walk. If the above tests produce the main chief complain of the patient, then the problem cause is the disc herniation. [20]

More specifically, the Straight leg raise test is performed with the patient in supine position and is performed passively. The examiner grasps the patient leg, which should be straight, and applies passively hip flexion with straight leg. This motion

increase the tension on the sciatic nerve and pull the affected nerve root over the protruding segment of the disc, which produces the radicular symptoms. After applying the SLR test, next test that can be applied is the Braggard's test which is similar the SLR test. After the symptoms have been appeared in SLR test the examiner lowers the affected leg approximately five degrees, where the symptoms are eliminated. Then he dorsiflexes the foot of the affected side. This action increases the tension in the nerve roots and produces the radicular symptoms. Another test that can be performed after the SLR test is firstly performed is the Sicard's test. During that test the examiner lowers the affected leg five degrees after applying the SLR test and then ask the patient to apply to do extension of the first digit of the leg. The examiner should also apply the Well Leg Raising test of Fajersztajin.

This test is performed passively by raising the unaffected straight leg. This test is positive if there is radiating pain into the affected leg. The Bechterew's test is performed in sitting position and the patient raises each of his legs actively. The test is positive if during the movements it is elicited radicular symptoms. Milgram's test, during that test the patient lies in supine position and actively lifts both legs simultaneously off the examining table 5 to 10 cm, holding this position for 30 seconds. The test is positive if the lower limbs or affected lower limb cannot be held for 30 seconds or if the symptoms reproduced in the affected lower limb. Valsava maneuver is done when asking the patient to sit take a breath, hold it and then bear down. If pain increases, it indicates increased intrahecal pressure.

Dejerine's test is present when the patient experiences radiating pain in response to increasing of intrahecal pressure as a result of coughing, sneezing or bearing down during defecation. Kemp's test can be performs with the patient in sitting or standing position. The examiner should support the patient's shoulders and bends forward while circumducting the patient until lateral flexion and extension are complete. The lateral flexion and extension components narrow the intervertebral foramen, which may compress the nerve root and result in radicular symptoms.

Heel and toe walk, is done evaluates the strength of muscle innervated by the affected nerve root. Inability to walk on heels indicates an L4 disc lesion affecting the L5 nerve root. Inability to walk on toes indicates weakness of calf muscles innervated by S1 roots. The S1 root is affected by L5 disc herniation. [20]

For determine whether a patient has disc herniation the most successful examination, is the MRI examination, and X-ray examination. The physiotherapists in

order to have a clear view of patient problem should definitely ask the patient to take an MRI and X-ray examination after applying their examination.

MRI examination**:** The MRI examination (Magnetic Resonance Imaging) can help the physicians /physiotherapists /orthopedics to assess to the patient's spinal anatomy and distinguish the anatomical cause of patient's back pain. They will have to correlate the findings on the MRI scan with the patient's symptoms and signs of the back in order to come to a conclusion of the clinical diagnosis. [32]

X-ray examination: An X-ray examination can provide in details the bones structures in the spine and it is used to determine the back pain as a result from instability such as spondylolisthesis, tumors and fracture. [34]

2.12.6. Conservative and non-conservative treatment

2.12.6.1.Conservative treatment

For the initial treatment of a patient with lumbar disc herniation in acute stages is recommended bed rest. The managing of the pain can be done with medication of non-steroidal anti-inflammatory medication. To patients with more substantial pain can be given mild narcotic pain medication.

The physical therapy for the patient can include gently stretching, ultrasound, whirlpool, ice – heat pack therapy, massage or electrical stimulation. [31]

I believe that important role plays of course the physiotherapy treatment. The role of physiotherapy treatment is to restore the symptoms that turned up to the patient body due to the lumbar disc herniation and also to restore to a tolerated point the disc herniation with specific exercises.

Physiotherapy treatment of patients with lumbar disc herniation includes exercises for the increase of spine stability and pelvis, strengthening exercises for weak muscle, gently stretching of short muscles; reduce of pain, mobilization of restricted joints, Facilitations of the areas with neurological deficit.

For patients with lumbar disc herniation, they are indicated to them exercises that can help to increase the stability of the trunk, strengthen the muscles of the trunk, and pelvis. Moreover those exercises have as goal to increase the strength of rectus abdominal, back extensors, transverse and obliques abdominal and quadratus lumborum. Important role plays posture for the patient. The patient should apply

exercises that will help them keep a good posture. The reason is that usually the not proper posture of the patient may be worse his situation. [19]
Mc Kenzie described several exercises that help the patient for treatment of lumbar disc herniation. [21]

In the book of Lewit it is discussed that manual traction may also be helpful in the chronic stage, and acute stage provided that the patient finds it agreeable and improvement is detected afterward. In every instance it is important to proceed in a manner that is consistent with the clinical findings, and this approach presupposes a fresh examination at every follow-up visit. Furthermore, in the book of Lewit it is said that if the techniques of traction fail to bring immediate relief, epidural anesthesia and bed rest as should analgesic medication.

However, bed rest should be kept as brief as possible because energetic (‘aggressive’) therapy in the acute stage is the most important step in preventing chronicity. [18]

It is important to say that concerning the treatment done by physical therapist, the manipulation is contraindicated. The physiotherapist should also advice the patient to avoid lifting and repeated twisting.

The physiotherapist should advice the patient that he should maintain the recommended exercises rather than stay on bed for too long and instruct him about alternate exercises that do not increase pain. [30]

2.12.6.1.1. Specific exercises for disc herniation:

Here I am explaining 3 specific exercises for patient with lumbar herniation the same as my patient had. Those three exercises are for patient who has a disc herniation in lumbar spine.

1st exercise:

Prone on elbows:

The patient is lied propped up in his elbows and allows his back to sag. The patient should maintain this position for 2 to 3 times .I f the patient has acute symptoms; he should perform this exercise several times a day. If the patient has chronic symptoms he should perform this exercise periodically. [9]

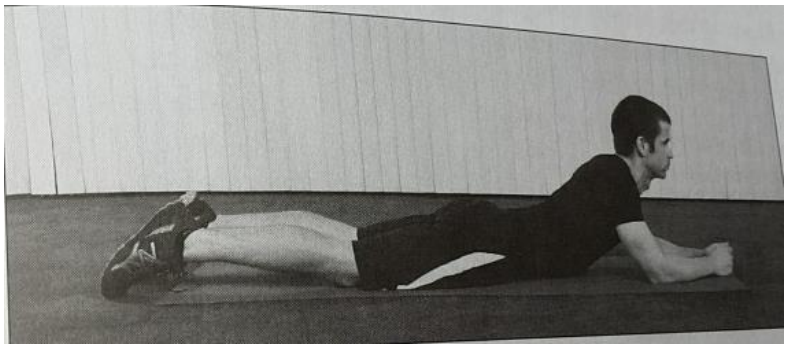

Figure No 13. Exercise prone on elbows. [9]

2nd exercise:

Trunk extension:

Is actually the same as the previous one, but in this case is lying in prone and tries to elevate his trunk into extension. Mc Kenzie also described that exercise for lumbar disc herniation patients. [9, 21]

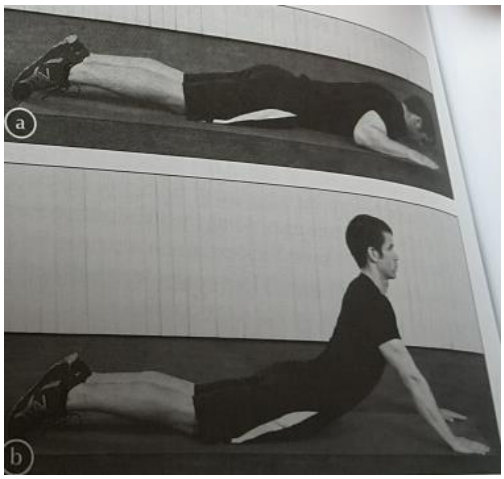

Figure No 14.Exercise of trunk extension [9]

3rd exercise:

Stand back bend:

The patient should stand with his hands on his hips and then back bend. He should not bend his knees. For acute symptoms the patient should apply 10 to 12 repetitions every few hours. For more chronic complains he should try to do the exercise several times a day, especially after long sitting position. [9]

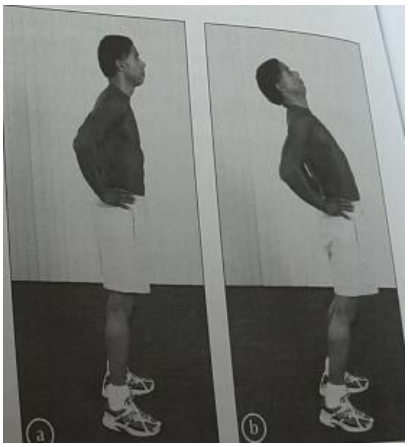

Figure No 15. Exercise of back bend in standing position. [9]

2.12.6.1.2. Research for rehabilitation of lumbar disc herniation.

For a herniated lumbar disc a rehabilitation program is done, that emphasized skill-base exercise therapy for the spine and effectively treated herniated lumbar disc. The program aimed to restore automatic control of muscular stabilization of the trunk by teaching the people involved to maintain a correct lumbar position.

Pain and physical dysfunction were improved in the patients that follow the research rehabilitation program during following a 10-week exercise program. Where areas those to factors worsened for the people that remained inactive. [25]

2.12.6.2.Non conservative treatment

Non conservative treatment includes surgery. It is indicated for patient who have severe symptoms and their pain is not tolerated.

Patients who have severe neurological deficits, perineal anesthesia, and incompetent rectal sphincter should go to a surgeon. The patients with stable sensory or motor deficits can advise a spine surgeon. The patients who have symptoms more than 6 months should also speak with a spine surgeon. [31]

Moreover patients whose conservative treatment was not successful (3-4 weeks) should be advised to have a surgery. [19, 31]

2.12.6.2.1. Types of surgical procedures for Lumbar disc herniation

As far the surgery procedure of lumbar disc herniation is concerned, it has a goal to remove or minimize the herniation that has appeared. There are several types of surgery for a disc herniation that a patient can have and depends on the surgeons experience which will procedure will follow. [36]

The most usual type of surgery is called discectomy or microdiscectomy. During that procedure the surgeon the small portion of the bone over the nerve root is removed to relieve neural impingement and provide more room for the nerve to heal. [35]

Another type of surgery is called Lumbar laminectomy is performed usually for the condition of spinal stenosis. [37]

Another option to treat a lumbar herniated disc is chymopapain injections that dissolve the disc. It is less invasive than surgery and with great success. [36]

2.12.6.3. Operative versus non-operative management of disc herniation.

The success of non-operative management in most studies is based on a combination of epidural corticosteroid injection and exercises. This is not to imply that surgical care should never be considered for the treatment of disc herniation. In fact, conservative care does not always equate to non-operative treatment. In clinical scenarios, early surgical intervention is more appropriate, and even essential, than comprehensive non operative rehabilitation. Although there are certainly other issues in determining operative versus non operative management of radicular syndromes due to disc herniation. The most important issue to be considered is the quality of life as affected by pain and resultant disability. [7]

3. SPECIAL PART

3.1. Methodology

My clinical work practice took place in Ústřední Vojenská Nemocnice in Praha. It was started on Monday 3rd of February 2014 and finished on Friday 14th of February 2014 each day had the duration of 8 hours. The total amount of the hours of my practice was 80.

My clinical work placement was supervised by Mgr. Helena Vomackova. The sessions with my patient were six. They were started on Friday 7th of February 2014 and they were continued every day until the end of practice period. Our last session was on Friday 14th of February 2014.

The therapeutic procedures that I used were manually therapy, Post –Isometric relaxation, Soft tissue techniques, sensomotoric exercises, breathing exercises and exercises for increasing the strength and the length of the muscles. Goniometer (plastic), measurement tape, neurological hammer, was the tools that I used for the examinations. For therapy I used softball, brush for Facilitation, and balance board. The patient was fully aware of the examination and therapeutic procedures at any given time, no invasive methods were used and a proposed informed consent was also assigned by the patient and me.

My work has been approved by the Ethics Committee of the Faculty of Physical Education and Sport at Charles University, under the approval number 082/2014

3.2. ANAMNESIS

Workplace: Ústřední Vojenská Nemocnice, UVN - Department of neurology

Supervisor: Mgr. Helena Vomackova.

Date: 3/2/2014 – 14/2/2014

Examined Person: S.L (male)

Date of birth: 1980

Diagnosis: Low back pain, disc herniation at L4/L5.

Code: M511

3.2.1. Present State:

Height: 185 cm, **Heart rate:** 84 beat/min, **Blood Pressure:** 122/80 mm/Hg
Weight: 100 kg, **BMI:** 29, 2, **Pain level:** 6/10, **Temperature:** 36.6 C

The patient is suffering from Low back pain (pain level 6/10) and also he feels pain in the area of the Right thigh (6/10). My patient claimed that he is feeling pain in the area of lower lumbar spine for 2, 5 years and his pain started first at the area of coccyx. I asked the patient to describe his pain from a scale 0 to 10 (while ten is considered to be the maximum pain) and he told me that he pain level is 6/10.The patient is lying on the bed but he is able to walk, and he feels pain when he is changing position from lying to sitting, from sitting to standing and also during walking. The patient claimed that during walking he feels pain after 15 minutes when he stars to walk.

Moreover, he is also feeling pain during night where he has to change position in the bed, during sleep. Furthermore, the patient also claimed that he is feeling pain in his right foot, pain level (5/10).

3.2.2. Anamnesis/History

The patient's problem started 2, 5 years ago, when he started having pain at his low back area at the region of coccyx. After that, his pain moved higher to the region of low back (lumbar spine area) .His problem started when was he was playing football, not professionally but with his friends every week. He used to play football 2 times per week. But because of his pain, he stopped playing football since then, because he couldn't. Before 1 year He decided to visit hospital (UVN, Ústřední Vojenská Nemocnice), and he stayed there for 3 weeks. The doctors also found that the patient has a flat foot at the right leg. And they instructed him to wear orthopedic shoes. When left the hospital after the period of three weeks, his pain has not stopped but he was feeling better. After one year his pain started again and he decided to visit again the hospital (UVN, Ústřední Vojenská Nemocnice).

3.2.3. Personal anamnesis

The patient has normal childhood diseases.

3.2.4. Family anamnesis

Mother and father are healthy

3.2.5. Occupational anamnesis

The patient is a soldier.

3.2.6. Social anamnesis

The patient is not married, he lives alone in a flat at the first floor, and there is elevator in his flat.

3.2.7. Operational anamnesis

The patient did not have any operation before.

3.2.8. Pharmacological anamnesis

Pain relief medication

3.2.9. Hobbies

Football. The patient used to play football one time per week, but stopped when he started to feel pain.

3.2.10. Abuses

The patient is a social drinker, and he is not smoking.

3.2.11. Allergies

None

3.2.12. Previous injuries

None

3.2.13. Previous rehabilitation

The patient previous rehabilitation was before one year at, Ústřední Vojenská Nemocnice, during November, and was applied to the patient myofascial techniques with ball, massage at the back and paraffin, strengthening and stretching exercises and use orthopedic shoes because of flat foot in the right leg. The patient after the rehabilitation was feeling better, his pain was decreased.

3.2.14. Statement from the patient's medical documentation

The patient at 10/2/2014 did an MRI examination in order to check if there was disc herniation at lumbar spine. The results showed that there was small disc herniation at lumbar spine at L4/L5 segment.

To the patient at 10/2/2014 was also applied an X-ray examination at the area of pelvis and lumbar spine. The results from the X-ray examination was the patient did not have any fracture or deformities in lumbar spine. The X-ray examination showed that the patient's right femur was more rotated into the direction of external rotation.

3.2.15. Differential Balance

Concerning the anamnesis of the patient and the diagnosis of his state, we can assume that patient suffers from low back pain. The results of MRI examination showed that the patient had a small disk herniation at L4/L5 this can be the main reason of patient low back pain. Knowing that the patient in his previous rehabilitation was also diagnosed with flat foot at the right leg, we can assume that this can affect the whole posture of the patient and the breathing pattern also.

Moreover as far as the results of X-ray examination are concerned, we can say the patient's right leg is rotated to the direction of external rotation which means that probably the piriformis muscle at the right side can be short. Piriformis muscle may also compress the sciatic nerve in the right side and causes pain in the areas of the right thigh.

Knowing those facts, we can expect that the patient will feel pain in his back at the area of lumbar spine, weakness of the muscles of lumbar area (deep stabilization muscles), buttocks, and the muscles of the leg at the right side. Furthermore, from neurological point of view we can expect numbness in the buttocks, back and right leg and decreased sensitivity and reflex response in the lower extremities Also I expect to find hyper tonicity of the muscles of the back, thigh and leg and also shortness and probably hypotonicity of gluteal muscles. The Range of Motion in the hip joints, knee joints and ankle joint can be also restricted.

Moreover, probably there will be restriction in the joints of lumbar spine, sacroiliac area and also in the hip joints and knee joints and ankle joints. Furthermore, there will be restriction in the skin, sub skin and fascia of the lumbar area. The movement pattern of hip extension and abduction will be altered and probably the breathing pattern also .There will be probably weakness of the deep stabilization system

of core of the patient and which probably will cause the patient to be instable on standing position and during walking. Knowing the patient's weight and the posture of the patient, I can assume that the patient is overweight and he has not the proper posture. This plays an important role for the causes of the low back pain.

Concerning patient's problem, his activities of daily living (ADL) will be limited, because of the low back pain. The patient feels pain when he changes positions, from sitting to standing position and during sleep, and when he is lifting objects. Also he is not able to walk or run for a long time of period because the pain in his low back area is rising.

3.3. INITIAL KINESIOLOGY EXAMINATION.

3.3.1. Posture examination

3.3.1.1. Posterior View

- Normal base of foot
- Right foot in slightly to lateral side
- No varosity or valgosity in ankle joint
- Valgosity in both knee joints
- Right calf is hypotrophic , left is less
- Hyperextension in the right knee
- Small hematoma at dorsal side of knee at left leg
- Both thigh are hypertrophic, right is less
- Right posterior iliac spine is higher than the left one
- Left iliac crest is lower than the right one
- Hypertrophy of both transverse abdominals, there was protraction of the muscles on both sides
- Right triangular space is bigger than the left one
- Right shoulder is lower than the left one
- Patient body from the Thoracic spine and cranially is shifted to the right side.
- Slight scoliosis to the right side at the level of thoracic spine

3.3.1.2. Anterior view

- Right foot is slightly to right side
- Valgosity in both knees
- Left t is more hypertrophic than the left
- Hypertrophy of transverse abdominal muscles at both sides
- Hypertrophy of pectoralis major muscle right side
- Patient body is shifted to the right side

3.3.1.3. Lateral view

Right side

- Flat foot in the right side
- Hyperextension of right knee
- Lumbar spine flat
- Slight kyphosis in thoracic spine
- Slight lordosis in cervical spine
- Patient is putting more weight on the right side
- Slightly protraction of head
- No protraction of shoulders

Left side

- Lumbar spine flat
- Slight kyphosis in thoracic spine
- Slight lordosis in cervical spine
- Slightly protraction of head
- No protraction of shoulders

3.3.2. Gait examination

The patient during normal walking is putting more weight on his right leg, because during the gait examination his trunk was slightly sifted to the right side. He feels pain in his lower back and he is not walking with comfort. He was applying small steps with low speed. Moreover, during normal walk he is applying circumduction of his left leg. His left leg is in external rotation. He is not using 3-point touch with his right foot, because he has flat foot. The patient right foot was flat in the coronal axe and

sagittal axe of the foot. The first touch with the floor was with the heels for both legs. He has normal movement of his arms. His head is protracted forward. The patient was able to apply to walking on toes and walking on heels.

3.3.3. Examination of movement patterns according Janda

Hip Abduction: There is altered movement pattern mostly on both sides. There was hip flexion during the movement. Quadratus lumborum is activated first as a primary muscle.
Hip Extension: Altered movement pattern. There a small and delayed activation of gluteal muscles in both sides.
Curl up (trunk flexion): Altered movement pattern in both sides. The abdominal muscles are weak and the patient is using his iliopsoas muscle for trunk flexion

3.3.4. Pelvis palpation

Iliac crests: The left iliac crest is slightly lower than the right one
Anterior Superior Iliac spine (ASIS): The ASIS from the left side is lower than the right side
Posterior Superior Iliac spine (PSIS): The PSIS from the left side is lower than the right side
Result: The patient has lateral tilt of pelvis on the left side.

3.3.5. Trendelenburg test

The results of that test are positive on both sides and more on the right side. There was drop of the pelvis on both side and more on the right side. That result indicates that the patient is not able to keep his pelvis straight. This means that the hip adbuctor muscles and the muscles that stabilize the pelvis are weak in both sides.

3.3.6. Romberg test

Romberg I: Negative

Romberg II: Negative

Romberg III: Negative

3.3.7. Scale test

Right scale: 52kg

Left scale: 48kg

The overall weight of the patient is: 100 kg

3.3.8. Dynamic test examination

Flexion

During the movement of flexion, the patient was not able to reach the floor with his fingers. Also there was no movement in the lumbar spine, which was flat. There was physiological movement of thoracic and cervical spine. The patient was feeling pain in the lumbar area when returning to normal position.

Moreover the patient during the movement of maximal flexion was feeling tension in both hamstrings muscles and he had slight knee flexion in both knees. This indicates that the patient has probably shortness of hamstrings.

Extension

During the movement of extension, the patient put his hand at his gluteal area and applied the movement. He was not able to apply the movement perfectly because he was feeling pain, there was restriction. Also there was no movement of lumbar spine which was flat.

Later flexion

The patient was able to do it. On the left side the patient could go slight more far than on the left side.

3.3.9. Examination of soft tissue according Lewit

Examination of Skin and Subcutaneous
There was restriction in all directions (cranial, caudal, medial and lateral direction) in the area lumbar spine at both right and left side. Restriction in right thigh in all directions, restriction in right calf area all directions.
Examination of Fascia
There was restriction in the thoracolumbar, right thigh and right calf fascia at both sides in cranial and caudal direction.

3.3.10. Anthropometric measurements of lower extremities

Length	**Right Leg**	**Left Leg**
Functional	105.5 cm	104cm
Anatomical	93.5 cm	92cm
Circumference	**Right Leg**	**Left Leg**
Quadriceps	50cm	51cm
Calf	40cm	41cm

Table No. 1. – Anthropometric measurements of lower extremities [cm]

3.3.11. Examination of Range of Motion, by Kendall

*for the examination of Range of Motion I used the plastic goniometer

Hip joint	**Right**		**Left**	
Plane	***Active movement***	***Passive movement***	***Active movement***	***Passive movement***
S	5-0-90	10-0-110	10-0-110	10-0-120
F	30-0-5	35-0-10	40-0-7	45-0-10
R90	30-0-20	35-0-25	45-0-20	45-0-25
Knee joint	**Right**		**Left**	
Plane	***Active movement***	***Passive movement***	***Active movement***	***Passive movement***
S	0-0-100	0-0-110	0-0-120	0-0-130
Ankle joint	**Right**		**Left**	
Plane	***Active movement***	***Passive movement***	***Active movement***	***Passive movement***
S	30-0-10	30-0-20	35-0-10	35-0-20

Table No. 2. – Examination of Range of Motion, by Kendall [degrees]

*The patient during the examination of internal rotation at the end of the movement was feeling tension in the areas of gluteal muscles and pain. The patient was feeling pain in during hip flexion.

3.3.12. Muscle tone examination

Muscle	**Right**	**Left**
Quadriceps	Hypertone	Hypertone
Quadratus lumborum	Hypertone	Hypertone
Tensor fascia latae	Normal tone	Normal tone
Iliopsoas	Hypertone	Normal tone
Biceps femoris	Normal tone	Normal tone
Semitendinosus	Normal tone	Normal tone
Semimembranosus	Normal tone	Normal tone
Piriformis	Hypertone	Normal tone
Adductor longus	Hypertone	Hypertone
Adductor magnus	Hypertone	Hypertone
Adductor brevis	Hypertone	Hypertone
Gracilis	Normal tone	Normal tone
Pectineus	Normal tone	Normal tone
Sartorius	Normal tone	Normal tone
Gastrocnemius	Hypertone	Hyper tone
Popliteus	Normal tone	Normal tone
Plantaris	Normal tone	Normal tone
Soleus	Normal tone	Normal tone
Tibialis Anterior	Normal tone	Normal tone
Tibialis Posterior	Normal tone	Normal tone
Gluteus maximus	Hypotone	Hypotone
Gluteus minimus	Hypotone	Hypotone
Gluteus medius	Hypotone	Hypotone
Rectus abdominal muscles	Hypertone	Hypertone
Transverse abdominal muscles	Hypotone	Hypotone

Table No. 3. –Muscle tone examination

3.3.13. Examination of muscle strength according Kendall

Muscle	**Right**	**Left**
Quadriceps	4	4
Quadratus lumborum	3	3
Tensor fascia latae	3	4
Iliopsoas	4	4
Biceps femoris	4	4
Semitendinosus	4	4
Semimembranosus	4	4
Hip medial rotators	3	4
Hip lateral rotators	3	4
Sartorius	3	4
Gastrocnemius	4	4
Poplieus	4	4
Plantaris	4	4
Soleus	4	4
Tibialis Anterior	4	4
Tibialis Posterior	4	4
Gluteus maximus	3	3
Gluteus minimus	3	3
Gluteus medius	3	3
Adductors	4	4

Table No. 4. – Examination of muscle strength by Kendall.

*because of the limited time, the muscles in the foot were not examined.

3.3.14. Examination of muscle length test according Janda

Muscle	**Right**	**Left**
Rectus Femoris	1	1
Tensor fascia latae	1	0
Hamstrings	1	1
Iliopsoas	1	1
Adductors	1	1
Piriformis	1	0

Paravertebral muscles	0	0
Quadratus lumborum	1	0
Soleus	0	0
Gastrocnemius and plantaris	1	0
Pectoralis major	0	0
Lateral rotators of shoulder	0	0
Medial rotators of shoulder	0	0
Trapezius	0	0
Sternocleidomastoid	1	1
Scalene muscles	1	1
Levator scapulae	0	0

Table No. 5. – Examination of muscle length by Janda.

3.3.15. Joint play examination according Lewit

3.3.15.1.Lumbar spine

Examination of lumbar spine with Springing test

Restriction in L5, L4, L3, L2, L1 segment

3.3.15.2.Sacroiliac joint

Examination of Sacroiliac with Spine sign in both sides by Lewit: Restriction of Sacroiliac joint in the right side.
Rosina test for Sacroiliac spine: The result was positive on the right side
Examination of Sacroiliac joint (springing test of the Ilium against sacrum in supine position with one leg flexed) by Lewit: Restriction on right side
Examination of Sacroiliac joint (springing test in prone position for the superior part of the sacroiliac joint) by Lewit: Restriction on right side
Examination of Sacroiliac joint (springing test in side-lying position of Ilium against sacrum) by Lewit: Restriction on the right side

3.3.15.3.Thoracic spine

Examination of thoracic spine in the direction of Flexion: No restriction
Examination of Thoracic spine in the direction of Extension: Restriction in the thoracolumbar segment.
Examination of Thoracic spine in the direction of Side bending: No restriction
Examination of Thoracic spine in the direction of Rotation: No restriction

3.3.15.4.Cervical spine:

Examination of cervical spine in the direction of rotation: No restriction
Examination of cervical spine in the direction of side-bending: No restriction
Examination of cervical spine in the direction of retroflexion: No restriction
Examination of cervical spine in the direction of anteroflexion: No restriction

3.3.15.5.Ribs

Examination of 1st rib: No restriction
Examination of Upper ribs: No restriction
Examination of Middle ribs: No restriction
Examination of Lower ribs: Restricted

Joint	**Right Side**	**Left Side**
Patella cranial direction	Blockage	No Blockage
Patella caudal direction	Blockage	No Blockage
Patella medial direction	No Blockage	No Blockage
Patella lateral direction	No Blockage	No Blockage
Tibiofibular joint ventral direction	Blockage	No Blockage
Tibiofibular joint dorsal direction	Blockage	No Blockage
Talocrural joint all direction	No Blockage	No Blockage
Lisfranc's joint all directions	Blockage	Blockage
Chopart's joint in all direction	Blockage	Blockage
Interphalangeal joint in all directions	Blockage	Blockage
Metatarsopahalangeal joints in all directions	Blockage	Blockage

Cuboid bone plantar direction	Blockage	Blockage
Cuboid bone dorsal direction	Blockage	Blockage
Navicular bone plantar direction	Blockage	Blockage
Navicular bone dorsal direction	Blockage	Blockage
Calcaneus bone all direction	No Blockage	No Blockage

Table No. 6. – Examination of Joint Play by Lewit

*The end-feel in cuboid joint, navicular joint, metarsophalangeal joints, chorpart and lisfranc joint was hard, especially in the right leg.

3.3.16. Breathing examination

The patient is using his abdominals to inspire and expire (abdominal breathing).Moreover there is no movement of lower ribs during breathing. Because there is hyper tonicity of rectus abdominal muscles the lower ribs are restricted and prevent the diaphragm to do the whole movement.

3.3.17. Neurological examination

Laseque test: Negative in left side, positive on right side
During the examination of laseque test the patient claimed that his was also feeling tension in the hamstrings
Opposite Laseque test:
Negative in Left side, Positive in Right side
Light touch in both sides:
The patient was able to feel the light touch

Examination of dermatomes L1, L2, L3, L4, L5, S1, S2 in both sides
The patient was able to feel the touch in the areas where are the dermatomes L1, L2, L3, L4, L5, S1, S2

Position sense examination:
The patient was able to feel, the patient was able to determine the movement flexion and extension in toes and dorsal and plantar flexion of the foot in both legs.

Deep tendon reflexes	Right side	Left side
Patella reflex	1	2
Achilles tendon reflex	2	2
Medioplantar reflex	2	2

Table No. 7. – Examination of Deep tendon reflexes

*The response levels of deep tendon reflexes are grade 0-4, with 2 being normal

3.3.18. Conclusion of examination:

The patient is feeling pain in the area of low back .Also he feels pain in the area of back and side thigh at right leg. Moreover the patient is feeling pain also in the area of right foot at areas of Lisfranc and Shopart joint this would be perhaps because the patient has right flat foot.

- The patient after the initial kinesiology examination was suspected for disk herniation. The results of MRI examination at 10/2/2014 approved that suspicion. The patient has disk herniation at the segment of L4/L5 of lumbar spine.
- The cause of patient's low back pain and right thigh is due to disk herniation at L4/L5.
- The patient has also postural asymmetries. His body is shifted to the right side**.**
- The patient has flat foot in the right leg and the right leg is bigger than the left one. Probably the flat foot in the right leg was created because the patient's right leg was bigger than the left, as a compensating mechanism.
- The results of neurological examination showed that the patient had no impaired sensation. The reflexes were physiological except the patella reflex in the right leg which was decreased. The Laseque test and opposite Laseque test were positive on the right side.
- From the examination of anthropometric measurements, posture and anamnesis , the patient has flat foot in the right foot and the right leg has bigger length, that perhaps why the patient is shifted to the right side.
- Patient has pelvis obliquity in the left side as the results of pelvis examination showed. That happens perhaps because the patient has bigger right leg than the left leg and there is flat foot in the right leg.

- The patient is putting more weight in his right side. The 2 scale test and the posture examination approve that result.
- As far as the muscle tone examination is concerned, there is hypertension of Quadratus lumborum (both sides and more on the right side), Quadriceps muscles (Both sides), iliopsoas (right side), Adductors muscles (both sides), Piriformis (Right side), Gastrocnemius (right side) and Rectus abdominals (both sides).There was hypo tonicity in gluteal muscles (both sides) and in transverse abdominal muscles (both sides).
- The weak muscles in the right side of the patient are quadrates lumborum (both sides), Tensor fascia late (right side), gluteus muscles (both sides), abdominal muscles (both sides), Hip medial rotators (both sides), Hip lateral rotators (both sides), Sartorius (right side).
- The short muscles are Rectus Femoris (both sides), Piriformis (right side), Adductors muscles (both sides),Tensor fascia late (right side) ,Hamstrings (both sides), Iliopsoas (both sides), Quadratus Lumborum (right side), Gastrocnemius (right side) , scalene muscles (both sides) , Sternocleidomastoid muscles (both sides)
- Concerning the soft tissue examination, there is restriction in all directions of skin, subcutaneous, and fascia in the area of lumbar spine in both sides, restriction in the skin, subcutaneous, fascia in right tight and right calf area.
- There is restriction in the range of motion of hip joint at Flexion, extension, external rotation and abduction in the right hip .In the left hip there is restriction of range of motion in the flexion and extension. The right knee joint has restricted extension and slightly the left knee joint.
- The patient has limited range of motion in the direction of extension at lumbar spine
- Concerning the gait examination the patient cannot walk with comfort, because he feels pain. He does short steps. He is able to walk on toes and on heels.
- Trendelenburg test was positive on both sides.
- Concerning the joint play examination, there is restriction in the lumbar spine at all segments .There is restriction in the right sacroiliac joint. There is also restriction in the joints of right and left leg and foot.
- Disturbed breathing pattern , the patient is using abdominal breathing
- Altered movement pattern in hip abduction and hip extension and trunk flexion

3.4. SHORT-TERM AND LONG-TERM REHABILITATION PLAN

3.4.1. Short term rehabilitation plan

- pain relief
- improve posture
- verticalization of the patient in standing, correction of upright position
- strengthening exercises for the weak muscles
- relaxation of hypertone muscles
- stretching of short muscles
- increase the limited the range of motion
- unblock of restricted joints
- sensomotoric training “small foot” for flat foot
- improve breathing pattern
- thromboembolic prevention
- improvement of movement pattern stereotypes
- increase the stability of lumbar spine and pelvis.
- improve the ADL activities

3.4.2. Long –term rehabilitation plan

- Maintain the goals of the short rehabilitation plan
- Education of correct posture in sitting, standing and when performing activities of daily living
- Correct walking pattern
- Exercises for better condition of the musculoskeletal system
- Strengthening exercises for increase pelvis and trunk stability.

3.4.3. Therapy proposal:

- Soft tissue techniques according Lewit at lumbar area, thigh and calf.
- PNF strengthening technique by Kabat for strengthening the weak muscles
- Post isometric relaxation for the hyper tone muscles and short muscles.
- Passive Stretching exercises for the short muscles.
- Mobilization according Lewit for the restricted joints

- Sensomotoric training for the flat foot and for the wrong posture
- Exercises for the stabilization of pelvis
- Auto therapy for correction of incorrect patterns during standing, sitting, walking and breathing patterns. Also therapy for correction of impaired ADL activities and for increase of the stability of the stabilization system of lumbar spine and pelvis.

3.5. THERAPY PROGRESS

1st Therapy session - Date: 7.2.2104

Goal of today's therapy unit:

- Reduce pain in lumbar area, at thigh and foot
- Increase of Range of motion in both hip and knee joints, ankle joint
- Thromboembolic prevention exercises
- Release tension in the hype tone muscles (Rectus Femoris muscle, Quadratus Lumborum muscle, Iliopsoas, Piriformis, Gastrocnemius, Adductors muscles, rectus abdominal muscles, Sternocleidomastoid and Scalene muscles)
- Increase mobility of skin, subcutaneous, fascia of lumbar area in all directions, calf and thigh at right side.
- Mobilization of restricted joints (Patella, Fibula head, Shopart's joint, Lisfrank joint, interphalangeal joints, metarsophalangeal joints, cuboid bone, navicular bone, lower ribs, sacroiliac joint)
- Facilitation of muscles of the right foot
- Sensomotoric exercises for the both foot, especially for the right one
- Sensomotoric exercises for the correction of posture

Execution:

- Soft tissue techniques by Lewit for skin subcutaneous in the craniocaudal and mediolateral direction. The technique was applied at the lumbar area at both sides, tight and calf at right side.
- Soft tissue techniques by Lewit for fascia of thoracolumbar area in cranial and caudal direction at sides of the body, thigh ventral dorsal direction at right side, calf ventral dorsal direction at right side.
- Mobilization technique by Lewit for right patella in cranial and caudal direction, fibula head at ventral and dorsal direction, left and right Lisfrank joint in dorsal and ventral direction, left and right Shopart joint in ventral and dorsal direction, interphalangeal joint of all toes in left and right side in all directions, metarsophalangeal joints of both feet in ventral and dorsal direction, right and left cuboids bones in ventral and dorsal direction, left and right navicular bone in ventral and dorsal direction.
- Post isometric relaxation by Lewit for Quadriceps muscles at left and right side, Quadratus lumborum at left and right side, Iliopsoas at right side, Piriformis at right side, Gastrocnemius right side, Hamstrings both sides and Adductor muscles at left and right side and Rectus abdominal muscles.
- Mobilization for lower ribs in all possible direction, and sacroiliac joint in the right side with the technique of Stoddard (crossed hands) gently, with springing mobilization of the upper part and with springing mobilization of the lower part.
- Active and passive movements of ankle ,knee and hip joint for thromboembolic prevention and improvement of range of motion
- Facilitation and Sensomotoric training by Janda for right flat foot.
- Sensomotoric exercises for correction of posture. I asked the patient to face the wall in standing position. Then I instructed him how to keep his posture straight in the mentioned position. After I asked to bend his knees and then return to the starting position. This exercise had 2 sets, 3 repetitions

Results:

The patient claimed that his pain at Low back area was 6/10. After the mobilization techniques in his right foot his pain was almost decreased, pain level (2/10).The mobility of the skin, sub skin, fascia was slightly increased. The length scalene and sternocleidomastoid muscles after the therapy was increased.

2nd Therapy session - Date: 10.2.2014

Today's present status of the patient:

The patient today was in a good mood. But he was feeling pain in the area lumbar spine (6/10) .I applied a short examination to check if there was any improvement.

Result:

Skin, sub skin and fascia are less restricted. The blockages of the joints of the lower extremities, sacroiliac joint and lower ribs were removed**.** The hypertension was decreased but still there was tension in the quadriceps, quadratus lumbrorum, adductors, rectus abdominis and piriformis and iliopsoas. There was no more shortness in the sternocleidomastoid and scalene muscles. Still decreased range of motion of the hip and knee joint.

Goal of today's therapy unit:

- Reduce pain in lumbar area, at thigh and foot
- Increase of Range of motion of the hip, knee joint and ankle joint.
- Thromboembolic prevention exercises
- Release tension in the hypetone muscles (Rectus Femoris muscle, Quadratus Lumborum muscle, Iliopsoas, Piriformis ,Adductors muscles, Rectus abdominal muscles
- Mobilization of lumbar spine by McKenzie method into extension
- Increase mobility of skin, subcutaneous , fascia of lumbar area, thigh and calf in all directions
- Facilitation of muscles of the right foot
- Sensomotoric exercises for both feet
- Sensomotoric exercises for correction of posture
- Breathing exercises
- Instructions for correction of posture and gait
- Exercises for stabilization of pelvis and trunk muscles

Execution:

- Soft tissue techniques by Lewit for skin, sub skin in the craniocaudal and mediolateral direction. The technique were applied at the lumbar area at sides, right thigh and right calf.
- Soft tissue techniques by Lewit for fascia of thoracolumbar area in cranial and caudal direction at both sides of the body, right thigh and right calf.
- Post isometric relaxation by Lewit for Quadriceps muscles at left and right side, Quadratus lumborum at left and right side, Iliopsoas at right side, Piriformis at right side, hamstrings both sides, Adductor muscles at left and right side, Rectus abdominal muscles.
- Use of Mc Kenzie method exercise. The patient was in prone position. We asked the patient to raise his trunk in the direction of extension.

  Active and passive movements of ankle, knee and hip joint for thromboembolic prevention and improvement of range of motion
- Facilitation and Sensomotoric training by Janda for both feet.
- Sensomotoric exercises for correction of posture. I asked the patient to face the wall in standing position. Then I instructed him how to keep his posture straight in the mentioned position. After I asked to bend his knees and then return to the starting position. This exercise had 2 sets, 3 repetitions. After I continued with the same exercise but I asked the patient to stand on balance table.
- Breathing exercises for activation of ribs during breathing and proper movement of diaphragm. I used localized breathing, and I asked the patient to apply breathing in the areas where I touched him.
- Then, I asked the patient to stay in sitting position with his spine straight and I pressed his lower ribs when he was breathing out and during the period that the patient was breathing in I released the pressure on his ribs.
- Exercise for stabilization of pelvis and trunk muscles. I asked the patient to stay in supine position with both knees flexed. After I asked the patient to raise his pelvis and his back from the bed and instructed him to apply this exercise for two sets, each set should include 10 repetitions.

Self-treatment:

- Instructions for correct posture in standing and sitting position
- Instructions for correct walking
- Instructions for self-treatment of hyper tone muscles.
- (Quadratus Lumborum Muscle, Rectus Abdominis, Rectus Femoris, Iliopsoas, Piriformis, Adductors) by Lewit.
- Instructions for self exercises
- In prone position ask the patient to elevate his trunk into extension. In standing position I instructed the patient to put his hands in his buttocks and apply extension of the trunk.

Results: The patient claimed that still his pain in the low back and his right thigh remained almost constant since the previous therapy.

3rd Therapy session - Date: 11.2.2014

Today's present status of the patient:

The patient was feeling pain in low back area and slightly in the right thigh. He was not feeling pain in the right foot**.** The skin sub skin and fascia mobility was improved. The hyper tonicity was decreased in rectus femoris, rectus abdominal, iliopsoas, piriformis and adductor muscles except quadratus lumborum muscle.

Goal of today's therapy unit:

- Reduce pain in lumbar area and at thigh
- Increase of Range of motion of the knee and hip joint
- Thromboembolic prevention exercises
- Release tension in the hypetone muscle Quadratus Lumborum
- Mobilization of lumbar spine by McKenzie into extension
- Facilitation of muscles for both feet.
- Sensomotoric exercises for both feet.
- Sensomotoric exercises for correction of posture.
- Breathing exercises
- Exercises for stabilization of pelvis and trunk muscles
- Stretching exercises for quadriceps and adductors
- Strengthening exercises with isometric contraction for gluteal muscles.

Execution:

- Facilitation and Sensomotoric training by Janda for both feet.
- Sensomotoric exercises for correction of posture. I asked the patient to face the wall in standing position. Then I instructed him how to keep his posture straight in the mentioned position. After I asked to bend his knees and then return to the starting position. This exercise had 2 sets, 3 repetitions. After I continued with the same exercise but I asked the patient to stand on balance table
- Breathing exercises for activation of ribs during breathing and proper movement of diaphragm. I used localized breathing, and I asked the patient to apply breathing in the areas where I touched him. Then, I asked the patient to stay in sitting position with his spine straight and I pressed his lower ribs when he was breathing out and during the period that the patient was breathing in I released the pressure on his ribs.
- Exercise for stabilization of pelvis and trunk muscles. I asked the patient to stay in supine position with both knees flexed. After I asked the patient to raise his pelvis and his back from the bed and instructed him to apply this exercise for two sets, each set should include 10 repetitions'.
- Active and passive movements of ankle ,knee and hip joint for thromboembolic prevention and improvement of range of motion
- PNF relaxation technique for Quadratus Lumborum ipsilateral side**.**
- Use of Mc Kenzie method exercise. The patient was in prone position. We asked the patient to raise his trunk in the direction of extension.
- **Passive Stretching exercises for quadriceps muscles**: Patient was in prone position and I asked to apply knee flexion on one leg. Then I asked him to grasp the towel that was around his ankle, with both hands and try to bring in as close as he could to his buttocks**.**
- **Passive Stretching exercises for adductors muscles:** The patient was in supine position with both legs straight. I grasped the one leg and applied abduction.
- **Strengthening exercises for gluteal muscles**: The patient was in prone position and I asked him to apply isometric contraction at the area of gluteal muscles.

Self –treatment:

- Instructions for correct posture in standing and sitting position
- Instructions for correct walking
- Instructions for self-treatment of hypertone muscle quadratus lumborum muscle, by Lewit.
- Instructions for self-stretching of hamstrings: I instructed the patient to stay in standing position and place his leg on a fixed point not high from the ground, and try to stretch gently until the point he could his hamstrings. I instructed him always to keep his posture straight.

Results: The patient after today's therapy claimed that the pain in his lumbar area was 5/10.Concerning that the pain that he was feeling in the right thigh he told me that was decreased at 4/10.

4th Therapy session - Date: 12.2.2014

Today's present status of the patient:

The patient was feeling better today. There was no tension in quadratus lumborum. The range of motion in the hip and knee was improved since the last therapy. The patients stretching exercises improved the shortness of Hamstrings, Quadriceps and Adductors muscles.

Goal of today's therapy unit:

- Reduce pain in lumbar area and at thigh
- Facilitation of muscles of both feet
- Sensomotoric exercises for both feet
- Sensomotoric exercises for correction of posture.
- Breathing exercises
- Exercises for stabilization of pelvis and trunk muscles
- Strengthening exercises with isometric contraction for gluteal muscles, quadriceps and adductors

Execution:

- Facilitation and Sensomotoric training by Janda for both feet.
- Sensomotoric exercises for correction of posture. I asked the patient to face the wall in standing position. Then I instructed him how to keep his posture straight in the mentioned position. After I asked to bend his knees and then return to the starting position. This exercise had 2 sets, 3 repetitions. After I continued with the same exercise but I asked the patient to stand on balance table.
- Breathing exercises for activation of ribs during breathing and proper movement of diaphragm. I asked the patient to stay lie in supine position with both knees flexed. Then I asked to try to activate his abdominal muscles and abdominal wall. During breath in the patient should try to bring the abdominal wall up and during breath out the patient tried to bring the abdominal wall down. This exercise was for improving the breathing patterns generally, the movement of the diaphragm.
- Exercise for stabilization of pelvis and trunk muscles. I asked the patient to stay in supine position with both knees flexed. After I asked the patient to raise his pelvis and his back from the bed and instructed him to apply this exercise for two sets, each set should include 10 repetitions.
- **Strengthening exercises for gluteal muscles**:

  The patient was in prone position and I asked him to apply isometric contraction at the area of gluteal muscles.
- **Strengthening exercises for quadriceps muscles**:

  The patient was in supine position. With the use of a soft ball under the knee of the patient I asked him to apply isometric contraction of his quadriceps muscles.
- **Strengthening exercises for adductors:**

  The patient was in supine position. With the use of a soft ball between his both knees I asked the patient to apply isometric contraction of his adductor muscles.
- Use of Mc Kenzie method exercise. The patient was in prone position. We asked the patient to raise his trunk in the direction of extension. At the end of that exercise we applied to the patient a special rope to his bed.

  We instructed him to place that rope over his lumbar area and under the bed for support and I apply the extension of the lumbar spine. This was instructed to the patient as a self –treatment exercise.

Results: The patient after today's therapy claimed that the pain in his lumbar area was 5/10.Concerning that the pain that he was feeling in the right thigh he told me that was decreased at 4/10.

5th Therapy session - Date: 13.2.2014

Today's present status of the patient: The patient today's claimed that he was feeling pain only in the low back (5/10) and slightly to the right thigh.

Goal of today's therapy unit:

- Reduce pain in lumbar area
- Facilitation of muscles of both feet.
- Sensomotoric exercises for both feet.
- Sensomotoric exercises for correction of posture.
- Application of kinesiotape for the right flat foot.
- Breathing exercises.
- Strengthening exercises with the use of PNF technique gluteus muscles, abdominal muscles.
- Mobilization of lumbar spine by McKenzie into extension.

Execution:

- Facilitation and Sensomotoric training by Janda for right flat foot. I apply short Facilitation in the right foot, plantar area with the use of brush. Then I asked the patient to stay in sitting position and try to put move his right foot into lateral, dorsal and ventral direction, without moving his foot. His foot should stay stable and ha contact with the floor. At the end of the therapy we applied kinesiotape in the right foot.
- Sensomotoric exercises for correction of posture. I instructed him how to keep his posture straight in the standing position. Then I place in front of him a rocker board and I asked him to stand on it for few seconds, try to keep his balance and his spine straight and then come back.

- Today I applied a different breathing exercise with my supervisor. The patient was supine position with hip flexion at 90 degrees and knee flexion at 90 degrees. Because both feet where not touching the ground and the patient was not able to keep that position so I placed a chair on the table and ask the patient to rest his leg on the chair.
- On that position, the goal of the patient was to try to stay on that position by raising the legs from the chair while applying breathing in and out slowly. That exercise was for breathing and for trunk stabilization
- PNF strengthening technique of lower extremities with the use of repeated contraction in the diagonal of first and second extension for strengthening the gluteal muscles.
- PNF strengthening technique for upper trunk with the use of repeated contraction for strengthening the transverse abdominal muscles.
- Use of Mc Kenzie method exercise. The patient was in prone position. We asked the patient to raise his trunk in the direction of extension.

Results: Today the patient was feeling better after the execution of the therapy and the exercises. His pain level of lumbar area was again 4/10 but the pain level at the right tight was 3/10.

6th Therapy session - Date: 14.2.2014

Today's present status:

The patient claimed was today it was feeling much better than the previous time. He still had pain in his lower back but he claimed it was tolerated.

Since it was my day of therapy with the patient, I didn't have enough time because I had to apply the final kinesiology examination. For that reason I applied sensomotoric exercises for the flat foot. And strengthening exercises with the use of PNF technique.

Goal of today's therapy unit:

- Reduce pain in lumbar area
- Facilitation of muscles of both feet
- Sensomotoric exercises for both feet
- Application of kinesiotape for the right flat foot.

- Strengthening exercises with the use of PNF technique gluteus muscles, abdominal muscles.

Execution:

- Facilitation and Sensomotoric training by Janda for both feet.
- Application of kinesiotape in the right foot.
- PNF strengthening technique of lower extremities with the use of repeated contraction in the diagonal of first and second extension for strengthening the gluteus muscles both sides.
- PNF strengthening technique for upper trunk with the use of repeated contraction for strengthening the transverse abdominal muscles both sides.

Instructions for self-treatment:

I instructed the patient to apply the strengthening exercises at home to improve his body condition. Also give him instructions of how to apply the PNF strengthening exercises for the lower extremities with the use of terra bands. It was also recommended to the patient to wear orthopedic shoes cause he still have right flat foot and the because he has also the right leg longer in length if he does not wear them probably he will posture will be worse again.

Results: Today the patient claimed that the pain in the lumbar area was decreased 4/10 while the pain that he was feeling in the right tight remain constant since the previous therapy but it was tolerated again he claimed.

3.6. FINAL KINESIOLOGIC EXAMINATION

3.6.1. Final posture examination

3.6.1.1. Posterior View

- Normal base of foot
- Right foot in slightly to lateral side
- No varosity or valgosity in ankle joint
- Valgosity in both knee joints
- Both calf are hypertrophic , right is more
- Hyperextension in the right knee
- Both thigh are hypertrophic, right is more
- Right posterior iliac spine is lower than the left one
- Right iliac crest is lower than the left one
- Hypertrophy of both transverse abdominals, there was protraction of the muscles on both sides
- Right triangular space is bigger than the left one
- Right shoulder is lower than the left one
- Slight scoliosis to the right side at the level of thoracic spine, improved

3.6.1.2. Anterior view

- Right foot is slightly to right side
- Valgosity in both knees
- Right thigh is more hypertrophic than the left
- Hypertrophy of transverse abdominal muscles at both sides
- Hypertrophy of pectoralis major muscle both sides
- Patient boy is shifted to the right side, but less than in the initial kinesiology examination

3.6.1.3. *Lateral view*

Right side

- Flat foot in the right side
- Hyperextension of right knee

- Lumbar spine flat
- Slight kyphosis in thoracic spine , improved
- Slight lordosis in cervical spine
- Patient is putting more weight on the right side
- Slightly protraction of head
- No protraction of shoulders

Left side

- Lumbar spine flat
- Slight kyphosis in thoracic spine
- Slight lordosis in cervical spine
- Slightly protraction of head
- No protraction of shoulders

3.6.2. Final Gait examination

The patient during walking in putting again more weight on his right leg. Now he is able to walk with more comfort. He still feels pain after walking for a long period, but he pain that he is feeling is less than before the therapies. Furthermore, my patient is able to apply larger steps and with slight more speed. Moreover, he is still circumducting his left leg.

3.6.3. Final Examination of soft tissue according Lewit

Examination of Skin and Subcutaneous:
The restriction in all directions (cranial, caudal, medial and lateral direction) in the area lumbar spine at both right and left side, calf and thigh was improved.
Examination of Fascia:
The restriction in the thoracolumbar fascia at both sides in cranial and caudal direction was improved.

3.6.4. Final Examination of movement patterns according Janda

Hip Abduction: There is altered movement pattern mostly on both sides. Quadratus lumborum is activated first as a primary muscle.
Hip Extension: Altered movement pattern. **There is a better and faster activation of gluteal muscles in both sides than the previous time.**
Curl up (trunk flexion): Altered movement pattern in both sides. The abdominal muscles are weak and the patient is using his iliopsoas muscle for trunk flexion

3.6.5. Final Pelvis palpation

Iliac crests: The left iliac crest is slightly lower than the right one
Anterior Superior Iliac spine (ASIS): The ASIS from the left side is lower than the right side
Posterior Superior Iliac spine (PSIS): The PSIS from the left side is lower than the right side
Result: The patient has lateral tilt of pelvis on the left side.

3.6.6. Final Trendelenburg test

The results of that test are still positive on both sides and more on the right side but the patient had a small improvement. There was less drop of the pelvis on both side and more on the right side than the first day that I did the same test to the patient.

3.6.7. Final Romberg test

Romberg I: Negative
Romberg II: Negative
Romberg III: Negative

3.6.8. Final Scale test

Right scale: 51kg
Left scale: 49kg

3.6.9. Final Dynamic test examination

Flexion:

During the movement of flexion, the patient cannot reach the floor but he was able to go further than in the beginning of his rehabilitation. Now there was a visible movement in the lumbar spine during trunk flexion.

Extension:

During the movement of extension, the patient put his hand at his gluteal area and applied the movement. The patient during the movement was able to go further than in the beginning of his rehabilitation but he still feels pain. There was movement of his lumbar spine.

Lateroflexion:

During the movement of lateroflexion to the right side, the patient was able to do it, but there was rotation of pelvis to the right side .He had full contact of his hand with his body. During the movement of lateroflexion to the left side, the patient was able to do it but he had decreased range of motion 6 cm in comparison with the right side.

3.6.10. Final Anthropometric measurements of lower extremities

Length	**Right Leg**	**Left Leg**
Functional	105.5m	104cm
Anatomical	93.5cm	92cm

Circumference	**Right Leg**	**Left Leg**
Quadriceps	51cm	50cm
Calf	41cm	40cm

Table No. 8. – Final Anthropometric measurements of lower extremities [cm]

3.6.11. Final Examination of Range of Motion, by Kendall

*For the examination of Range of Motion I used the plastic goniometer

Hip joint	**Right**		**Left**	
Plane	**Active movement**	**Passive movement**	**Active movement**	**Passive movement**
S	5-0-**100**	10-0-**115**	10-0-110	10-0-120
F	**40-0-10**	**45**-0-10	**45-0-10**	45-0-10
R90	**40-0-25**	**40**-0-25	45-0-20	45-0-25
Knee joint	**Right**		**Left**	
Plane	**Active movement**	**Passive movement**	**Active movement**	**Passive movement**
S	**0-0-120**	**0-0-130**	**0-0-130**	0-0-130
Ankle joint	**Right**		**Left**	
Plane	**Active movement**	**Passive movement**	**Active movement**	**Passive movement**
S	**35-0-20**	**40-0-20**	**40-0-10**	**40-0-20**

Table No. 9. – Final Examination of Range of Motion, by Kendall [degrees]

3.6.12. Final Muscle tone examination

Muscle	**Right**	**Left**
Quadriceps	Slightly Hypertone	Slightly Hypertone
Quadratus lumborum	**Normal tone**	**Normal tone**
Tensor fascia latae	Normal tone	Normal tone
Iliopsoas	Normal tone	Normal tone
Biceps femoris	Normal tone	Normal tone
Semitendinosus	Normal tone	Normal tone
Semimembranosus	Normal tone	Normal tone
Piriformis	**Normal tone**	Normal tone
Adductor longus	**Normal tone**	**Normal tone**
Adductor magnus	**Normal tone**	**Normal tone**
Adductor brevis	**Normal tone**	**Normal tone**

Gracilis	Normal tone	Normal tone
Pectineus	Normal tone	Normal tone
Sartorius	Normal tone	Normal tone
Gastrocnemius	Normal tone	Normal tone
Poplieus	Normal tone	Normal tone
Plantaris	Normal tone	Normal tone
Soleus	Normal tone	Normal tone
Tibialis Anterior	Normal tone	Normal tone
Tibialis Posterior	Normal tone	Normal tone
Gluteus maximus	Hypotone	Hypotone
Gluteus minimus	Hypotone	Hypotone
Gluteus medius	Hypotone	Hypotone
Rectus abdominal muscles	**Normal tone**	**Normal tone**
Transverse abdominal muscles	Hypotone	Hypotone

Table No. 10. – Final Muscle tone examination

3.6.13. Final Examination of muscle strength according Kendall

Muscle	**Right**	**Left**
Quadriceps	**4+**	**4+**
Quadratus lumborum	**3+**	**3+**
Tensor fascia latae	3	3
Iliopsoas	4	4
Biceps femoris	4	4
Semitendinosus	4	4
Semimembranosus	4	4
Hip medial rotators	3	4
Hip lateral rotators	3	4
Adductors	**3+**	**3+**
Sartorius	3	4
Gastrocnemius	4	4

Popliteus	4	4
Plantaris	4	4
Soleus	4	4
Tibialis Anterior	4	4
Tibialis Posterior	4	4
Gluteus maximus	**3+**	**3+**
Gluteus minimus	**3+**	**3+**
Gluteus medius	**3+**	**3+**

Table No. 11. – Final Examination of muscle strength by Kendall.

3.6.14. Final Examination of muscle length according Janda

Muscle	**Right**	**Left**
Rectus Femoris	**0**	0
Tensor fascia latae	0	0
Hamstrings	1	1
Iliopsoas	**0**	**0**
Adductors	**0**	**0**
Piriformis	**0**	0
Paravertbral muscles	0	0
Quadratus lumborum	0	0
Soleus	0	0
Gastrocnemius and plantaris	0	0
Pectoralis major	0	0
Lateral rotators of shoulder	0	0
Medial rotators of shoulder	0	0
Trapezius	0	0
Sternocleidomastoid	**0**	**0**
Scalene muscles	**0**	**0**
Levator scapulae	0	0

Table No. 12. – Final Examination of muscle length by Kendall.

3.6.15. Final Joint play examination according Lewit

3.6.15.1.Lumbar spine

Examination of lumbar spine with Springing test: No Restriction in L5, L4, L3, L2, L1 segment

3.6.15.2.Sacroiliac joint

Examination of Sacroiliac with Spine sign in both sides by Lewit: No Restriction of Sacroiliac joint in the right side.
Rosina test for Sacroiliac spine: The result was negative on the right side
Examination of Sacroiliac joint (springing test of the Ilium against sacrum in supine position with one leg flexed) by Lewit: **No Restriction on right side**
Examination of Sacroiliac joint (springing test in prone position for the superior part of the sacroiliac joint) by Lewit: No Restriction on right side
Examination of Sacroiliac joint (springing test in side-lying position of Ilium against sacrum) by Lewit: No Restriction on the right side

3.6.15.3.Thoracic spine

Examination of thoracic spine in the direction of Flexion: No restriction
Examination of Thoracic spine in the direction of Extension: No Restriction in the thoracolumbar segment.
Examination of Thoracic spine in the direction of Side bending: No restriction
Examination of Thoracic spine in the direction of Rotation: No restriction

3.6.15.4.Cervical spine:

Examination of cervical spine in the direction of rotation: No restriction
Examination of cervical spine in the direction of side-bending: No restriction
Examination of cervical spine in the direction of retroflexion: No restriction
Examination of cervical spine in the direction of anteroflexion: No restriction

3.6.15.5.Ribs

Examination of 1st rib: No restriction
Examination of Upper ribs: No restriction
Examination of Middle ribs: No restriction
Examination of Lower ribs: No restriction

Joint	**Right Side**	**Left Side**
Patella cranial direction	**No Blockage**	No Blockage
Patella caudal direction	**No Blockage**	No Blockage
Patella medial direction	No Blockage	No Blockage
Patella lateral direction	No Blockage	No Blockage
Tibiofibular joint ventral direction	**No Blockage**	No Blockage
Tibiofibular joint dorsal direction	**No Blockage**	No Blockage
Talocrural joint all direction	No Blockage	No Blockage
Lisfranc's joint all directions	**No Blockage**	**No Blockage**
Chopart's joint in all direction	**No Blockage**	**No Blockage**
Interphalangeal joint in all directions	**No Blockage**	**No Blockage**
Metatarsopahalangeal joints in all directions	**No Blockage**	**No Blockage**
Cuboid bone plantar direction	**No Blockage**	**No Blockage**
Cuboid bone dorsal direction	**No Blockage**	**No Blockage**
Navicular bone plantar direction	**No Blockage**	**No Blockage**
Navicular bone dorsal direction	**No Blockage**	**No Blockage**
Calcaneus bone all direction	No Blockage	No Blockage

Table No. 13 – Final Examination of Joint Play by Lewit

3.6.16. Final Breathing examination

The patient now after the therapy and my instruction has an improved breathing pattern. He is trying not to use abdominal breathing. Moreover, during inhalation and exhalation there is movement in the lower ribs and for that reason there is better movement of the diaphragm**.**

3.6.17. Final Neurological examination

Laseque test: Positive in right side

Opposite Laseque test: Positive in right side

Light touch in both sides: The patient was able to feel the light touch

Examination of dermatomes L1, L2, L3, L4, L5, S1, S2 in both sides

The patient was able to feel the touch in the areas where are the dermatomes L1, L2, L3, L4, L5, S1, S2

Position sense examination:

The patient was able to feel, the patient was able to determine the movement flexion and extension in toes and dorsal and plantar flexion of the foot in both legs.

Deep tendon reflexes	**Right**	**Left**
Patella reflex	1	2
Achilles tendon reflex	2	2
Medioplantar reflex	2	2

Table No. 14 – Final Examination of Deep tendon reflexes

*The response levels of deep tendon reflexes are grade 0-4, with 2 being normal

3.7. Evaluation of the effect of the therapy

During the period that I applied the therapy to the patient I achieved most of therapy goals. When the patient came to the hospital his pain level at the lumbar area was 6/10 at the right thigh was 6/10 and in the right foot was 5/10.After the therapy session that I applied the pain level were decrease at the level of 4/10 In lumbar area, 3/10 in the right thigh and 2/10 in the right foot.

The therapy that was applied to the patient was concentrated in reducing the pain in the areas where the patient was feeling pain, improving posture and stability of trunk and pelvis, instructing the patient for proper use of exercises and ADL activities.

At the end of the therapies sessions the pain in the areas of lumbar spine, thigh and ankle was reduced. More specifically during the whole sessions of the therapies I decreased the hyper tonicity in the hyper tone muscles. Moreover I slightly increased the length of the short muscles and increase the strength slightly in the weak muscles. Furthermore, I removed the restriction in most of the restricted joints .I improved the

condition of the skin, sub skin and fascia in the lumbar area where there was restriction. After the evaluation of my therapy there was a visible improvement in the posture of the patient. Also there was a visible slight improvement in the gait and in the range of motion (R.O.M) of hip joint, knee joint and ankle joint. The posture of the patient after the therapies was slightly improved; the patient is still slightly sifted to the right side but less than the beginning of the therapies. The patient claimed that he feels the difference in his posture and that he has better breathing. Furthermore, the patient during the movement of extension of lumbar spine was improved was able to go further than in the beginning of his.

Moreover the patient was putting less load on the right side than at the beginning of the therapies. Concerning his flat foot at the right side it was not being corrected but was there was created a small arch which there was not before. Furthermore the movement patterns of the hip extension were slightly improved because there was activation of gluteus muscles.

Finally I believe that the mentioned therapies that I have chosen for the rehabilitation of my patient were successful and had a positive effect during my short time period of practice with my patient. The patient during the whole therapies session with me was very cooperative and happy after feeling the effects of the therapies. He was in good mood and grateful for my therapy. My patient after the end of the applications of the therapies in the hospital went home.

Concerning the prognosis of patient's condition, I would like to point that because of patient diagnosis, his problems may arise again in the future. For that reason the patient should be careful and follow the instructions that were given to him.

4. CONCLUSION

I would like to mention that it was a great experience that I had my two week practice in UVN hospital. I tried to apply most of the techniques and therapies that I learned from the university. My patient was very cooperative and helpful enough during the therapies sessions. A good thing to mention is that the patient was improving during the everyday therapies.

I had a very good communication with my patient and he was trying to get better. I believe that the therapies and the exercises that I used where successful and I am really satisfied with the results, knowing also that my patient after the therapies was able to return to his home and he didn't have to stay more time in the hospital.

Finally, my supervisor at UVN hospital, Mgr. Barbora Grmanova was very helpful and cooperative also. She guided me and helped me during my whole practice in the hospital. This contributed to the success and fulfillment of the goals of the practice.

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The citation of the references in the bibliography is according to APA citation norm.

6. SUPPLEMENTS

6.1.List of Figures:

6.2. List of tables.

6.3. List of abbreviation

UVN – Ustředni Vojenská Nemocnice

R.O.M – Range of Motion

PIR- Post isometric relaxation

PNF- Post neuromuscular facilitation

S – Sagittal plane

F – Frontal plane

R - Rotation plane

SLR – Straight Leg Raise

MRI- Magnetic Resonance Imaging

ADL- Activities of Daily Living

Application of Ethics Board Review.

CHARLES UNIVERSITY IN PRAGUE
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Application for Ethics Board Review

of the research project, doctoral research, master degree research, undergraduate research, involving human subjects

Project title: Case study of a patient with diagnosis Low back pain

Nature of the research project: Bachelor's Thesis

Author (chief investigator): Konstantinos Falidas

Supervisor (in case of student research): Mgr. Helena Vomackova

Research project description Case study of physiotherapy treatment of a patient with the diagnosis of low back pain will be conducted under the expert supervision of an experienced physiotherapist Ústřední Vojenská Nemocnice
Guaranteed safety to be judged by experts: safety to be judged by experts: No invasive methods will be used
Ethical aspects of the research: Personal data obtained during the investigation will not be published, draft informed consent (enclosed)

Informed consent (attached)

Date: 6.2.2014

Author's signature:

Faculty of Physical Education and Sport, Charles University in Prague
ETHICS BOARD REVIEW

Ethics Board members: Doc. MUDr. Staša Bartůňková, CSc.
Prof. Ing. Václav Bunc, CSc.
Prof. PhDr. Pavel Slepička, DrSc.
Doc. MUDr. Jan Heller, CSc.

The Ethics Board at the Faculty of Physical Education and Sport, Charles University, approved the research project.
Approval number: 08/2014
Date: 10. 2. 2014

The Ethics Board at the Faculty of Physical Education and Sport, Charles University, reviewed the submitted research project and **found no contradictions with valid principles**, regulations and international guidelines for biomedical research involving human subjects.

The chief investigator of the project met the necessary requirements for receiving the Ethics Board approval.

Official school stamp
UNIVERZITA KARLOVA v Praze
Fakulta tělesné výchovy a sportu
José Martího 31, 162 52, Praha 6
1

Signature, REB Chairman

INFORMOVANÝ SOUHLAS

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Dnešního dne jsem byla odborným pracovníkem poučena o plánovaném vyšetření a následné terapii. Prohlašuji a svým dále uvedeným vlastnoručním podpisem potvrzuji, že odborný pracovník, který mi poskytl poučení, mi osobně vysvětlil vše, co je obsahem tohoto písemného informovaného souhlasu, a měla jsem možnost klást mu otázky, na které mi řádně odpověděl.

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Souhlasím s nahlížením níže jmenované osoby do mé dokumentace a s uveřejněním výsledků terapie v rámci studie.

Datum:……

Osoba, která provedla poučení:……

Podpis osoby, která provedla poučení:……

Vlastnoruční podpis pacienta /tky:…….